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Exploring the Role of Higher Education in Responsible Deployment of Artificial Intelligence

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EXPLORING THE ROLE OF HIGHER EDUCATION IN RESPONSIBLE DEPLOYMENT OF ARTIFICIAL INTELLIGENCE

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Shahin Vassigh

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To: Dean Michael R. Heithaus
College of Arts, Sciences and Education

This dissertation, written by Shahin Vassigh, and entitled Exploring the Role of Higher Education in Responsible Deployment of Artificial Intelligence, having been approved in respect to style and intellectual content, is referred to you for judgment.

We have read this dissertation and recommend that it be approved.

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Florida International University, 2021

DEDICATION

I dedicate this study to my family to: my mother Maliheh who instilled in me my love of education; my husband Kevin who has always given me his unwavering support; my sons Kian and Kasra who have been a continuous source of encouragement; and my brother Bijan who keeps me motivated to achieve my academic goals.

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ABSTRACT OF THE DISSERTATION

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Professor Benjamin Baez, Major Professor

Higher education is the key driver for the teaching, research, and development of Artificial Intelligence (AI), as it bears responsibility for preparing engineers, scientists, technologists, and corporate leaders who shape and fuel its revolutionary advances. With AI and automation technologies relying on more advanced levels of training, and universities serving as the prime site for their development, faculty views on the implications of this technology are critically important.

The purpose of this case study was to gain insights into how academics and disciplinary experts perceive their roles and responsibilities in the teaching, development, and deployment of AI. Using FIU as a case study provided a base for a contextual understanding of the complex issues surrounding AI from the perspective of key actors at a large public university. In conducting the study, 16 faculty from a range of disciplines were interviewed. The interviews were recorded, transcribed, and analyzed. The data from the interviews were examined to identify the connectedness of ideas and develop themes to classify distinct concepts.

The study found that while participants were optimistic about the transformative possibilities of AI for improving human life, they were concerned about its implications. They stressed the intensification of many social challenges by AI, including gender and racial bias in class, gender and race in automated decision-making systems, its negative impact on social media, the use of AI for manipulation of the public, and deceptive practices of internet corporations. The participants also discussed the economic impacts of AI on job markets, particularly the potential for massive job loss, as well as the role of government and higher education in mitigating the adverse impacts of AI through education and appropriate research policies.

The findings of this study provide insights into the challenges of a changing society because of AI and how higher education can mitigate its impact. These findings provide a basis for improving organizational policies and practices in response to the imminent technological changes. They also inform educational and research policy formulation to promote social change.

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CHAPTER I

INTRODUCTION TO THE STUDY

In recent years, the impacts of Artificial Intelligence and Automation Technologies (collectively referred to as AI) have been extensively discussed among social scientists, economists, and other experts. However, there are very few qualitative studies that have examined the perspectives of faculty who are actively involved in teaching, research, and implementation of AI. Thus, this study will focus on exploring the viewpoints and experiences of disciplinary experts on AI and will examine how they perceive their role and responsibility in the realization of this technology.

This chapter provides the introduction to the study, the background of issues under examination, the framework and statement of the problem, the purpose of the study, research questions, statement of significance, definition of terms, and delimitations of the study. In addition, it includes a summary and organization of the study.

Background of the Study

Artificial Intelligence is changing how we live. AI is poised to revolutionize scientific discovery, the healthcare industry, construction, military, transportation, business, and the legal profession, among others. The broad-based application of AI has launched significant structural change to how we live and work, creating software applications and robotic machines that learn from experience, make predictions, and process vast amounts of data to reach independent conclusions.

Modeled on the human brain's neural network and data pathways, AI Deep Learning is advancing exponentially to enable machines to analyze data in a similar

way humans do and increasingly without the need of human programmers. The application of AI technology for quick processing and analysis of Big Data has completely changed social research, advertising, politics, and law enforcement. The combined power of AI and Big Data has enabled making meaning out of massive amounts of data to assess consumer and voter preferences, tendencies, and behavior.

Recent progress in the integration of AI with industrial robotics is leading to the development of machines that not only surpass human physical capacity but are increasingly enhancing and augmenting humans in a wide range of endeavors. The use of intelligent software and robotic machinery is impacting nearly all industries and occupations, including high-knowledge, high-skill professions, such as manufacturing, the construction industry, and medicine.

Deployment of AI may be the most economically disruptive event since the dawn of the industrial age. According to the US Department of Commerce, 40% of existing US jobs could be potentially automated within the next 10 years. The McKinsey Global Institute estimates that by 2030 up to 375 million workers world-wide may need to change occupations as their current jobs are displaced or changed. (Lost, 2017, p. 11).

Besides the unfolding economic impacts of AI, the social implications of this technology have become increasingly apparent. AI technologies have introduced challenging ethical and civil rights issues, bias and discrimination, and misuse of data for surveillance, political gain, and deception (Müller, 2020; Whittaker et al. 2018; Endo, 2018; & Burell, 2016). AI decision-making systems, or "Predictive Analytics," are increasingly used to assess and recommend actions that directly impact people's lives who often do not know or understand the implications (Ingram, 2020). These

technologies, particularly in the US, have led to entrenching social divides and deepening inequality, particularly among historically marginalized groups with potentially far-reaching economic and political consequences (Hagerty & Rubinov, 2019).

The impact of AI on social media has also been significant. AI has diminished the promise of social media to facilitate democratic participation through grassroots movements, activism, and information sharing. The use of AI is now leading to the spread of disinformation and fake news to manipulate entire groups of people, threaten democratic processes and jeopardize public interests (Kaplan, 2020).

AI technologies have vast implications, that touch all aspects of human life with economic, social, and political consequences which could alter society's trajectory in a very short time. Thus, understanding the process by which these technologies are researched, developed, commercialized, and applied are critical in steering their development and challenging ways by which they harm society.

The Framework of the Study

There is a debate among experts on how AI will affect the future of jobs and how it will alter society in the coming decades. A widely accepted belief suggests that investment in AI technologies will benefit society by increasing worker productivity, enhancing economic growth, spurring new jobs, freeing people from working mundane jobs, and reducing working hours.

Many economists argue that AI will lead to the creation of new jobs, many of which we cannot even foresee. They argue that as automation reduces the cost of production with savings in labor, it introduces opportunities for new tasks that have higher labor productivity, leading to increases in wage, employment, and labor share

(Acemoglu & Restrepo, 2018, p. 1490). In addition, as technology eliminates low-skill jobs in the short term, the growth in productivity boosts demand for goods and services, thus leading to the creation of new jobs in the long term. Katz argues that there is no historical evidence that technological change leads to a net decrease in jobs. He states that while it may be painful for the replaced workers and take decades for the workforce to gain the required skills, new jobs have always come, and "we have never run out of jobs" (Rotman, 2013, p. 23).

On the other side of the debate, many analysts believe that AI automation could lead to large-scale and permanent job displacement, structural unemployment, increasing income disparity, and unprecedented economic and political instability (West, 2018). They state that predicting unemployment based on past trends and statistics is not useful, because AI technologies are bringing about new changes which not only impact jobs but entire professions. There is substantial literature arguing that the pace of job loss due to productivity-enhancing technologies will exceed the pace of new job creation, leading to mass unemployment and a jobless society (Frey, & Osborne, 2017).

On the social implications of AI technologies, the debates are often focused on the appropriate uses or the misuse of AI, and issues associated with a technology that has not completely matured. An example of this is in the area of predictive analytics, which uses AI analytics to predict trends and behavior patterns to recommend courses of action. Researchers have documented that the widespread use of predictive analytics in private and public institutions has led to discriminatory and prejudiced decisions (Guardian, April 13, 2017; Whittaker et al. 2018, p. 5).

On the other side of the debate, computer scientists argue discriminatory decisions are a problem of AI algorithms that are processed in a closed system. They argue that it is difficult for them to understand how and why a certain decision or prediction was determined because of the opacity in the system. However, "explainable AI", which is a new area of AI research is expected to allow researchers to gain insights into the functioning of AI models and provide explanation necessity for transparent decision making in practice (Samek & Miller, 2019).

Another area of debate is AI-driven surveillance technologies that are now employed extensively by military, government, commercial and private corporations. Feldstein's research indicates that "at least seventy-five out of 176 countries globally are actively using AI technologies for surveillance purposes" (Feldstein. 1019, p. 1). They argue that technologies such as face recognition save lives, destroy criminal organizations, and nullify terrorist attacks. Yet AI surveillance is also extensively used to monitor citizens living out their normal daily lives leading to violations of civil and human rights.

Because AI technologies are changing so quickly, assessing their economic and social implications is complicated and is subject to debate. However, understanding the nature of this powerful technology which is rapidly embedding into the core of our institutions is critical. With AI being introduced with increasing speed into so many domains of private and public life, assessing our social, economic, and political vulnerability in the face of rising injustice and inequality is essential for determination of how to deploy this technology in a responsible manner.

Problem Statement

Higher education is the key driver of teaching AI, as it bears responsibility for preparing engineers, scientists, technologists, and corporate leaders who shape and fuel its revolutionary advances. The far majority of technologists who develop and lead AI innovations are educated and trained within our university systems. In addition, universities are at the forefront of research and development of AI technologies, either through major public investments from federal agencies such as the National Science Foundation (NSF), Defense Advanced Research Project Agency (DARPA) and National Aeronautics and Space Administration (NASA) or through funding and collaboration with private industry.

Because of the vast implications of AI, and higher education's role in enabling this technology, Universities can take a leadership position in driving the future direction of this technology. By taking a responsible approach, universities can steer the process by which these technologies are developed, commercialized, and applied in a direction which expands social justice and economic opportunities for all people.

Purpose of the Study

With AI technologies depending on more advanced levels of training and universities serving as the prime site for their development, the role of higher education is critical. Because technology is a social process made up of people and professionals who undertake its development (Feenberg, 1991), a deep understanding of the educational context, economic, social, and political implications of AI are imperative. To prepare for a radically different future and a fair society that is increasingly defined by AI technologies, we need to develop a better understanding

of how people who create, implement, and teach AI, understand and perceive this technology.

This study was designed to reveal the perspectives of academics who are at the forefront of developing and responding to challenges posed by AI technologies. The purpose of this study was to gain insights into how academics and disciplinary experts at Florida International University (FIU) perceive their roles and responsibilities in the teaching, development, and deployment of AI.

Using semi-structured interviews with sixteen faculty engaged in teaching, research, and administration of AI revealed a range of perspectives and sentiments about AI and its implications. I used interviews because they provide the flexibility to gather in-depth information while collecting a large amount of data on participants' experiences. Faculty's perspectives, situational context, and challenges through in-depth interviews and discussions provided critical insights into how higher education can mitigate the impact of AI on society. Conducting this study was essential to higher education as it may lead to reconsideration of organizational policies and practices that address social responsibilities and response to challenges arising from the broad-based deployment of AI.

Research Questions

The study is focused on addressing the following three research questions:

1) What are faculty perspectives on social and economic impacts of AI?
2) What are their views on how AI is managed?
3) What type of policies and organizational changes can support a responsible use and development of AI at the university?

Statement of Significance

The broad-based application of AI has launched a significant leap forward, creating software applications and robotic machines that learn from experience, make decisions, and process vast amounts of data to reach independent conclusions. The use of intelligent software and robotic machinery is impacting nearly all aspects of our economic, social, and political lives.

These technologies are on the brink of fundamentally changing how we work, live, and relate to each other. Economic and social organizations are being reshaped using increasingly sophisticated machines that enhance human dexterity, visual perception, speed, and strength. Experts say that "AI is the new electricity and millions of people should learn how to use it", it will be "everywhere and in everything" (Forrest, 2017).

Given the scale of these impacts, an AI-enhanced society may present the most significant collective challenge we face today. However, the future of the automated society is neither an economic nor technological fait accompli. Building an automated future that is fair and inclusive depends on the educational systems, policy, and regulatory frameworks that we can develop today.

Understanding the perspectives of university faculty and administrators on research, development, and educational needs of a society impacted by these technologies is essential in easing the transition to a more automated and AI-enhanced society.

Delimitations of the Study

Limitations in a research study are matters and occurrences that are beyond the researcher's control that may affect the result and conclusions that can be drawn,

while delimitations are the result of specific choices made by the researcher (Simon & Goes, 2013). In addressing the study's research questions, the researcher used FIU as a case study, restricting data collection to faculty and program directors at FIU. The participants included faculty who were directly involved with teaching or research and development of AI or had written about the subject. Thus, the study did not include any graduate students, faculty in unrelated fields, or others affected by AI who did not teach or have been actively researched it. Another, delimitation of the study was that the majority of the interviews were conducted in one session and the study did not include consecutive interview sessions with the participants.

In addition, the scope of the study's discussions was limited to existing AI technologies and did not examine the implications of Singularity or Artificial General Intelligence (AGI). These technologies which refer to the capacity of machines to closely mirror human intelligence or exceed human intellectual capacity through autonomous learning are not fully developed yet (Adilin, Dec. 2020).

Definitions of Terms

AI Black Box is an established problem with AI closed systems that receive input, produce output and offer no clue as to why (Yu & Alì 2019). Many AI system inputs and operations are not visible to the users. The algorithm takes millions of data points as inputs and correlates specific data features to produce an output. As this process is largely self-directed, it is often difficult for data scientists, programmers, and users to interpret the outcomes (Wigmore, 2019).

Deep Learning (DL) is a subset of Machine Learning (ML) where artificial neural networks, algorithms inspired by the human brain, learn from large amounts of data. Similar to how we learn from experience, the deep learning algorithm

performs a task repeatedly, each time adjusting it slightly to improve the outcome (Marr, Feb 2019).

Explainable AI means that conclusions from the AI model can be explained for understanding how decisions and outputs are generated. This increases human users and operators' trust in the outcomes of AI decision-making. Since, the actions of the AI systems are traceable, it also enables humans to observe AI decision loops to both monitor and control its tasks whenever the need arises (Schmelzer, 2019).

Interpretable AI and Explainable AI are closely related and are often used interchangeably. Interpretability is the degree to which a human can understand the cause of a decision (Miller, 2019). Interpretability is also defined as the degree to which a human can consistently predict the results of an AI decision making process. AI models with high interpretability make it easier for people to understand why certain decisions or predictions have been made (Kim, et al. 2016).

Natural Language Processing (NLP) is a branch of AI that is broadly defined as the automatic manipulation of natural language, like speech and text, by software (Brownlee, 2017). NLP is particularly concerned with enabling computers to understand text and the spoken word in much the same way human beings can. NLP integrates insights from computational linguistics with AI and statistical models to process human language and to understand its meaning, including the speaker or writer's intent and sentiment.

Neural Networks are a series of algorithms that recognize relationships in a set of data using a process that mimics operations of the human brain. Using network functions neural networks act as a computational learning system that can adapt by

changing inputs to generate the best possible output without the need to redesign the output criteria (Chen, J. 2020).

Machine Learning (ML) is a subfield of computer science that is concerned with developing algorithms that rely on a collection of examples of some phenomenon to build a clear understanding that phenomenon. These examples can come from nature, be crafted by humans, or be generated by another algorithm. Machine learning can also be defined as the process of solving a practical problem by gathering a dataset, and algorithmically building a statistical model based on that dataset (Burkov, 2019, p. 3).

Predictive Analytics is an area of statistics that deals with extracting information from data and using it to predict trends and behavior patterns. Often the unknown event of interest is in the future, but predictive analytics can be applied to any type of unknown whether it be in the past, present, or future (Ongsulee, et al. 2018).

Summary and Organization of the Study

This study examines how academics and disciplinary experts perceive their role and responsibility in teaching, development, commercialization of AI. The goal of the study is to provide important insights into how higher education can mitigate the impact of AI, inform relevant policies and regulations, and provoke action in higher education. This chapter provided an introduction to the study by offering an overview of the critical social and economic implications of AI. It described the problem statement, the purpose for conducting the study, and the research questions that the study intends to address.

Chapter II provides a review of the current research and literature on the implications of AI and offers the theoretical contexts in which AI is developed and deployed. Chapter III describes the research methodology and design and provides details on the data collection and analysis processes. Chapter IV and V report on the results of the study which are -organized in themes and subthemes. Finally, chapter VI provides a summary of the study and presents the implication of the study for higher education policy and practice.

CHAPTER II

REVIEW OF THE LITERATURE

Higher education is the key driver of the teaching, research, and development of AI as it bears much responsibility for preparing engineers, scientists, technologists, and corporate leaders who shape and fuel its revolutionary advances. With AI and automation technologies depending on more advanced levels of training and universities serving as the prime site for their development, faculty views on the implications of this technology are critically important. Therefore, the primary purpose of this qualitative case study is to explore faculty perspectives in answering three research questions 1) what are faculty perspectives on social and economic impacts of AI, 2) what are their views on how AI is managed? and 3) what type of policies and organizational changes can support a responsible use and development of AI at the university?

Current research and literature provide a solid foundation for understanding significant issues of AI by presenting the perspectives of social scientists, economists, legal scholars, and others. However, the majority of these experts have not been directly engaged in developing AI algorithms, conducting AI research, or teaching it to others. As a result, the perspectives of disciplinary experts who are engaged in the daily research and teaching of AI have not been thoroughly examined.

The goal of this chapter is twofold. The first goal is to presents an overview of the existing literature and the debates surrounding AI, situating them in the border social, economic, and theoretical settings. Its second goal is to provide a context for gaining a better understanding of faculty perspectives and sentiments, which are presented in chapters IV and V of this study.

The chapter begins with an examination of the social challenges posed by AI in the first section. This section explores how the recent advances in AI technology have enabled private and public entities to collect and analyze massive amounts of data from the public using AI-enabled technologies. It describes how this data is used for surveillance of people at home, work, and in public. It also explores the "Black Box AI" phenomenon and discusses problems of the opaqueness of data processed by the AI algorithms.

The second section of this chapter presents research on the economic implications of AI. It explores the most recent expert debates on how AI is changing the job markets and the types of jobs most vulnerable to automation. It also discusses how AI technologies have contributed to income polarization, industry concentration, and globalization which has led to growing income disparities. Lastly, this section examines the growing corporate power in controlling AI technology and how its political and economic consequences has led to undermining society and democracy.

In its final section, the chapter focuses on the theoretical context of the study, discussing how our worldview frames our understanding of the technology and influences our approach to its development and implementation. This section includes a summary of the most prevalent theoretical approaches to technology, including instrumental view, technological determinism, substantive theory, critical theory, and technological mediation.

Social Challenges

The broad-based application AI to software and hardware systems is launching a significant technological leap, creating intelligent software applications and robotic machines that learn from experience, process vast amounts of data to

reach independent conclusions, and interact with other machines and humans using a common language. While AI promises enormous benefits, its deployment may be the most disrupting event since the dawn of the industrial age as it poses unprecedented risks and challenges.

Research shows that AI technologies have a pattern of intensifying the social divide, entrenching social and economic inequalities, and infringing civil liberties, particularly marginalized groups (Mirken, 2021, Gebru, 2020, Hagerty & Rubinov, 2019, Whittaker et al. 2018 & O'Neil, 2016). The low level of explainability, lack of transparency, data biases, and other ethical problems are among the hallmarks of AI-based technologies (Siau, & Wang, 2020). With human roles replaced by AI algorithms, questions about the context in which AI algorithms are developed, who designs and controls the technology, who bears responsibility, what data is used, and what social risks they carry are increasingly important.

Big Data and Predictive Analytics

Big data refers to data that are too vast, too unstructured, and too fast-moving to be managed with traditional methods (Zakir, 2015, p. 81). The application of AI, particularly machine learning, to big data has allowed the delegation of complex pattern recognition, learning, and other tasks to algorithms (O'Leary, 2013). Machine learning uses data mining and statistical modeling to develop "predictive analytics", that can predict future events in real-time (Cohen et al., 2014). Sprague writes that advances in predictive analytics in recent years are immense due to the availability of massive amounts of data:

> The range of predictive analytics is bolstered by the vast amount of increasingly available data: online transaction records, email messages and metadata, images, web browsing logs, search queries, health records, social

> networking interactions, geolocation tracking, and sensors deployed in infrastructure such as communications networks, electric grids, global positioning satellites, roads and bridges, as well as in homes, clothing, and mobile phones provide the "big data" needed for data mining and predictive analytics (Sprague, 2015, p.4).

In other words, because of the vast amount of available data from people's interactions with the internet, personal and public devices such as sensors, and communications devices, organizations are enabled to gain access to the immense amount of data. Using predictive analytics to analyze this data allows organizations to look for patterns and relations that are not otherwise readily apparent, predict future conditions, and make recommendations for courses of action.

Big data is used to predict shopping, dating, law enforcement, worker productivity, terrorism, cybersecurity, and voting patterns, among others (Heproplrschel & Miori, 2017; Richards, & King 2014). Considered the oil of the twenty-first century, big data is a major asset and source of income for the largest internet corporations like Google, Facebook, Amazon, eBay, Microsoft, and Yahoo! (Rubinstein, 2012). The vast majority of data collected by these corporations are personal data accessed without the knowledge or consent of the public, using every click of each individual, recorded by cookies, super-cookies, and other processes (Helbing, 2019). The "free" internet services provided to the public are paid for with the data trail that we leave unknowingly behind while being lured to continue to leave more such data (Muller, 2020).

Data are widely used for marketing and targeted advertisement, often using deceptive strategies for the targeted audience. Muller writes that the operating business model for the largest internet corporations is based on deception, exploiting

human weaknesses, furthering procrastination, generating addiction, and manipulation (Muller, 2020 & Harris 2016).

The problem with predictive analytics goes beyond monetizing online behaviors for profit-making to broaching ethical boundaries and civil rights issues. There is substantial literature that documents amplification of bias, discrimination, surveillance, and misuse of data for political gain and deception using AI (Müller, 2020; Whittaker et al. 2018; Endo, 2018; Burell, 2016; Stone, et al. 2016, Van Dijck, 2014, and Rubinstein, 2012). The scandal of Cambridge Analytica, a political consulting firm in elections of the US and UK, has become an iconic example in revealing the power of predictive analytics for manipulating public opinion with targeted advertisement. By providing Cambridge Analytica access to private information during the 2016 election, Facebook enabled the firm to psychologically profile its users:

> Cambridge Analytica (CA) targeted individuals with a lesser-known Facebook feature called "dark post" that contains personalized ads that are visible only to targeted individuals. CA consciously exploited fears of individuals with targeted advertising based on their personality profiles. The use of highly personalized ads made them vulnerable to Trump's messages that compelled them to vote for him. This digital onslaught played a significant role in Trump's victory over Hilary Clinton (ur Rehman, 2019, p.2).

This cooperation between CA and Facebook for accessing personal information for psychological profiling and targeting people with deceptive misinformation led to one of the most significant leaks in social media's history. The revelation of the scandal led to Facebook notifying 87 million people that their information was given to Cambridge Analytica (Filibeli, p.96, 2018 & Hern, 2018). The case of Cambridge Analytica showed the power of predictive analytics as a new technological control

tool. By violating the privacy rights of numerous people, Cambridge Analytica succeeded in mass manipulation of the public and potentially changing the course of history.

Predictive analytics also amplifies bias and discrimination. There is abundant documentation on how Machine Learning algorithms intensify bias and perpetuate both gender and racial prejudice (Guardian, April 13, 2017). Computer scientists consider algorithmic bias as the inherent attribute of data. They argue that existing data reflect decisions made in the past and bias is deeply embedded in our existing data. Because ML algorithms process stockpiled data to make predictions, they are subject to group characteristics that can reinforce deep-seated prejudice within the existing data. However, bias is not just embedded in data and the intentionality of the code writer is also factor. Nelson argues:

> Algorithms have authors and are assembled according to instructions made by people. Bias is a reflection of the data algorithm authors choose to use, as well as their data blending methods, model construction practices, and how results are applied and interpreted. That is to say these processes are driven by human judgments (Nelson, 2019, p. 220).

In other words, because algorithms are developed by people using methods they choose, their values and choices are a part of the process and not value-free. However, regardless of how bias finds its way into algorithms, predictive analytics is applied to major decisions that range from employment to loan approvals, hospital treatment to insurance eligibility, qualification for social benefits, and policing (Mirken, 2021). Research has shown that algorithmic bias impacts most vulnerable communities the most. In his book of Weapons of Math Destruction, O'Neil documents how people in lower socioeconomic classes are subjected to a higher rate of automated decision-making (Gebru, 2020 & O'Neil, 2016). Predictive analytics

intensifies “lack of due process, accountability, community engagement, and auditing” (Whittaker et al. p.18, 2018).

Big data and predictive analytics are being extensively used for understanding our social behavior. We have entered an era that our behavior is codified, quantified, and monetized without our knowledge or consent. Psychological profiling through access to our internet searches, emotional responses, likes, and dislikes has led to exploitation of our fears resulting in further polarization of society. Furthermore, algorithmic decisions are causing harm to society by amplifying bias and discrimination. Relying on opaque and flawed algorithms that involve critical matters in our lives presents a fundamental problem to the democratic decision-making process in society.

Conducting a qualitative study by interviewing people who are directly engaged with AI provides a context to better understand the implications of big data and predictive analytics by offering personal examples and detailed accounts of the process of developing codes and algorithms from the experience of people who develop them or teach others how to develop them. By providing these insights, the study brings new perspectives from the experts to the existing literature on big data and predictive analytics.

Surveillance and AI Productivity Technology

Modern surveillance can be defined “as the collection and processing of personal data, whether identifiable or not, to influence or manage those whose data have been garnered” (Schermer, 2007, p.7, & Lyon 2001). Among multiple data sets collected from people, facial recognition is one of the most widely used surveillance technologies with broad commercial and law reinforcement applications. The

advocates of this technology argue that facial recognition is thwarting attacks, saving lives, destroying criminal organizations, and informing policymaking (Cayford & Pieters, 2018, p. 2).

However, automated surveillance deployed by states and private corporations has resulted in the violation of the Constitution, codes surrounding the transparency of government, and privacy values (Connor, 2021; Macnish, 2018 and Marx, 2002). Facial recognition has expanded the tracking and monitoring of citizens by governments and the private sector in many countries, including the US. Feldstein's research indicates that at least seventy-five countries are actively using AI for surveillance:

> The spread of AI surveillance continues unabated. Its use by repressive regimes to engineer crackdowns against targeted populations has already sounded alarm bells. But even in countries with strong rule of law traditions, AI gives rise to troublesome ethical questions (Feldstein, 2019, p. 24).

Ubiquitous surveillance of people in private and public spheres is problematic because it infringes on privacy rights and changes the dynamics between the watcher and the watched, risking coercion, discrimination, and selective reinforcement of the law (Richards, 2012). In addition, an increasing number of private corporations use surveillance systems known as AI productivity technology. These systems are used for managing and measuring worker productivity in a pervasive manner. For instance, *Prodoscore*, a proprietary scoring system, uses Machine Learning, AI, and Natural Language Processing to measure thousands of daily activity points to produce and generate actionable analytics that measures productivity with a score (Prodoscore, 2020). Using a similar system, Amazon sets performance targets which are called *rates*. Crawford writes that:

> The “rate” is calculated automatically, and changes from day to day. If a worker falls behind, they are subject to disciplinary action. In many warehouses, termination is an automated process (not unlike being “kicked off” a gig-economy platform). According to Abdi Muse, an organizer with Amazon warehouse workers in Minneapolis, if workers fall behind the algorithmically set productivity rate three times in one day, they are fired, however long they may have worked for the company, and irrespective of the personal circumstances that led to their mistakes (Crawford, 2019, p. 14).

Amazon is continuously surveilling employees on the length of their breaks, how many packages they handle, and their overall productivity using software to make critical decisions about their lives without allowing any human interaction to remedy issues. This ruthless business model has created strenuous working conditions, resulting in high firing rates in Amazon.

Similarly, AI management systems are increasingly used for recruitment and hiring. HireVue, a recruiting firm, is among many that have designed a system that uses a computer or cellphone camera to “analyze the candidates' facial movements, word choice and speaking voice before ranking them against other applicants based on an automatically generated employability score” (Harwell, 2019, Nov. 6). These systems rely on pervasive surveillance to provide substantial exercise of control over the employee by the management. Continuous observation of employees with AI productivity technology is threatening individual rights and personal autonomy.

Chapter IV of this study provides insights from faculty experts on additional issues with the implementation of ubiquitous surveillance. In this chapter, they explain that in addition to the ethical problems with the intentional use of AI for surveillance, image recognition, natural language processing, and predictive analytics are fraught with errors. They provide real-world examples of how technological shortcomings of AI have implicated the criminal justice system, employment

recruitment, and groundless financial decisions impacting large groups of people among others.

Opacity and Black Box AI

Black Box AI is any artificial intelligence system whose operations and potentially inputs, are not visible to the user or another interested party. Generally, a black box is an impenetrable system" (Wigmore, 2019). Two types of opacity in machine learning - opacity as intentional concealment and opacity as cognitive mismatch - are posing significant challenges to society (Carabantes, 2019 & Burrell, 2016).

Machine learning algorithms used for automated decision-making map data features into a class or a score without describing the reasons for such decisions. The opacity of decisions made by these algorithms presents many problems because there is no concrete sense of why or how a particular classification or decision has arrived from inputs (Burell, 2016).

Intentional opacity exercised by the government and private corporations is often considered and argued as a necessity to safeguard security and competitiveness (Carabantes, 2019). However, the lack of institutional transparency has led to legal and moral violations and the implementation of discriminatory practices (Pasquale, 2015). Whittaker argues that the "black box effect" reinforced by corporation secrecy makes it difficult to assess bias, contest decisions, and remedy errors, ultimately leaving companies unaccountable (Whittaker et al., 2018).

Opacity as a cognitive mismatch happens when machine learning processes are too complicated for humans to understand. "Because the data structure of machine-learning algorithms continually evolves, the inner workings of algorithms

are difficult to analyze, particularly in terms of how results are reached" (Lu, 2020). Danaher writes:

> Many algorithms are produced by large teams of coders, cobbled together from pre-existing code, and grafted into ever more complex ecosystems of other algorithms. It is often these ecosystems that produce the outputs that affect people in serious ways. Reverse engineering this messy, inelegant and complex code is a difficult task. This heightens the level of opacity (Danaher, 2016. March 5).

This type of opacity makes accountability almost impossible. The black box effect is a difficult problem for computer scientists as writing code is complicated and involves many people in many cases. When the designers and writers of algorithms do not understand the process and how conclusions are drawn from data, how can they be accountable?

AI systems are making decisions that directly impact the lives of people who often do not know or understand their implications. "It is not clear who is setting the agenda and what standards or rules, if any, are being applied" (Ingram, 2020, p. 3). Opacity leads to procedural injustice and decisions "which implicates individuals' substantive rights, such as with credit scoring, government benefit eligibility decisions, national security screening, and criminal sentencing" (Endo, 2018, p. 823).

Economic Challenges

While AI algorithms are integrated into software and decision-making systems, they are also integrating with physical machines. The rapid development and growing use of robotics and intelligent devices across an ever-expanding list of occupations is changing the nature of work and moving to augment or replace humans. Knowledge-based jobs and entire professions requiring advanced education, skills, and experience once thought to be irreplaceable by a device are now in danger

of automation. Many functions within the highest-level careers, such as medicine, law, journalism, marketing, and finance, are incorporating robotic and AI enhancements that replace core human functions. This demonstrates that a broader spectrum of the workforce is directly impacted by AI automation.

There are a variety of predictions about how AI automation will impact the economy. On one side, economists warn that advances in A.I. may result in massive unemployment and significant changes to our way of life. A study by the McKinsey Global Institute estimates that between 400 to 800 million of today's jobs will be automated by 2030 (Lost, 2017, p. 11). It is also projected that the U.S. will see a higher percentage of job loss as most of its workforce performs routinized tasks (Berriman & Hawksworth, 2017, p. 2). Several studies indicate that 40% of existing jobs are vulnerable to automation within 10 Years (Reisinger, 2019, Jan.10, & Darina, 2021, April 19).

Susskind and Susskind, argue that AI and robotics technology are changing many professions and foresee that these advances will eventually dismantle many of the existing professions, leaving many professionals vulnerable to replacement by high performing systems (Susskind and Susskind, 2016, p. 303). A new study by the Brookings Institute suggests that these technologies will displace “middle of the skill and wage spectrum while leaving the status quo more or less intact for both high-pay and low-pay interpersonal or nonroutine work” (Muro, 2019, p.10). In this scenario, the disrupted labor will test the social safety nets, requiring the identification of new income sources and restructuring income distribution (Rifkin, 1997).

However, some economists argue that because US labor is a product of technological advancement, new jobs will continue to be produced as they have in

the past. Experts believe that automation combined with other changes in the economy indicates that new jobs will be a fraction of the overall job loss. While studies have different projections of job loss due to automation, they all point to an alarming rate of jobs being automated. More importantly, when AI impacts on jobs are examined in the context of the widening gap in income distribution, expanding corporate power, and weakening of public welfare and safeguards, they point to disturbing and critical challenges.

Income Distribution and Inequity

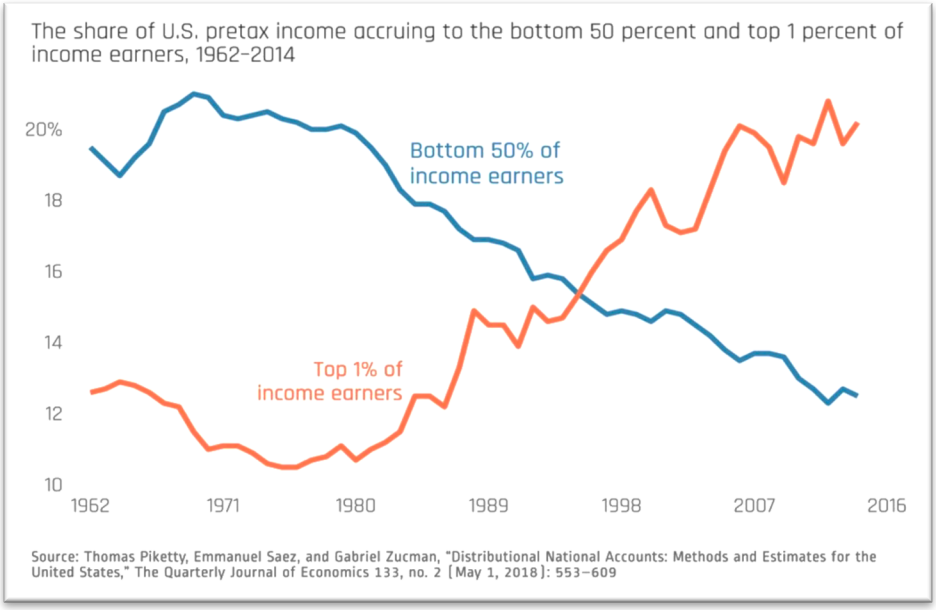

Figure 1: U.S. Workers Share of National Income from 1962-2016

Automation and advanced technologies are recognized as one of the economic factors behind *income polarization*, *industry concentration*, and *globalization* that has led to worldwide income inequality. Autor argues that while technology has created high-paying jobs that require critical thinking skills, automation has increasingly replaced middle-class jobs such as clerical, bookkeeping, and manufacturing, which traditionally bring in middle-income wages. In addition, the

demand for low-skill jobs such as janitors, restaurant workers, and home aids which are not yet automated, has increased. This has created "polarization" and "hollowing out" of the middle class (Autor 2015, p. 4). Abel and Deitz also write that while job opportunities for high-skill workers have improved, opportunities for middle-skill workers continue to diminish. As a result, traditional pathways to the middle class have become more difficult to follow (Abel and Deitz, 2012, p. 7).

The vast growth of corporate profits is also a significant cause for income polarization (see Fig. 1). Many economists attribute the increase in private-sector profits to low-interest rates, which has made it cheaper to borrow and invest. According to Bessen corporate investment in the past decades has been focused on research, development, and acquiring advanced computer technologies to enhance productivity (Bessen, 2017, p. 10).

Melville defines *industry concentration* as "the degree to which the output of an entire industry is produced by a few corporations and is considered an inverse proxy for industry competitiveness" (Melville, 2007, p. 229). Their study shows that

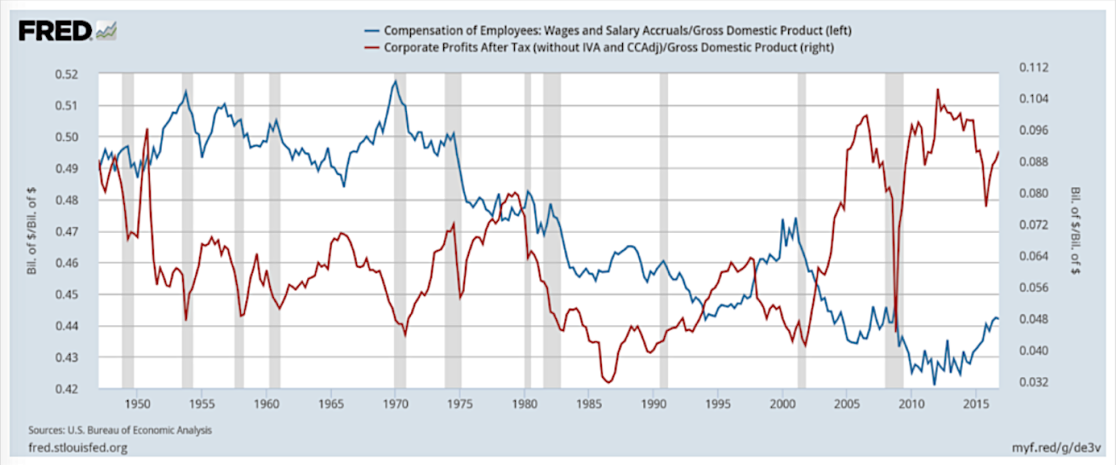

Figure 2: Wage vs corporate profits
Blue: Wages| Red: Corporate Profits
Source: U.S. Bureau of Economic Analysis

large productivity impacts are seen in only a few industries because highly competitive corporations apply advanced technologies more efficiently than others (Melville, 2007, p. 239).

Bessen's research confirms that a small number of top high-tech corporations in each industry achieve higher productivity than others, leading to faster growth for only a few (Bessen, 2017). (See Fig. 2.) These corporations have higher profit rates and abnormal stock returns, suggesting that the nature of US markets has undergone a shift that has weakened competition (Grullon et al., 2016 p. 2).

Globalization, driven by technological progress, is another factor in creating inequality worldwide. Atif's study shows that while globalization promotes economic growth, it is considered a root cause of growing income inequality at the global scale, suggesting increasing globalization would worsen the income distribution (Atif et al. 2012, p. 11). The result of this study is supported by an International Monetary Fund report in 2015. The report shows that technological progress associated with globalization has led to an increase in demand for high-tech and high-skill labor, thus increasing its premium disproportionately. The report also indicates that financial globalization and technology cause an increase in the top 10% disposable income share in all countries (Dabla-Norris et al., 2015, p. 23). In the US, income inequality has been among the highest in the world. According to the US Central Intelligence Agency, "income inequality in America is roughly in par with that of Philippines and significantly exceeds that of Egypt, Yemen and Tunisia (Ford, 2015, p. 46).

Corporate Power and Influence

The economic trends discussed demonstrate that emerging technologies have brought economic changes that represent a significant departure from the past, leading to unfair economic conditions for most people. Equally important is that with the advent of these technologies, corporations have expanded their reach and enhanced their capacity to reshape the broader technological agenda. AI alliances among a handful of high-tech corporations have led to consolidation control effectively placing these corporations in a position to self-regulate concerning their own ethical conduct. For example, a partnership among Amazon, Facebook, Google, IBM, and Microsoft announced in September of 2016 (with Apple joining later) promises to advance public understanding of AI and create design standards for research:

> The objective of the Partnership on AI is to address opportunities and challenges with AI technologies to benefit people and society. Together, the organization's members will conduct research, recommend best practices, and publish research under an open license in areas such as ethics, fairness, and inclusivity; transparency, privacy, and interoperability; collaboration between people and AI systems; and the trustworthiness, reliability, and robustness of the technology. It does not intend to lobby government or other policymaking bodies (Staff, 2016, Sept 28).

Although the objectives of the Partnership on AI are appreciable and no one can argue with fair research, transparency, and inclusivity, it is a difficult task for companies to monitor themselves. Because these corporations are profit-driven, these objectives diverge from their business goals. An example of this is their practices for collecting data from individuals without their knowledge or permission, which is in conflict with their objectives of transparency, respecting privacy rights.

Together these companies hold the world's largest databases, which places them in de facto control of Artificial Intelligence. As Mannes suggests, "whichever company owns the data, effectively owns AI" (Mannes, 2016). These corporations have also increased the purchase of small innovative companies to consolidate their control, eliminate competition, and add to their assets. In 2015, mergers and acquisitions in private tech companies totaled $318 billion, an increase of $250 billion over the previous year (Fiegerman, 2016). The routine coopting of smaller innovative companies for removing competition has led to the elimination of many alternative technologies and progress in alternative directions. The corporate control of AI places a small group of companies in charge of critical decisions on the automation of the workforce, social media, scientific discovery, healthcare, and agriculture, among others.

Relying on corporate leadership to determine how to apply AI and automation for our society presents several problems that deepen current dilemmas and weaken democratic processes. First, corporations exist to make profits, and their choices for investing in technology are motivated by revenues, not potentially risky discoveries for the public good. Therefore, lucrative technologies with a high rate of profitability drive the pattern of their investment. Noble argues that the key innovation brought about by corporations is not in scientific advancements or automation, but "in the transformation of science into capital" (Noble, 1979, p. 6). He writes that like any human activity, technology contains the subjective elements which drive its production and assumes the form and direction given by the most powerful and forceful part of society (Noble, 1979, p. xxii).

Thus, alliances such as the one with Amazon, Facebook, Google, IBM, and Microsoft to control standards, guidelines, ethics, and AI rules are disconcerting. Without demanding accountability, any misalignment between corporate goals and public welfare could potentially be resolved to benefit corporations.

The corporate control of the entire technological process of AI undermines society and democracy. Suarez-Villa argues that the creation of technology is an activity that has social, political, economic, and natural consequences which may decide the human trajectory. "The power of corporatism over these decisions should raise grave concerns about human society" (Suarez-Villa, 2012, p. 2).

Second, increases in corporate profits and corporate power over technology is built on a regulatory and legal framework that has been rapidly transformed over the past few decades. Stiglitz writes that intense deregulation of the American economy, including property rights, business behavior, enforcement of contracts, tax policies, executive pay, public spending, and monetary spending, have prioritized corporate welfare over making the economy strong, leading to a dysfunctional economy (Stiglitz, 2016, p. 2). In his book "Great Divide", Stiglitz contributes much of this trend to the deep corruption of the political system:

> As a government of the 1 percent, for the 1 percent, and by the 1 percent works to enrich the 1 percent, through corporate welfare and tax benefits, fewer resources are available in infrastructure, education and technology investment that are needed to keep the economy strong and growing" (Stiglitz, 2015, p. 213).

In other words, we have a government that works for an extremely narrow portion of the population. By serving the needs of a few through tax benefits and deregulation. The far majority of the population is deprived of the recourses they need and deserve. Deregulation and increased tax breaks reinforced by corporate lobbying of

legislators, bribing officials, creating effective media campaigns with advertisements, journalism, funded articles, and financing opinion surveys favoring corporate agendas (Suarez-Villa, 2012, p. 157)".

Finally, corporations use their wealth to compete and prevent others from participating in markets. "They use their privileged position in markets to capture a larger and larger portion of existing values and distort the economy, lowering efficacy and economic growth" (Stiglitz, 2015, p. 420).

Chapter V of this study expands the boundaries of current discussions and literature on the economic implications of AI by providing expert perspectives through the lens of education and research. In analyzing the future job markets, faculty participants elaborated on the role of appropriate training and education, describing that job loss due to AI is not inevitable and we can prepare for the future. They also discuss how large-scale training and education can mitigate AI-driven inequality. In addition, participants bring new insights to the economic debate and the new AI-driven power of corporations by underscoring the importance of research and research policies in higher education that could protect the public.

Theoretical Context

Our ability to see the underlying challenges of AI technologies is embedded in the context and worldview by which we understand technology. Our conceptual perspective of technology frames our actions and influences our ability to lead and guide its development. Questions about technology and whether it is a dominating force or humans are in complete control of technology have preoccupied philosophers and scholars throughout history. However, there are several dominant views and approaches to the theoretical positioning of technology which has guided

our understanding of technology. The following presents a brief study of these views and theories. The following synopses provide a brief overview of the prevalent theories of technology with a specific focus on the role of technology in society.

Instrumental View

From an instrumental perspective, technology is defined as the "application of practical sciences to industry or commerce," the "methods, theory, and practices governing such application," and as the "total knowledge and skills available to any human society for industry, art, science," (Technology, 2015). These definitions are based on a view that considers technology as a mean to an end or a neutral tool ready to serve the purpose of its user, without valuative content of its own. "Technology, as pure instrumentality, is indifferent to the variety of ends it can be employed to achieve" (Feenberg, 1991, p.5).

Melvin Kranzberg, a historian of technology who has written extensively on the nature of technology, believed that "technology is neither good nor bad" (Kranzberg, 1995). This view of technology is ambivalent to the political and social context. From this perspective, when technology fails, it is not the technology but the improper use which leads to harm (Okan, 2007 & Pacey, 1983). This instrumental view of technology as a benign tool has become predominant, shaping the general population's understanding of technology.

Technological Determinism

Although there are many interpretations of technological determinism, there are two fundamental positions that dominate this perspective on the role technology in society. First is that technological development occurs outside cultural and

political spheres. Wyatt writes from this position, claiming that social and cultural contexts do not influence how technology is advanced:

> New or improved products or ways of making things arise from the activities of inventors, engineers, and designers following an internal, technical logic that has nothing to do with social relationships (Wyatt, 2008, p.108).

The decontextualization of technology from its socio-political context leads to another interpretation of technological determinism that considers it an autonomous and dominant force that drives the course of society (Webster, 2017; Leonardi, 2008; Leonardi, 2009). From this perspective, technology is an unstoppable force that shapes society's politics, economics, and culture. McLuhan (1911-1980), who is credited for putting forward the theory of Technological Determinism, writes that it is "not only inventions that shape our activities, but they, in turn, shape us (quoted in Griffin, 1991, p. 294). From this position, technological change is a powerful force that not only drives social phenomena, but it is an independent force beyond human control and agency.

Substantive Theory

The substantive theory of technology is a form of dystopian determinism, which suggests that the impact of technological tools cannot be understood or evaluated based on their original intent. Once a technology is available, it will be exploited, and its impact on people cannot be controlled (Northcut, 2007, p. 255). Feenberg wires the following on the Substantivists perspective:

> Technology within late-modernity frames our values to such an extent that it "reveals" our epoch as distinguished by the fact that technology is no longer "mere instrumentality" but now "forms a culture of universal control…Substantivists view technology as "essentially" reducing

> everything, and especially its very human users, to "functions and raw materials" (quoted by Vita, 2010).

From this position, technological rationality overrides social concerns, and technological tools shape human values and actions. With the logic of technology as the dominant power, efficiency, productivity, and performance are how humans are valued in society. Rogers writes that technology perpetually creates and destroys humanity as it propels us to innovate, leading to "an inhumane world that is beyond human control" (Rogers, 2009, p. 38).

Martin Heidegger, Walter Benjamin, and Jacque Ellul are among substantivists theorists who have written on technology with deeper philosophical contemplation. For example, in The Question Concerning Technology, Heidegger's argument that the instrumentalist approach to technology as a "means to an end" or a "human activity," while correct and undeniable, is overly simplistic and does not reveal the essence of technology (Lovitt, 1977). He writes that:

> Essence is more than just the visible qualities or characteristics of a given thing. It includes both the seen and the unseen ... Like all other things, the essence of technology also unconceals and conceals itself (Tabachnick, 2000, p.490)

Heidegger elaborates that by the essence of technology, he means a "mythological abstraction" concerning how things are revealed as "resources to be optimized" (Thomson, 2000). He articulates that "what is most essential about technology – namely, is the way in which it alters how reality shows up for us – it cannot be controlled" (quoted by Thomson, 2000, p.207). Heidegger maintains that technology has its own autonomous logic and humans do not have the agency to guide its progress. Technological rationality has the power to control and reshape society.

Critical Theory

Several theorists have used a Marxist framework for the theoretical positioning of technology in society. For example, Noble writes that modern technology is "intrinsically linked to the rise of corporate capitalism," stating that they are "two sides of the same process of social production… they are fundamentally related: to study one is to study the other" (Noble, 1977, p. xxi). Noble asserts that technology is not a force but a human activity. For Noble, technology is a social process that is formed by powerful corporations and is continuously shaped by engineers and scientists who are trained in the value systems of corporations. He argues that the "professional engineers" who emerged in the late nineteenth century, were the agent of corporate capital and were formed to serve their needs (Noble, 1977, p. xxiii).

Feenberg, credited with articulating the Critical Theory of Technology, also writes about the relations of technology, power, and capitalism. However, he disagrees with the traditional Marxist view of technology's power of "impersonal domination". In his book Democratizing Technology: Andrew Feenberg's Critical Theory of Technology, Veak writes that Feenberg rejects the fatalistic view of technology, arguing that technology is socially constructed, and its form and development are a political choice. While accepting that technology is a threat to human agency, he writes those democratic interventions into technological designs can subvert its entrenched power (Veak, 2012). Feenberg writes:

> The choice of civilization is not decided by the immanent drift of technology but can be affected by human action. Political struggle, as a spur to cultural and technical innovation if not necessarily in its traditional statist form, continues to play a role (Feenberg, 1991, p. 12).

Examining technology from a political perspective, Feenberg offers the potential of change by "substituting control from below for control from above." (Feenberg, 2012, p.123). His call for public intervention or 'democratic interventions' creates a bridge between resignation and utopia, providing a path for action and human agency in technological development.

Technological Mediation

This is a recent critical framework put forward by Don Ihde and Paul Verbeek and, in part, a response to Heidegger and Ellul's pessimistic positions. Technological Mediation Theory takes a phenomenological approach to understand "the role of technology in everyday human experience and how technological artifacts affect people's existence and their relationship with the world" (Verbeek, 2001, p. 119). According to Ihde, Technological Mediation centers on examining technology in terms of its relation to humans and improving the connection between human beings and the world they live in:

> A basic notion in the mediation approach is that human existence is always influenced by technology. There is no original, and certainly not a clear-cut distinction between humans and technology. Instead, what is of interest are the different kinds of human-technology relations (Ihde, 1990), p. 7).

Verbeek examines the political nature of technology and how power is mediated through technology. He writes, "technology should be analyzed not only in terms of the social processes in which it is constructed but also in terms of the role it plays in social processes itself" (Verbeek, 2005).

Although Foucault is not known as a technology theorist, his studies of *power relations* have extensively informed the Critical Theory of Technology. Rao et al. write that technological mediation considers the "power perspectives and ways of

coping with relations of power embedded in technical artifacts and systems" (Rao et al., 2015, p. 449).

By examining technology in terms of power relations, Technological Mediation opens the possibility of reshaping the relationship between humans and technology. It enables questioning the rationality of technological tools and creates agency for the responsible development of technology. Verbeek writes:

> Anticipating the social and political implications of these technologies, as a part of the responsible use, design, and social implementation of technologies… are much needed in order to deal with technology in a responsible way (Verbeek, 2012, p. 395).

Technological Mediation rejects both Ellul and Heidegger's fatalistic perspectives and the instrumental approach that considers technology a rationally constructed and value-free tool. Technological mediation creates the potential for choosing the pathway to progress by opening the door for public engagement to reform human-technology relations.

Chapter VI of this study examines faculty sentiments on AI technologies in the context of theoretical mindsets discussed in this section. This examination reveals how the worldviews of faculty experts guide their path to the research and development of AI. Furthermore, it provides a clear contrast in participants' approach with an instrumental view and faculty who view technology from a critical perspective in solving problems posed by AI. Hence the study contributes to the existing literature on theories of technology by offering real-life examples of how theoretical understanding of experts influence their solutions for mitigating social and economic challenges posed by AI technologies.

Chapter Summary

This chapter provided an overview of the fundamental challenges of AI and its impact on society. By examining social, economic, and theoretical contexts in which AI is developed and deployed, this chapter provided a foundation for a better understanding of faculty perspectives who are actively engaged with daily research and teaching of AI. Furthermore, this literature review provided a basis for exploring how faculty sentiments and beliefs in this case study confirmed or differed from the experts not directly involved in research or teaching of AI.

In considering the social implications of AI, three significant areas of concern were discussed: 1) big data and predictive analytics, 2) surveillance and AI productivity technology, and 3) Black Box AI. These discussions explored the role of bias in data leading to new forms of discrimination, the increased role of AI for surveillance of citizens at home and at work, and the lack of transparency in AI, leading to deceptive practices in social media.

Economic implications of AI were explored in terms of the number and types of jobs that could potentially be impacted. The discussion also examined the implications of AI technologies on economic trends such as income polarization, industry concentration, globalization, and AI's contribution to intensified income equality at the global level. An overview of the expanded role of corporations and their control of AI technologies revealed that, with free access to massive data, corporations have encroached on the government's control and monopoly of data on citizens. Additionally, coordination among the largest corporations for self-regulation and ethical conduct has enhanced their power, placing them in practical ownership of AI. Finally, the chapter summarized the prevalent theoretical perspectives of

technology in society by exploring its role in shaping our understanding of technology. It examined how decontextualization of technology from the broader social context forecloses the possibility of effecting change. Critical theory and Technological Mediation were introduced as alternative conceptual frameworks that resist the notion of an autonomous technological rationality and allow for technological development for social good.

CHAPTER III

METHODOLOGY

In recent years the impacts of AI technologies have been increasingly debated among economists, social scientists, and others. However, there are not many studies that explore the perspectives of people who are actively engaged in the teaching, research, and development of AI. This qualitative study provides an opportunity to examine the perspectives of university faculty, their role, and their perceptions on how to mitigate the challenging issues brought forth by AI.

This chapter begins by describing the purpose and significance of the study. It then describes the research design as a qualitative case study, its appropriateness, and its advantages in addressing the issues of concern. It provides details of data collection through semi-structured interviews and describes the sampling techniques, recruitment of the participants, and participant profiles.

The data analysis section provides details on the coding procedure and how it led to bundling various segments of interview transcripts into comparable categories. It also describes how these categories were used for theme and subtheme generation. The last section describes various approaches for establishing credibility in qualitative research and the steps taken in this study to ensure data integrity and creditability.

Purpose of the Study and Research Questions

Understanding how academics and disciplinary experts perceive their role and responsibility in the teaching, development, commercialization, and application of AI and automation technologies can provide important insights into how higher education can play a responsible role in mitigating the adverse impacts of these

technologies on society. Faculty who are directly involved with teaching and research of AI can be critical in informing organizational procedures and practices in educational settings. In addition, faculty input can provoke response to the technological challenges presented by AI, leading to regulation at a national scale.

The purpose of this study is to gain insights into how faculty at Florida International University (FIU) who are in key positions leading programs, teaching, and researching AI and automation technologies understand the significant economic, social, and educational implications of these technologies. Conducting this study has allowed me to address the following research questions:

1) What are faculty perspectives on social and economic impacts of AI,

2) What are their views on how AI is managed?

3) What type of policies and organizational changes can support a responsible use and development of AI at the university

Research Methodology

Pasque and Lechuga write that qualitative research is a critical approach for examining complex problems of higher education. Through in-depth study of issues in their natural context, qualitative research can lead to developing public policies which guide our institutions in meeting the demands of their constituents, legislators, and other stakeholders (Pasque, & Lechuga, 2016, p. xi).

In this study, the qualitative approach offers several advantages. First, it has provided a contextual understanding of the complex issues surrounding AI and automation technologies from the perspective of key actors at a large public university. Creswell writes that qualitative research is a situated activity with a set of interpretive materials, attempting to make sense or interpret the condition in terms of

its meaning to the participants (Creswell, 2017, p. 7, & Denzin and Lincoln, 2011, p. 3). By interviewing university faculty who are involved in day-to-day technology education and research, I have been able to understand the role of advanced technologies from their perspectives and learn how they perceive the future from their particular stance. In addition, this study has explored how the participants' beliefs have been informed by their unique situation and context, influencing their experience and how they view their role in responding to challenges posed by AI.

The qualitative approach provides a framework for continuously modifying and reconstructing the study. Maxwell writes that qualitative research offers flexibility. Rather than following a strict sequence of activities based on the initial decision, it creates a reflexive process through the entire project (Maxwell, 2012, p. 2).

Using this iterative process, I have been able to reconsider my research questions based on faculty feedback, reevaluate the study's logic as conditions changed, and inform the research design accordingly. This process has enabled me to reflect on my misconceptions and what I had not considered by drawing from the participants' context and their specific institutional knowledge.

Finally, unlike quantitative research methodologies such as randomized control studies designed to validate or reject an assumption, qualitative inquiry provides opportunities to describe underlying reasons, opinions, and motivations. Rather than excluding unexpected results as anomalies, it looks for explanations that may be far-reaching. This approach has helped me to go beyond the simplistic discussions about the impact of advanced technologies on higher education and gain a better understanding of the opportunities and obstacles it presents.

Research Design

Yin writes that research design is the link that connects research questions to research finding through the steps taken by the researcher in data collection and analysis (Yin, 2009). Research design is a blueprint that addresses "the research questions, relevant propositions/hypotheses, the unit of analysis, the logic linking the data to the propositions, and the criteria for interpreting the findings" (Baskarada, 2014, p. 1).

To address the research questions, I selected FIU as the unit of analysis. Thomas writes that "Case studies are analyses of persons, events, decisions, periods, projects, policies, institutions, or other systems that are studied holistically by one or more methods" (Thomas, 2011). Case studies are different from other types of qualitative research in that they require extensive description and analysis of a single bounded system (Mariam, 1998 &, Smith 1978). They offer an in-depth study of the situation involved, its meaning for the people involved, and more importantly, the process, not the outcome. In a case study, the focus is on the context and discovery rather than confirmation (Merriam, 1998).

Because a case study provides a roadmap for an in-depth understanding of issues, it can be conducted within the framework of critical theory. VanWynsberghe and Khan argue that because a case study provides detailed accounts of complex settings, it is "aligned with critical theory in that it also focuses on reconstructing history to understand the values and practices that are responsible for our state of affairs" (VanWynsberghe & Khan, 2007, p. 89).

To develop a logic for linking the data to the propositions, I selected the participants from various programs to represent the diversity of approaches used in

the research, teaching, and development of AI. Thus, my participants included faculty and directors of research institutes or scientific labs, or faculty who were focused on teaching AI. My criteria for interpreting the study's findings were to provide a clear context by a thorough examination of literature and scholarly work on issues surrounding AI, as well as a survey of theories of technology. This allowed me to gain a holistic view of the research problem and helped me to address the research question with a deeper understanding.

Setting

Focusing on FIU as a bounded system, I have studied efforts, initiatives, plans, and activities concerning the adoption of AI in pedagogical and research frameworks. My focus on FIU provided ample opportunity and access to faculty and university documents to understand the various issues surrounding AI and to learn how the university responds to the challenges posed by this technology.

The primary source of data for this study has been interviews with faculty and program directors who are central figures in teaching, researching, and examining AI and automation technologies. These participants constituted a *purposeful sample* as my selection included key informants who are knowledgeable about the subject matter. In this type of sampling, Creswell writes that the participants are selected purposefully to inform the research problem as they are central to the phenomenon under study (Creswell, 2017, p. 158). Selecting key informants who are especially well informed or experienced with a phenomenon of interest is critical to effective use of resources (Palinkas et al. 2015; Cresswell & Plano Clark, 2011). Potter defines interviewing as a "technique of gathering data from humans by asking them questions and getting them to react verbally" (Potter, 1996, p. 96). The purpose of the

interview is to gain a complete account of information about the participant's experience (Polkinghorne, 2005, p. 142).

Using *semi-structured open-ended* interviews, I initiated the discussions with a few questions about the participant's experience with AI and automation technologies. Gill writes that key questions designed to initiate the conversation in the area to be explored, allow both the interviewer or interviewee to diverge in pursuing ideas or responses with greater depth (Gill et al., 2008. p. 291). Green et al. write that semi-structured interview offers the advantage of asking all participants the same question while providing the freedom of follow up questions that build upon the received answers (Green et al., p. 362). The semi- structured format allowed me to engage in dialogue where I would follow up with new questions and probe each participant on their experience.

Upon completing the review process and approval of the interview protocol questions by FIU's Internal Review Board (please see Appendix A), I interviewed sixteen faculty in separate individual interviews. The interviews lasted between 60 to 90 minutes, the typical duration for semi-structured interviews (Marshall et al., 2013, P. 15). In addition, I conducted four 30 to 45 minutes follow-up interviews to clarify several responses of the participants. The interviews were scheduled and conducted in seven consecutive months and were all conducted using the same teleconferencing software platform (Zoom).

During the interviews, I collected data by recording the conversation, making observations, taking notes, and writing memos. Lofland and Lofland suggest that taking notes during or after the interviews serves as a memory aid when full notes are constructed (Lofland & Lofland, 1984). These notes included the context, the

description of the interaction, and the connections I saw to other interviews. Glaser considers memos as "the records of the researcher's idea development about codes and their interconnections" (Glaser, 1998 and Montgomery & Bailey, 2007, p. 68). At the conclusion of each interview, I wrote a memo to incorporate the theoretical backdrop of the study.

Role of the Researcher

I am an Iranian woman who came to US to attend university with the intention of moving back to Iran. However, due to circumstances in Iran I decided to stay in the United States. I have a diverse educational background that spans across Civil Engineering, Urban Planning, Architecture, and most recently Higher Education. I am a faculty member in FIU's Architecture Department where I have been teaching for the past ten years. I have been an academic for the past twenty years, I became a full professor five years ago, served as the Associate Dean of Research and Faculty Development for 3 years at the College of Communication, Architecture and the Arts (CARTA). Currently I am the director of the Robotics and Digital Fabrication Laboratory and the director of Technology Research Development for CARTA.

I first became interested in teaching during professional practice at engineering firms where I realized the limitations of my education as an engineer. Going back to university to study architecture and urban planning made me even more aware of how narrow and technical my education had been and made me think of how teaching technology could be more engaging, more broad-minded, and more thoughtful.

After completing my Architecture degree, I became an instructor of architectural technology. Since then, I have taught many technology courses, researched alternative ways of teaching technology, and have been a part of many technology initiatives.

I believe technology is a social process made up of people who undertake its development. Therefore, the processes by which these technologies are taught, developed, commercialized, and applied are critical to whether they will be utilized in ways that benefit or harm society. I hope my work on this dissertation will help me and others to better understand the role of the university in the process of technological development, education, and dissemination.

Participants

To conduct the study, I recruited participants from informal networks of colleagues at FIU, particularly the Quality Enhancement Plan (QEP) Committee. I have been a member of the QEP committee since January of 2020. QEP is a component of the Southern Association of Colleges and Schools Commission on Colleges (SACSCOC) concerned with the reaffirmation of the accreditation process.

FIU's leadership has selected to focus on delivering micro-credentials on "Comprehension of the potential and limits of AI as well as its ethical, social, and moral implications" in the following six years. This faculty committee was formed to discuss content and prepare an AI curriculum available to all FIU undergraduates.

In addition, I used snowball sampling for further recruitment. *Snowball sampling* is a recruitment technique in which an interviewee gives the researcher the name of another potential interviewee, followed by that interviewee providing

another name, thus growing like a snowball (Kirchherr, 2018). Using this recruitment method, I was able to interview sixteen faculty.

Faculty participants in this study are from a wide range of disciplines, including architecture, biology, business, chemistry, computer science, engineering, law, and public administration. The participants' experience is diverse, spanning from Assistant Professors who have just begun their research in AI to Full Professors who have devoted many years to research and teaching AI. Several participants are in leadership positions that could influence how AI should be integrated with teaching and research at FIU.

I conducted the interviews over six months and have listed the participants profiles in the order that they were interviewed. To protect the interviewees' identity, I have provided a pseudonym for each participant. My initial plan was to interview 15 faculty, but I added an additional interview to make sure that my data has reached saturation. Data saturation is a widely accepted criterion in the determination of the sample size in qualitative research. Saturation is defined as “the point at which the data collection process no longer offers any new or relevant data” (Dworkin, 2012, p.1320).

I initially approached the interviewees with an email that included a brief description of my study and a consent form which was approved through FIU’s IRB process. Upon their agreement to participate in the project, I followed up with a meeting invitation for an interview on FIU’s standard teleconference platform, Zoom.

Data Collection and Analysis

Merriam writes that in qualitative research, data collection and analysis should happen simultaneously. They further elaborate that the recursive and dynamic process of data collection and analysis distinguishes qualitative design from traditional positivistic research (Marriam, 1988, p. 155). In addition, qualitative research is based on an inductive reasoning process built on the interpretation of the data and structuring meaning from the data. When data collection and analysis are concurrent, the new analytic steps inform the process of additional data collection, and new data informs the analytics process- all folded in the theoretical lens of the researcher, and what might count as relevant in answering the research question (Thorne, 2000, p.69).

Maxwell suggests three main methods for analysis: 1) memos, 2) categorizing strategies (such as coding and thematic analysis), and 3) connecting strategies (such as narrative analysis) (Maxwell, 2012, p. 105). They argue that developing coding categories, analyzing the structure of the interviews, establishing relationships between categories, and creating tables and displays are all critical parts of data analysis.

I transcribed the recordings of the teleconference interviews using *Otter.ai*, which is an AI based speech to text transcription application. I watched the video recordings of the interviews, examined, and reviewed each transcript for errors and inaccuracies, and highlighted critical points of each interview manually. I also made notes on any issues that were not clearly stated and required further clarification. These were addressed in follow up interviews. This was the last step in preparing the data for coding.

Coding Data

In qualitative research, codes are descriptive tags that are applied to segments of the transcript (Green et al., 2017). Coding allows similar data to be tagged with the same descriptor and bundled into categories that can be compared to contextualize data and develop some meaning (Smit, 2002). Basit writes, "Codes are links between locations in the data and sets of concepts or ideas, and they are in that sense heuristic devices, which enable the researcher to go beyond the data" (Basit, 2003, p. 144, and Coffey & Atkinson, 1996). Basit considers creating categories as the start of constructing a conceptual scheme based on the data.

Creswell states that "Coding is the process of analyzing qualitative text data by taking them apart to see what they yield before putting the data back together in a meaningful way" (Creswell, 2015, p. 156). Coding allows the researchers to recognize the interdependent relationship among data to construct meaning. In addition, rigorous and consistent coding is a critical process to conform to validity and reliability standards associated with qualitative research (Williams & Moser, 2019).

To code the interview data, I used *open coding*. In open coding, codes are developed directly from exploring data using phrases and terms used by the participants. Although this approach is mainly associated with the ground theory (Glaser & Strauss, 1967; Strauss & Corbin, 1998), it has been further developed and used in other approaches (Linneberg & Korsgaard, 2019). Open coding "almost invariably involves collecting data, breaking it up… and then abstracting at a higher level… this process is at the heart of what most theory-building qualitative researchers are doing" (Gehman et al., 2018, p. 288).

I also used template coding, which allowed me to use some of the data from my literature study and the ideas that were reflected in the interview questions. Blair writes that template coding is where the investigator uses theoretical views, literature reviews, and reports rather than from observation (Blair, 2015, Crabtree & Miller, 1992). Combining these two approaches allowed me to focus on the important issues in relation to my research questions while looking for emerging ideas without a preconceived notion of what they might be. To code the data, I used *NVivo*, which is a data management and analysis tool used for qualitative research. Using *NVivo* required assigning each interview to a "Case" and a classification category. Using cases provided an easy method for coding, searching for high-level themes using text and word frequency query, grouping words, and creating word clouds. In addition, I used text search with manual coding, which I developed based on my notes. Using the NVivo query function, I created a list of frequently used words by the participants and their frequency in the interviews listed in Table 1.

Theme and Subthemes Generation

According to Strauss and Corbin, Themes, or categories, are the classification of distinct concepts, "this classification is discovered when concepts are compared against one another and appear to pertain to a similar phenomenon. Thus, the concepts are grouped under a higher order, a more abstract concept called a category" (Strauss & Corbin, 1990, p. 61). Themes are often generated from data as well as the researcher's own understanding and theoretical perspective of the phenomenon, and unlike literature review reviews, themes are partly empirical (Ryan, & Bernard, 2003). To develop themes and subthemes I used a combination of several approaches. First, I examined my notes taken during the interviews and

Table 1

Frequency Distribution of Words Used by Participants

Code	Number Participants Mentioning the Word	Frequency
Ethic/al	16	149
Deep Learning	15	204
Wellbeing	15	165
Work	15	149
AI Courses	14	813
Social Media	14	133
Decision making	14	99
Corporations/Companies	14	99
Climate Change	14	76
Social Sciences	13	111
Jobs	13	104
University Policy	13	97
Government	13	46
Machine Learning	11	139
Robot(ics)	11	89
Economic(al)	11	45
Automation	11	44
Healthcare	11	21
Facebook	10	66
Research Policy	10	32
Accountability	10	22
Control	9	44
Bias	8	30
Black box	7	19
Privacy	7	18
Facial recognition	6	26
Cancer	6	24
Interdisciplinary	6	14
Disease	5	32
Predictive analytics	4	26
Surveillance	4	20
Disruption	4	8
Environment	4	6
Fairness	3	10
Weapons	3	9
Discrimination	3	5
Employment	3	4

Table 2 Word Consolidation to Groups	
Word	**Group**
Health	Healthcare
Disease	
Wellbeing	
Work	Work and life
Jobs	
Employments	
Environment	Environment
Climate change	
Wellbeing	
Decision making	Bias and discrimination
Predictive analytics	
Black box	
Fairness	
Bias	
Discrimination	
Accountability	
Social Media	Social Media, Privacy and Surveillance
Facebook	
Facial recognition	
Surveillance	
Employment	Job Loss or Job Gain
Disruption	
Privacy	
Ethic/al	
Economic(al)	Blue-Collar or White-Collar Jobs
Jobs	
Automation	
Robot(ics)	
Corporations/Companies	Role of Governments and Corporations
Control	
Government	
Privacy	
Weapons	
University Policy	Research policies
Deep Learning	
Machine Learning	
AI courses	Teaching AI
Social Sciences	
Interdisciplinary	

focused on the specific coded chunks in each transcript to understand the data in fragments. I also examined the words that were repeatedly used by the participants in their context (interview transcripts). Using high-frequency words, my notes, and coded information, I developed the initial grouping of data as summarized in Table 2.

Finally, I used Beck's suggestion of using Smith et al. (2009) interpretive phenological analysis method to refine my process of developing subthemes. Among several recommended approaches, I used *abstraction*, which is the clustering of similar data to superordinate themes (Beck, 2019). I used abstraction in two ways: first to examine the connections across various coded data used for developing the cross-cutting or common subthemes and second to make sure that the participants' phrases and words supported the sub-themes. The refined subthemes are presented in Table 3.

Table 3
Refined Subthemes with Abstraction

- AI for Social Good
- Adverse Impacts of AI
- Employment Implications of AI
- AI Ownership and Oversight
- Teaching AI in Higher Education

The final step of data organization was developing the major themes. To generate the major themes, I used the *subsumption* approach which is described by Beck as "when an emergent theme itself is considered a superordinate as it assists in clustering a series of related themes" (Beck, 2019, p. 96). This thematization approach allowed me to bring together the subthemes under two major themes as shown in Table 4.

In the overall organization of the study, each major theme led into a chapter of results. Theme 1: Social Implications of AI was populated from two subthemes of *AI for Social Good* and *Adverse Impacts of AI*. Theme 2: The Economics Implications and Management of AI, was populated by all relevant data from the three subthemes of *Employment Implications of AI, AI Ownership and Oversight, and Teaching AI in Higher Education*.

Table 4
Refined Themes with Subsumption

Themes	**Subtheme**
Social implications of AI	AI for Social Good Adverse Impacts of AI
Economics Implications and Management of AI	Employment Implications of AI AI Ownership and Oversight Teaching AI in Higher Education

Data Integrity

The credibility of qualitative research is a criterion that establishes the trustworthiness and plausibility of the research findings. Merriam writes that credibility deals with the question of "How congruent are the findings with reality?" (Merriam, 1998, p. 201). Lincoln and Guba consider credibility as the principal goal of qualitative research, reflecting the claim to truth of the inquiry. They write that credibility addresses how closely the research results reflect the experience of participants or the context in a believable way. To establish creditability, they consider member check a critical technique (Lincoln & Guba, 1985).

Member check refers to asking for feedback, review, and comments from interview participants. To solicit feedback, I sent the entire transcript of the study,

including interview quotations, method of analysis, and the results to all participants. The participants review of the transcript led to adjustments of the text in how their views were represented as well as the specific language used in describing their profiles. Thus, information included in this study is based on the approval and consent of the participates.

Researchers have established several other approaches to establish credibility for qualitative research. Building on the work of others, Tracy lists the four pillars of credibility as *the thick description*, *triangulation*, *multivocality*, and *partiality*. Geertz introduced the concept of the *thick description* to enhance the credibility of qualitative research through the extensive description of accounts (Geertz, 1973). Thick description is the communicative process of the detailed description, clarification of implicit knowledge, and in-depth and evidence-based account of the researcher's claims (Tracy, 2010, p. 843).

Denzin writes that this type of description goes beyond relaying superficial information:

> It presents detail, context, emotion, and the webs of social relationships that join persons to one another, … it establishes the significance of an experience, or the sequence of events, for the person or persons in question. In thick description, the voices, feelings, actions, and meanings of interacting individuals are heard" (Ponterotto, 2006, p .504 and Denzin, 1989, p. 83).

In conducting the interviews, I have provided descriptions that represent a true and detailed picture of the participants' positions and perspectives, data, and the consequent analysis.

Although *data triangulation* has been mostly associated with quantitative approaches, it has become increasingly important in qualitative research. Decrop

describes triangulation as “looking at the same phenomenon, or research question, from more than one source of data” (Decrop, 1999, p. 158). It helps to corroborate and elaborate the research. Data triangulation ensures the convergence of results and conclusions from multiple data sources. Mathison writes that triangulation is a way of controlling bias and establishing valid propositions in qualitative research (Mathison, p.3, 1988).

Combining data from different sources, people, places, and times will help to balance out the subjective influences of individuals (Flick, 2004, p. 178). To triangulate the data, I worked with the interview recordings, interview transcripts, field notes, and institutional documents for cross-referencing and corroborating findings and analysis results which confirmed my findings.

Multivocality refers to the detailed description of the participant and their significance to the interpretation of meaning in the study (Lindlof & Taylor, 2002). Tracy adds that “providing an empathic understanding, attending to multivocality provides space for a variety of opinions” (Tracy, 2010, p. 844). Multivocal researchers establish relationships with the participants in their study to create a dialogue and opportunity to engage rather than having them answer precomposed questions

Partiality or subjectivity refers to the personal engagement of the researcher in the study. Some qualitative researchers advocate a ‘partial’ stance for the researcher to provide a space for emotion in the ethical process (Orb et al. 2001, p. 20). However, Baur and Ernst argue that partiality introduces a dilemma in qualitative inquiry. Partiality can result in distorting research if the researcher is entangled in their own value system that can lead to misinterpretation of the results.

At the same time, the researcher must participate in the research to access and elicit insider knowledge and a deeper understanding of the issues through engagement with the participants. Mitigating this dilemma is the researcher's most critical responsibility. Researchers should state their partiality, subjectivity, and personal perspective in the clearest possible way (Baur, & Ernst, 2011).

In addition, my purposeful sampling of the participants from different departments and units within the university allowed for cross-checking of different perspectives from different sources. I worked with the participants in a collegial manner and engage them in honest conversations rather than presenting them with a list of predetermined questions. Finally, to establish my position in the research concerning partiality, I have prepared the following subjectivity statement.

Participant Profiles

The following provides a brief profile for each of the participants, highlighting their involvement in research and teaching of AI. In developing these profiles, I used my interview transcripts, notes taken during the interviews, and faculty bios.

Professor Oxman is an interdisciplinary researcher who investigates the intersection of design and technology within the environmental context. She explores data-driven and citizen-centric approaches for improving the built environment. She teaches computational design, data and spatial science, and interactive media design. Her most recent project involves using AI tutoring systems for individualized learning in virtual reality.

Professor Scott is an architectural historian who has written extensively on the role of AI in the architecture profession. His research interests fall broadly into

two fields of critical theory and digital design. Professor Scott has published several monographs and edited volumes that examine the ubiquitous nature of AI and its potential impact on the profession's future.

Professor Turing's research intersects artificial intelligence, computational linguistics, and cognitive science. His research has been funded by the NSF, NIH, DARPA, and IBM. He teaches AI and Natural Lanuguge P courses to graduate and undergraduate students in the computer science program. He has recently developed a course called "AI Concepts," which is open to all FIU graduate students.

Pro Professor Engelberger's research is focused on mobile robots and sensor development for underwater robotics communication. He is developing methods that enable fundamental robotics tasks such as navigation, patrolling, tracking, and motion safety. His most recent NSF-funded project is focused on examining the intersection of security and privacy in robotics technology. Professor Engelberger teaches both graduate and undergraduate students, including Machine Learning and Introduction to Mobile Robotics which are sub-areas of AI. He also teaches Planning Algorithms to advanced computer science students.

Professor Marshall teaches and researches cyberlaw, intellectual property, antitrust, international, and comparative law, and human rights. His most research concerns using AI filters trained on copyright infringement copyright or content regulation in illegal pornography and violence threats. He has published articles on copyright, trademark, and antitrust law in various journals and books. He has also published works on antitrust law, telecommunications law, and net neutrality in American University Law Review, Hofstra Law Review, and Santa Clara Law Review.

Professor Brooks is a data scientist with a research focus on bioinformatics and biological science. His most recent research examines data science and Artificial Intelligence approaches for improving decision-making in local governments. He also works with the Academy for Computer Science Education to develop new teaching methods that better communicate computer science principles. His research in this area revolves around making computer science more assessable to minorities and underrepresented communities.

Professor Menges research is in the area of robotics and digital fabrication. His research interest is focused on AI driven design and construction of the built environment and the application of robotics augmented by artificial intelligence for construction practices.

Professor Neumann research focuses on deep learning for computer vision, robotics, distributed AI/ML, and Broad Scope Artificial Intelligence and Machine Learning. His most recent NSF-funded project is focused on developing an adaptive and intelligent learning platform for training students on industrial robotics. He teaches Image Processing, Computer Vision, Artificial Intelligence, Machine Learning, Deep Learning, Data Science, Data Mining, Modern Control Systems, and Robotics.

Professor Mumford's research is focused on community development and studying how AI is impacting government processes. He also investigates big data and data analytics for local and state governments in the public domain for policymaking. His most research project investigates the ethics of AI and algorithmic bias. Professor Mumford teaches a new course called “technology for government,” where he teaches technology topics and AI. He is also a member of the Advanced

Technology Academic Research Center (ATARC), where he researches the ethics of AI.

Professor Blum is the director of a research lab working at the intersection of machine learning and its applications in real-world engineering systems. Professor Blum's research interests include machine learning and decision-making algorithms as well as internet-of-things.

Professor Hopper's research is focused on affective and social computing. Her research projects aim to create digital and socially engaging and intelligent agents that can interact naturally with humans via expressive multi-modalities in various contexts involving socio-emotional content. Her interests involve research on virtual characters for health communication and behavior change.

Professor Watson's research area includes Image Processing, Computer Vision, and Human-Computer Interface. Professor Watson and his team use data from Magnetic Resonance Imaging (MRI) measurements from the brain to examine cortical thinning (shrinking of the brain) and Positron Emission Tomography (PET) to detect amyloid plaque (a protein plaque in the brain) which is a precursor to Alzheimer's disease.

Professor Linnaeus's research includes aquatic ecology, predator-prey interactions, food web ecology, and urban stream ecology. He is the director of several large NSF-funded projects focused on aquatic chemistry and water contamination. He also leads projects such as introducing fish to native fish communities in western US lakes and urbanization on sustainable freshwater resources.

Professor Johnson's research involves the use of analytics in healthcare, including Machine Learning and Natural Language Processing. Her recent project is focused on using AI to provide alternative medication for doctors at the time of prescription to reduce cost. She teaches business applications of AI in Health Informatics and MBA, which are both graduate programs. She also teaches a new undergraduate course in teaching how to use AI strategies for business.

Professor Lovelace's background is in Statistics and Information Management Systems. Her research is focused on the healthcare system and finding ways to improve patient care. Her most recent work examines patient-centric Health Information Exchange (HIE) initiatives and how they can empower patients to aggregate and manage their health information. She teaches fundamentals of AI and ML to graduate students in Information Management Systems.

Professor Mendeleev is a researcher in analytical and environmental chemistry with a focus on organic mass spectrometry. He leads a team of researchers who examine highly toxic halogenated compounds and their metabolites and degradation products in aquatic organisms and sediments.

Chapter Summary

This chapter discussed the research methodology used to study and understand faculty perspectives on the implications of AI and how they see their roles in its implementation. The beginning sections of the chapter focused on showing how the qualitative research method used for conducting this study provides a critical approach for answering the research questions and inform institutional practices and policies. These sections presented how using FIU as a case study helps to gain an in-depth understanding of the faculty beliefs, theoretical perspectives, and

unique experiences, and how these factors influence faculty response to challenges posed by AI.

The following sections of this chapter provided an overview of the study's setting, the approach for conducting the interviews, the sampling method, and how the participants were recruited. A brief bio for each participant followed by presenting the approach for credibility and ensuring data integrity was also provided. The analysis of the interview data and the details of theme and subtheme generation were described in the last section of this chapter. This section showed how analyzing the interviews resulted in the development of 37 codes which merged into seven subthemes, categorized under two overall themes. The analysis results in Theme 1, the Social Implications of AI, will be discussed in Chapter IV, and Theme 2, the Economic Implications and Management of AI, will be discussed in chapter V.

CHAPTER IV

SOCIAL IMPLICATION OF ARTIFICIAL INTELLIGENCE

As discussed in previous chapters, this study was designed to explore faculty perspectives on AI technologies, their impacts on society, the economy, and their implications on higher education. Because faculty are the responsible for educating the AI technology workforce and industry leaders who drive its design and implementation, their views are essential for mitigating its impacts. Faculty stands on how to teach, research and implement this technology can provide valuable insights for practice and policies regarding AI.

This qualitative research is a case study focused on FIU as a bounded system. The focus on FIU has provided opportunity and access to faculty to address the following research questions: 1) What are faculty perspectives on social and economic impacts of AI, 2) What are their views on how AI is managed? 3) What type of policies and organizational changes can support a responsible use and development of AI at the university?

This chapter reports on the results from interviews with 16 faculty conducted over seven months. The faculty participants were selected through purposeful sampling based on their direct involvement with teaching, research, development, or examining the impacts of AI. Participants of the study were an interdisciplinary group of faculty from seven departments at FIU. Interviews were conducted and recorded via Zoom video conferencing application and transcribed using Otter.ai, which is speech to text transcription application. Prior to coding data, the transcripts and the researcher notes were examined for errors and inaccuracies, leading to four follow-up interviews. This was followed using by NVivo software which is a data

management and analysis tool to examine the structure of the interviews, develop coding categories and categorize them into themes and subthemes, and establish relationships between categories.

The interviews revealed a wide range of faculty perspectives categorized under the two themes of 1*) Social Implications of AI*, which is presented in this chapter, and 2) *Economic Implications of AI*, which is presented in the following chapter. Faculty discussion under the theme of *Social Implications of AI* was divided into (a) *AI for Social Good* which reports faculty perspectives on positive impacts of AI, and (b) *Adverse Implications of AI*, which is focused on social challenges presented by AI.

AI for Social Good

To begin the interviews, I asked each faculty participant to provide a brief background of their engagement with AI and what they saw as some of its significant implications. In general, all participants were genuinely excited about how AI has enabled their research and is helping them to address scientific and social challenges in ways that were not possible before. By providing examples of how AI is helping them in their work, the faculty presented a clear picture of how AI is leading to significant break thoughts and solving some of the most changing problems facing humanity. The faculty talked about using AI for curing diseases, improving the healthcare system, mitigating climate change impacts, revamping education, and improving our physical infrastructure. These are discussed under the two subheadings of (i) Life and Work and (ii) the Environment.

Life and Work

Professor Brooks began by saying how "AI is touching our lives in more ways than we can think about." He stated that AI is bringing unprecedented opportunities for solving human challenges, and it "can solve the problems of mankind." He also talked about the possibilities of AI for improving economic aspects of people's lives:

> AI brings us new possibilities and opportunities from an economic point of view for addressing our challenges or ways to improve our lives. I see AI as something that is simply opening up the field for people, but it requires a rethinking of who we are and how to solve our society's various problems. I think that AI can solve the problems of humankind.

Dr. Brooks was optimistic about AI's vast potential and its capacity to change people's lives for the better. He argued that AI is creating new jobs for technologists and all the people who are willing to learn and get retrained. However, he noted that we need to rethink the role of AI and guide it in a direction that will benefit our entire society. He argued that teaching computer science in an inclusive way will enable more people to share the benefits of AI.

Professor Blum argued that AI would make everything more efficient, and with the right type of policies, AI could potentially help facilitate a fair distribution of resources. He talked about the prospect of making predictive analytics available to every citizen:

> AI is going to revolutionize the economy in a sense that in ten years from now, everyone would be able to purchase GPUs similar to what we have in our tablets now. This means that everyone can make intelligent decisions, not by themselves but by the support of AI algorithms.

Professor Blum went on to say that if we can design and manage policies for fair deployment of AI to allow everyone to benefit, this technology will change

everyone's life for the better. Like Professor Blum, he felt that teaching AI should be a major component of every student's education.

Professor Lovelace talked about the capacity of AI to augment human abilities and increase productivity "it can eliminate human error, it can eliminate human fatigue, it can eliminate many issues that are associated with the inefficiencies of human in jobs." She argued that AI could change and potentially improve people's lives by eliminating the need for conducting mundane tasks.

Professor Menges talked about the way that the integration of AI and robotics is revolutionizing how we work. He also argued we could potentially enjoy shorter working hours by eliminating routine and dirty tasks for humans:

> We have developed robots with a high level of dexterity, and the combination of this technology with Artificial Intelligence is revolutionizing the field of robotics. Although we are not seeing the impact on the economy right now, economies such as China are already employing intelligent robots in performing many types of jobs.

He expressed that these technologies "will free humanity from doing things that are repetitious and allow us to expand into new territories that we have never been able to explore." Professor Menges stated that AI is not being utilized at its full capacity yet, and there will be a long time before we have the infrastructure for its expanded implementation. He believes that when AI technologies are fully realized, it will be more impactful than the internet.

Professor Scott talked about how AI is improving architecture and construction of buildings, "clients are asking architects to use AI because it optimizes the design to get a better value from their site and improve their building performance." He elaborated that AI is helping architects to design more efficient buildings by using less materials for construction and less energy for their daily

operation. In addition, AI is expanding design possibilities, helping architects make buildings that provide a better experience for people. In addition,

Professor Watson, who has conducted extensive work with AI, explained his research on Alzheimer's disease and the potential benefits of knowing who is at risk. He described how machine learning is helping him to find ways of predicting the onset of this disease in people:

> We use machine learning to determine two things: multi-class classification and prediction using imaging measurements like Magnetic Resonance Imaging (MRI) and Positron Emission Tomography (PET). Magnetic Resonance Imaging shows whether there is any cortical thinning or brain shrinkage. We found out that the brain shrinks in certain areas for people who have Alzheimer's disease. Also, with PET, we can detect amyloid plaques, a protein plaque in the brain which makes people forget. And we put all of these measures into machine learning.

Professor Watson explained the process for combining these measures with information from blood specimens and neuropsychological testing using a machine learning system. He described that this is a very complex problem and involves many steps and numerous patients. Although this process seemed to be painstaking and complex, the outcomes of this research could be lifesaving for people at risk. Dr. Watson is optimistic about the result of this research and his ability to impact this field.

Professor Johnson stated that "AI is here to help us and augment our abilities, "we could use AI for social good" and continued with how AI can enable delivering better healthcare services for both patients and doctors:

> What we are trying to do, is to augment the doctors' ability to better serve their patients. So, if we can use AI to help them with their scheduling, we would reduce their idle time. If we use AI to help them to identify diseases and help them with fast prescriptions, then they can focus on more important things that are more related to human needs.

Following the statement on how AI can help physicians, Dr. Johnson emphasized that using AI "does not mean that humans will be replaced" but rather will be used to augment our ability and increase our productivity. She stated, however, we need to train people and prepare them to use AI for supplementing their abilities, everyone needs to be up to speed, and she believes that is not an insurmountable task.

The Environment

Professor Blum explained that using AI can eliminate human mistakes, improve infrastructure, and lead to a fair distribution of resources if managed responsibly. In addition, he discussed that AI could provide accurate predictions of natural disasters, which can mitigate the climate crisis. Using one of his projects as an example, he explained:

> Hurricanes and wildfires in the U.S. cost the government trillions of dollars, and if we could predict them, we can mitigate their impact. In California, for instance, managing the power grid in high temperatures could prevent the majority of what is happening.

This statement was made at the time that California was experiencing an abnormally high amount and severity of wildfires. Professor Blum went on to describe that when the temperature rises due to weather conditions, it increases the demand for air conditioning and overloads the powerlines:

> That is something that policymakers should be aware of. When we have weather conditions and the temperature goes up, the demand for air conditioning increases. At that point, the power lines need to transfer more power than their limits and at some point, there will be a line failure.

He continued that line failure causes small fires, which can expand easily due to dry heat. However, authorities can act on this information to prevent the expansion of fire:

> When they see that the temperature is going up, they can start local outages for a few hours or ask people to adjust their temperature in return for incentives, which could mean cash incentives for customers or discounted utility bills.

Professor Blum argued that this could only happen if events are predicted far in advance, and large-scale autonomous system and predictive analytics have that capacity. He continued to say that this is only one example of how AI can provide input for critical decisions for managing infrastructure challenges due to climate change. Predictive analytics can be a powerful tool for policymakers to mitigate the looming crisis of global warming.

Professor Linnaeus talked about how AI can be used to provide food security in the climate change crisis:

> AI and quantum computing will allow us to use DNA structures to crack all kinds of challenging problems. And some of those problems are going to be things like creating genetic mutations in crop plants that do not have to be bred into. We can do this by taking environmental information to mutate the genes in plants, and the plants will be able to grow, for example, in a dryer area.

He continued to explain how that this is important because of the threat of climate change on food security. AI has opened new ways of thinking about genes making it possible to program plants to grow differently. Genetic mutation enables agriculture practices that not only increase food production but also benefit the environment by producing more food from the same amount of land and protecting plants from disease which leads to wase. AI is making genetic mutation this much more effective and easier.

Professor Linnaeus provided another example of AI enabling water quality research at FIU's Institute of Environment:

> We are collecting large enough real time environmental data on water quality and the huge networks that go from the Everglades all the way to Biscayne Bay. But we are not able to find where all the particular sources of the contaminants are coming from, without just plodding through and collecting thousands of samples and spending hundreds of hours. Artificial intelligence will take many layers of data, and basically say, these are where your problems are focus here.

He explained that knowing the type, location, and exact source of water contaminants can be extremely helpful in addressing water pollution issues. AI allows us to map data and see the connection points and correlations among them, helping to make sense of the information. This Technology has the power to help us understand large-scale global problems of the environment and new ways of addressing them.

In discussing the positive impacts of AI, faculty referred to their research and provided examples of how their work with this technology has contributed to social good. They discussed the transformative impact of AI on curing diseases and improving the health care systems, AI's role in improving the way we live and work by eliminating repetitive and meaningless work, and how AI can augment human activities and efficiency. They also provided insights into how AI can resolve some of the most critical challenges of climate change, including infrastructure challenges, food security, and water pollutions.

Adverse Implications of AI

Although faculty spoke about the positive impacts of AI and the possibilities for positive change, many were fully aware and concerned about AI's harmful impacts and ethical implications. They discussed bias and discrimination associated with AI decision systems as a well-established problem of predictive analytics. They provided examples of intensification of bias in gender, race by AI, and how has it has impacted the criminal

justice system, hiring practices, and politics. Some faculty spent a significant amount of time during the interview discussing the use of AI for manipulating people's behavior in social media while violating their privacy rights. The following summarizes this discussion under the two subheadings of (i) *Bias and Discrimination* and (ii) *Social Media, Privacy, and Surveillance*.

Bias and Discrimination

In explaining their understanding, views, and social implications of AI, some faculty presented an instrumental perspective of the technology. For example, Professor Scott argued that:

> From a theoretical perspective, the argument to be made is affordance put forward by James Gibson about 50 years ago. He was saying every tool affords the possibility of certain things. A screwdriver is good for screwing a screw, and the hammer is good for hammering; potentially, you could use a screwdriver to hammer in a nail. I guess either of those could be a murder weapon. So, tools have their own affordance, and they have no agency as we are in control of them.

Professor Scott presented a rational conceptualization of AI technologies as a tool, and a means to an end developed to serve the purpose of its user. He argued that, like any other technology, AI could be used to cause harm and in a way that it was not designed to be used. Thus, it is neither good nor bad. He further elaborated that the problem with AI is not the technology but how humans use it.

> I do not subscribe to the idea of technological determinism. In other words, I do not believe that any technology has an assigned kind of impact. It is really a question of how it is used. It can be good or bad.

Dr. Scott considered the big problems with AI that have emerged in the recent past a consequence of the human bias embedded in data and not any issues with how the technology is developed. Professor Johnson had a similar view, using the analogy

that guns do not kill people; people kill people. She argued that "you could use AI for good, and you could use it for bad," cautioning that we should educate people on how this technology can be misused.

Professor Turing's view was in sharp contrast as he described AI in the larger context of technology, situated in our social and cultural values. He argued that technology is not an ambivalent or inert process because our social values are reflected in its design and not merely its use:

> I think there are plenty of people who would protest that even things as simple as hammers have embedded values. If you think about a pair of scissors, you have a right-handed pair or a left-hand version. There's a value there, right? If no one is making left-handed scissors, then the people who are lefties have a problem, so there's bias in a so-called inert tool.

Using another example Dr. Turing continued to explain if a very simple object can have built-in bias, we can expect AI which is a very complex technology to reflect our values in a much broader way:

> When they were designing seat belts, their standard crash test dummy was the average American middle-aged male, which completely ignored more than half of the population, namely women and children…And we saw that fatality rates and injury rates for women and children were much higher…now you take AI, which is an infinitely more complex technology and draw the analogy. There are going to be a ton of biases all over the place. I think even the simplest pieces of technology can incorporate our cultural and social biases unconsciously and we don't even realize it until someone points it out.

Professor Turing explained that in the case of AI everything becomes more complicated, especially that we are at the beginning stages of understanding these problems and we are suffering from them. However, on the positive side, it seems that the issues of bias in AI, are bringing attention to how our value systems are embedded in other technologies:

> It is really interesting because it (bias) has become such a prominent issue in AI, that is bleeding back to earlier technologies. People are starting to realize that even simple technologies that we thought were inert do have biases built into them. I mean there's a positive side to that, people are much more aware of these issues than they used to [be].

Dr. Turing continued to say that we are in the early stages of understanding bias in AI. As of now, our best approach is to increase the diversity of the team of code writers to catch bias problems. Although we can adopt different approaches to get better results, we do not have a systematic method to address this problem as of now. Like the case of seat belts, hammers, or scissors, address bias in AI remains a difficult issue.

Professor Linnaeus had similar views. He explained that he does not think that technology, and in particular AI is inanimate. He said that from a biologist's perspective, AI is dynamic and has much more potential than a neutral tool. He referred to his example of programing plants with AI, stating that although this may address the crop shortage, there is always the danger that those mutations will have unwanted consequence "you could imagine that one of these plants becoming home to a virus and then that virus just wipes everything [out]." He continued to say that this could be an unintentional mistake or a maliciously planned event.

> AI can enable biological weapons that can eliminate an entire race or ethnicity. This would be extremely dangerous in the political climate like we have now. I would just assume that a racist leader can wipe out the entire black population of the U.S., and it is possible that you could come up with a disease that would be targeted enough to do just that.

Dr. Linnaeus argued that ethical conduct should be at the forefront of AI research, and we need to make sure that there are limits on the type of research and development at the university. While AI can help us unravel many of our challenges,

we need to have stringent policies and preclude research that can have a devastating impact either by design or error. Without appropriate strategies to guide AI research in higher education, we are vulnerable to its harmful impacts.

Professor Lovelace stated that AI is not an autonomous tool by any standards, as it performs the tasks humans teach it to do. In this sense AI is not a tool independent from its architects as it incorporates the values, logic, and desires of those who are developing the algorithm. "Whatever you dictate, AI will do with perfection, and you dictate through the algorithms." She went on to describe if robots were programmed to kill all Muslims, they will be flawless in its execution, without getting mental or physical fatigue or having conscious problems:

> If you code that in a robot, then what will happen to the entire generation? No matter woman or man, young or old, or whoever it is, as long as they are Muslims they will get killed. Because AI will execute the algorithms to the perfect level.

Professor Mumford described that from a social science perspective, nothing is inert. There is a value-based system behind any production and "whoever is producing these kinds of technologies, we have to be able to check what is underneath." He talked about the fallacy of Predictive Analytics as being fair because of its automated nature:

> You can see it with the recent voting machines or elections. The manufacturer is being blamed for being from a certain party… If you are using AI for voting blocks, then you're going to see even more ethical questions towards one party or the other. It all depends on who is handling the technology and how the technology is being put into use."

He pointed out that there are numerous issues in the forecasting methods used in AI systems, which have led to an increase in bias and discrimination in the past several years. We need to have the right tools to investigate and find strategies to stop them.

Eliminating human judgment and differing critical decisions to AI algorithms disguises the reasons behind decisions and makes it difficult to hold anyone accountable.

Professor Johnson talked about how AI systems can perpetuate human bias which is embedded in the existing data used to train the algorithms:

> We give the machine several observations, several data points, and then it gets to learn from that data. If the observations and data have a built-in bias, then the recommendation or the output will be biased as well, and that is a big problem.

She continued by presenting examples to communicate her point. In her first example, she explained that many corporations are increasingly using AI for recruitment. To get the best person for the job, "AI algorithms are trained with data collected from people who have historically performed well in that specific position." However, as those positions have been mainly given to white males in the past, the algorithm learns that white males are best for those jobs. "[What] that means is that [AI] model would not recommend a woman for that job."

As a second example, she used a recent study published in the journal of Management Science. She explained that the study investigated a recurring problem with scheduling at a doctor's office which used an AI-based program:

> The office noticed a strange pattern in scheduling that overbooked appointments for black patients and not for the white patients. When they examined data used to train the algorithms, they noticed that blacks and minorities, in general, show to appointments late or do not show up... The algorithm learned that when scheduling appointments minorities, should be overbooked. Therefore, recommendations were flawed or biased.

Professor Turing, described the issue of bias in Natural Language Processing (NLP) models as a well-known problem and active topic of research and discussion in the

AI community:

> Modern language models and most of the statistical models are trained on data that are collected from natural language use, and people are biased in their language use. For example, if you look at how more often female names are associated with the profession of nurse versus doctor, it reflects our bias and how people talk about that in the real world. But the models learn these patterns to predict the next word. If you say Joan works in the medical profession, Joan is a doctor or nurse, it is more likely, that it'll say nurse.

He further described that beyond simple examples that can be easily explained, numerous and sophisticated and subtle examples of how people's conversations about race, ethnicity, and other stereotypical categories are captured and amplified in the Natural Language Processing models. This presents a difficult problem to scientists, and addressing it is as complicated as resolving the bias problem in any other domain.

Professor Watson explained the problem of bias in terms of training algorithms on "limited data," stating that for machine learning algorithms to work properly they must be trained with a massive amount of data:

> If the data doesn't include variability, there is no machine learning… it is overfitting the results and that is unethical. When you overfit, you tweak the decision function in your favor. But that is not the machine learning decision function because it did not take into account what happens with various features.

Professor Mumford explained the issue of bias in AI both in terms of embedded human bias in data as well as the limited available data. He argued that the increased use of facial recognition in the criminal justice system is leading to serious discrimination against black people:

> If you look at how AI is being used in criminal justice, there is limited data for training the algorithms on the entire population, so the data is being mostly trained on some specific populations, especially minority and black

> communities, resulting in a wide range of errors… We are not doing a good job of making AI equitable… that is a very blatant example of ethical questions with AI.

He elaborated that these issues do not just result in simple mistakes, their discriminatory outcomes impact people's lives in a profound way. Professor Scott also talked about the problem of face recognition by referring to the image recognition algorithms in Google Photos that classified African Americans as "gorillas" by mistake:

> It was because the data had prejudice in them. You are always going to get the prejudice that is reflected in society. Those biases in the input data, come out in the biases in the output. The data is inherently biased, then again, we are inherently biased species, and this is a problem.

Professor Engelberger explained the lack of diversity in hiring computer scientists who design the algorithms as another contributing factor. He argued that there is a problem of diversity in large corporations like Google. As long as these corporations keep training the system with a particular group of people (mainly white males), they will continue to get biased results. In addition, he talked about the ethical problems at large corporations by pointing out the recent firing of Timnit Gebru and Margaret Mitchell, the co-leads of the ethical AI team at Google. He stated that it seems that Google's ethic leaders were fired as a result of their intention to write a paper on the dangers of large language processing models:

> They (Gebru and Mitchell) say that they were fired because they were going to publish a paper (On the Dangers of Stochastic Parrots: Can Language Models Be Too Big?) which would raise two issues on AI: one about the natural Language Processing Models because they include bias, and the other about the energy consumption and resources they need to run these models… they're kind of like power-hungry.

He continued to say that although Google did not allow the authors to publish the paper, the paper was published after they were fired. The paper has generated significant interest and awareness in different AI communities:

> I think this opened a whole can of worms…I was not aware on how decisions were made, but since this news came out at the national AI organizations, it has become really important because it has raised awareness of ethical issues and the weaknesses of these models. The paper shows how they are replicating existing structures of bias.

Stressing the importance of this paper in the computer science community, and how it has led to new discussions and academic papers, Professor Engelberger described the paper. He explained that the paper is focused on how Natural Language Processing models use data with various types of stereotypical associations and negative sentiment towards specific groups. The result is that models that encode stereotypical and derogatory associations with gender, race, and ethnicity.

Professor Engelberger also talked about the environmental risks and financial costs of deep learning models that were discussed in the paper. He echoed environmental concerns about the extremely large carbon footprint of AI training models which society and the natural world has to bear.

Dr. Turing, described the issue of energy consumption as the following:

> It takes a lot of electricity to train these models- basically, a big cluster of GPUs (Graphics Processing Units) which are very power-hungry, and you run them for a ridiculous amount of time, like a week or two, to train one of these models. And when you're exploring and trying to figure out how to build a model correctly, you might do that a bunch of times.

He explained that beyond the environmental cost of training very large Language Processing Models, the financial cost for training models is a barrier for small companies. “There are a lot of issues wrapped up in here, not just CO2 and pollution.

There is a bias towards large companies who have the resources to buy these machines, run and maintain them, and train the models". He stated that this costs eliminates access of a large portion of the scientific community to conduct AI research. Therefore, only a handful of large corporations are able to research and develop these models. He continued to say that however there has been many discussions on how these models can be developed to be more effective and less power-hungry.

Professor Brooks described the problem of bias in AI in terms of the lack of transparency in predictive analytics, known as the "AI black box problem." He argued that although computer scientists understand how the systems works, they cannot understand why they work and "how they do what they do," they cannot interpret or explain the outcomes:

> To train a neural network, scientists use a massive amount of data, adjust them based on some parameters and criteria and build a mathematical model that can identify patterns or predict a phenomenon. However, if the results are not interpretable or explainable, the use of the model is extremely limited.

He clarified that because the results are not explainable or interpretable, detecting, removing, or reducing human bias, has not been possible until now:

> In the initial stages of AI research, this was overlooked…however, we are building systems that address this very question, how can I interpret a decision made by an AI program? This question itself has blossomed into a new research area, and it is beginning to become a mainstream AI research.

Professor Brooks concluded that this new research area would address some of the complaints about the fairness, discrimination, and bias issues associated with AI decision-making. Professor Watson also spoke about the AI black box problem and explained the nature of the issue. He stated that to train convolutional networks, we

deploy thousands of artificial neurons to process and learn from data. Finding different relationships in data is a very complex task and it is difficult or even impossible to determine how decisions or predictions are made. "We know what's going on inside the black box, but we do not know how to relate it exactly to what we have fed it." This leaves the system vulnerable to mistakes, including incorrect and unfair decisions.

Professor Marshall presented a different perspective regarding AI bias by stating that he was not convinced that AI would *necessarily* lead to increasing bias and discrimination in the criminal justice system:

> If you were to implement more empirical work on sentencing patterns, you can find bias and rectify human biases through litigation. On the other hand, if one of these parole programs or probation programs uses data from the past record of discrimination to feed into the AI model, there would be a reinforcement loop. But at some point, people could challenge that! They would use other software or other experts to say, look at what your program is doing! Give us access to the code, and we will challenge these results. So, I'm not sure that it would necessarily be worse because courts are using some computer program to give somebody a score, either for parole, probation, bail, or something else.

To explain how AI could be used to mitigate human bias and racial bias discrimination, he used the following example:

> In North Carolina, there was a lawsuit about how they drew the districts to split up black communities, so there will be two non-black Congresspersons for a very large black community because they split them into two and they were surrounded by non-black communities. The community used software to figure out that this was leading to disparity, and they had the court strike it down.

He argued that this is a good example of how using AI can detect anomalies, fraud, reduce exclusionary practices and improve the democratic process. Professor Marshall also talked about his recent research training AI filters to recognize

copyright infringement, to monitor illegal pornography, and to identify potential threats of violence to women. These filters use Machine Learning algorithms to match the incoming uploads with the trained data sets to block inappropriate uploads.

Professor Johnson also had a positive perspective on the use of AI to address bias and social injustice. She used her current project as an example:

> We are trying to look at how we can use AI to make algorithms such as the one used in LinkedIn to be fairer. We know that in social media, the information that goes out to people in the network is privileged and reaches only certain people in populations, creating some imbalance or reinforcing the imbalance. Using AI now, we can train algorithms to be fairer and ensure equity amongst people from different races and genders.

She argued that although recommendations and decisions made by AI can be biased, AI algorithms can be trained in many domains to detect human bias and prevent unfair treatment of individuals. She believes that AI technologies are moving to address the issues of bias in data and predictive analytics with better and more advances algorithms.

In summary, while a few faculty were hopeful about the future direction of AI research and its potential use for detecting bias and discrimination, the discussions revealed several fundamental issues. The use of AI in automated decision support systems or Predictive Analytics so far has been problematic because of many unresolved issues that include: intensification of human bias which is already embedded in the existing data; serious mistakes resulting from training algorithms on limited data sets leading to prejudiced decision recommendations; lack of transparency which makes the results vulnerable to human error or manipulation; lack of diversity in people who design training algorithms resulting in the

perpetuation of bias; and enormous energy cost which makes AI development for small companies difficult if not impossible to pursue.

Social Media, Privacy, and Surveillance

Participants discussed disinformation, fake news, and targeted advertisement as significant social impacts of AI. Professor Neumann talked about how false and misleading information spread through social media undermines democracy. He described three problems with how AI is being used in social media platforms. First, using machine learning algorithms in social media is based on a business model that optimizes user data for prolonged engagement. For example, the YouTube model is to develop accurate predictions on what video should be recommended to the user based on what they have watched. Keeping the user engaged longer means that they have more time to run advertisements and generate more revenue from their clients. However:

> The problem with this business model is that it creates echo chambers of content… when it is benign content like videos of cats doing stupid things, that is all fine. The problem comes when they are politicized videos, misinformation, and conspiracy theories.

He argued that because the human brain is wired to react to stimuli that is shocking and sensational, this model works better with dramatic content:

> The result of this has been the creation of influence mechanisms that push the users to a very narrow path, limiting their exposure to different ideas, lowering their tolerance for diversity of ideas, and magnifying susceptibility of people. This has led to the extreme political division in our society which we have no control on.

He explained that the second issue with AI in social media is its use to categorize and select extremely narrow slices of users based on a given set of characteristics to exert influence. This was initiated with Facebook several years ago when they launched an

experiment to study vulnerabilities of their users' behavior and test how to influence their decision-making. The experiment results showed that, depending on the types of content and advertisements prioritized in the feed, they could change user behavior:

> This strategy is being used by many of social media platforms today for targeting advertisements; however, Facebook can target users at the micro-level. An example of this is when they let advertisers on their platform target a few hundred people in a district of suburban Georgia with ads to discourage them from voting successfully.

The third issue is that AI is proliferating extremism by providing radicals the ability to reach massive audiences, leading to the potential for great harm with deceptive content. The response of social media to criticism of this practice has been to describe it as protection of free speech:

> This is absolutely false since the content feed is algorithmically controlled and prioritized and not randomly selected… Facebook is destroying our democracy and democracies across the world because there is no question that one of the key differences between now and 20 years ago is social media, and they (the owners) are not doing anything about it, they do not care, and they turn a blind eye to it. Facebook is actively tearing the fabric of society and enabling despots and authoritarian regimes to rise.

Professor Neumann concluded by stating that social media platforms present the greatest challenge for AI as "they are not leveraging AI for profit, but profit at all costs". He discussed the lack of policy and effective oversight as a critical factor in empowering social media platforms to continue their deceptive and divisive practices. The sentiments of Professor Neumann on social media were echoed by several other faculty.

Professor Watson used the presidential election of 2016 as an example of social media's impact on changing the result of the election in Trump's favor. He

argued that people's opinions were manipulated with disinformation "it all depends on what you put into the human mind, Hitler was democratically elected. Would you believe that? it all depends what you feed people." He expressed the same frustration as Professor Neumann, by talking about the lack of oversight and the failure of our government system to protect its citizens.

Among other social media challenges exacerbated by AI, the data-mining practices of Facebook presented the most concern for some faculty. They discussed how Facebook is changing the notion of privacy and how AI is enabling them to analyze massive amounts of data collected without the authorization of Facebook users. Professor Mendeleev described a new feature in Facebook which harvests data from all other applications installed on people's devices, even when they are not interacting with the Facebook application:

> There's a new setting in Facebook that enables them to mine data from all other applications you have in your phone. Did you know that? They never asked for permission, but I'm sure that happens when [I] downloaded Facebook for my phone. If I have the McDonald's application to order my hamburger, somehow Facebook has my permission to get information from that application and use it for their database, and that is problematic.

Professor Linnaeus discussed the problems posed by Facebook as a result of the limited privacy protection laws, stating that we need to come together as a society for ending these practices:

> Facebook is a great example of being unregulated and the damage they can do with the information they collect, which is an ethical challenge. Where do you weigh the balance between individuals' rights and these huge corporations?

Dr. Linnaeus continued to say that regulating access to big data and applying AI to data is the key to gaining control of individual rights. He believes that we, as a

society, need to have many debates and discussions on how to persuade politicians on how you balance the individual versus the collective whole.

Several faculty discussed the widespread violation of privacy rights beyond social media. They shared concerns on the impacts of integrating AI with other emerging technologies. They argued that the growing use of sensor networks, social media tracking, video conferencing platforms, facial and affect recognition enabled by AI make data collection much easier. Private data is being continuously collected from individuals without their direct knowledge and without any regulatory framework.

As an example of AI's encroachment on privacy rights, Professor Johnson discussed a new practice used in many corporations for job interviews. She described that companies are increasingly recording interviews conducted on zoom or in-person without the interviewee's permission or knowledge:

> These interviews are then analyzed with AI algorithms to determine whether that candidate is suitable for that position, whether they are depressed or not, whether they are passionate or not. The AI algorithm analyzes everything from the tone of the voice, the movement of the hands and in the face and it gives a recommendation of whether or not that person would be adequate for the job.

She stated that this is a direct violation of the privacy right of the person who is being interviewed, as they have no idea that they are being recorded and analyzed by AI algorithms. She explained that while this practice continues in many states, a few states have become aware and are taking steps to place restrictions by requiring corporations to inform interviewees that they are being recorded and asking the corporations to delete the recording after 30 days. However, this does not address the analysis of facial expressions and speech with AI to make hiring decisions.

Professor Hopper discussed data privacy challenges in the context of her own research:

> You know my work is in affective computing. Ideally, I will have a fully adaptive and responsive virtual character that is able to recognize the social cues and adapt to them, knowing whether you are nodding or whether you're confused… my agent would perform better if it can read your facial expressions if I turn on the camera to enable it to read your facial expression."

She explained that collecting data and the way that she handles this data is critical. However, there are no guidelines or regulations to monitor how she should manage this information. She continued to say that "It is very important that people know what data they are providing and how that data is being used and interpreted." Confidentiality of this data is an ethical issue and should be treated the same way HIPAA protects health information.

Professor Menges expressed concerns about the massive volumes of data governments are collecting on their citizens. He argued that at some point, governments may use this data for surveillance purposes:

> I do not think that the U.S. government will use private data for surveillance of its citizens like other countries, at least not so openly. I mean, as a surveillance state. Collecting data is going to get a lot easier because of these technologies and the governments are catching up.

He expressed that it is unlikely that people in the US will have a social score connected to their identification like it is in China including demerits for simple misconduct and minor infractions such as Jaywalking. Still, he can see how data will be utilized entirely and may eventually be leveraged against our society's own citizens.

In addressing the adverse impacts of AI, faculty discussed the amplification of bias in race and gender and the discriminatory practices amplified by the broad-based application of AI. Faculty shared their research and experience to discuss ethical implications of AI and expressed concern on the role of internet corporations such as Facebook, Google. They discussed how micro-targeting practices of these corporations are leading to proliferating extremism. They also talked about using AI as a pervasive data mining and surveillance tool which has led to infringement of citizens' privacy rights.

Chapter Summary

In discussing the *Social Implications of* AI, faculty expressed their excitement about the new research possibilities afforded by AI. They provided many examples of transformative research projects in medicine and healthcare; the critical role AI can play in eliminating mundane and repetitive work; and combating infrastructure problems resulting from climate change. The discussions on the constructive impacts of AI were presented under the two subthemes of (a) *AI for social good*, which were covered under the two subheadings of (i) *Life and work* and (ii) *The Environment*.

The second subtheme, (b) *Adverse impacts of AI,* captured faculty sentiments on the ethical implications of AI. The discussion under this subtheme included the discriminatory role of AI in automated decision-making systems, AI-enabled violation of privacy rights, AI impact on social media, the use of AI for manipulation and deceptive practices of internet corporations, and the role of large corporations in contributing to ethical problems surrounding the design and implementation of AI. These discussions were presented under the two subheadings of (i) *Bias and Discrimination* and (ii) *Social Media, Privacy, and Surveillance.*

The following chapter (V) will continue with the presentation of interview results under the second theme, Economic Implications of AI. Chapter V will summarize faculty views and discussions on the short-term and long-term impact of AI on employment, the types of jobs vulnerable to automation, and the role of higher education in teaching, research, and management of AI.

CHAPTER IV

ECONOMIC IMPLICATIONS OF ARTIFICIAL INTELLIGENCE

This chapter captures faculty beliefs on the economic impacts and the process by which AI is developed, managed, and regulated. It presents faculty discussions and perspectives on how AI will impact future employment, both in terms of availability and types of jobs. Discussion on job markets reflected the larger debate among experts concerning whether AI will create more jobs than it destroys.

The faculty also spoke about the role of large corporations and governments in the control and deployment of AI. They discussed policies to safeguard employment, maintain privacy rights, and protect people from algorithmic bias and manipulation. They also examined the role of teaching and research in the ethical implementation of AI. Finally, faculty provided their views, insights, and recommendations on what we should about whom we should teach AI.

I have summarized their discussions under three subthemes. Subtheme (a) *Employment Implications of AI and Automation Technologies* which is categorized under the two subheadings of (i) *Job Loss or Job Gains?* that reflects the opposing views of the participants on future jobs and (ii) *Blue-Collar or White-Collar Jobs?* which summarizes faculty views on which jobs are more vulnerable to automation. The second Subtheme, (b) *Ownership and Oversight of AI*, categorizes the faculty discussions under the three subheadings of (i) *Role of Government and Corporations*, (ii) *Regulations and Oversight*, and (iii) *Research policies*, summarizing faculty views on how AI is or should be regulated and managed. The third Subtheme (c), *Teaching AI in Higher Education*, provides faculty views on how and what we should teach about AI.

Employment Implications of AI

Faculty perspectives on the impact of AI on job markets reflected the ongoing debate among experts who disagree on the net effects of AI on employment. The majority of participants believed that AI will not lead to massive unemployment. Arguing that while AI is making strides to replicate human intelligence in conducting some tasks, there are major barriers to AI driven robots replacing humans in a foreseeable future. However, a smaller group of faculty believed that looming advances in AI might result in substantial unemployment if we do not develop appropriate policies and prepare people for new jobs.

Faculty views on which types of jobs will be impacted most by AI were also diverse. Many believed that lower-wage workers could be more exposed to potential disruption from intelligent robotics. They can be easily replaced with intelligent robots, similar to what has happened in the manufacturing sector over the years. Others argued that more educated middle income-class would be most affected as AI algorithms become more intelligent and learn from experience.

Job Loss or Job Gains?

Professor Lovelace argued that although AI can lead to short-term unemployment, new jobs-will be created in the long term. Professor Lovelace used the industrial revolution as an example, stating that when new industry comes to life, people lose their jobs. However, new jobs will eventually be created around that industry, “this always happens when a new industry comes.” However, the concern is how quickly those jobs will emerge:

> AI is coming quite fast, replacing at least components of some of the jobs. But the speed of generating new jobs for those people who get laid off

> because of AI is not as fast. So, there is a gap, but how fast we can rectify the unemployment issues is a question that we don't know the answer to yet.

She argued that government agencies, private corporations, and higher education share the responsibility to develop policies, training programs, incentives, and innovative ways of addressing the short-term impacts of AI on employment. She talked about the necessity to work together in addressing this problem by speeding up the rates at which new jobs are generated and the rate at which people are prepared to gain access to those jobs.

Professor Mendeleev also compared AI to past technological advancements stating that AI will not result in any major job losses in the long term. Using the advent of the desktop computer as an example, he argued:

> Is the computer that I have in my office now the equivalent of artificial intelligence for a scientist or a faculty in the 50's? The answer is probably yes. Were there people fearful about what that computer could to their jobs? I'm sure initially yes, but then the benefits outweighed… this is a natural progression of how we do things.

He felt strongly that AI is a "natural progression" of technology and did not believe that it will take away people's jobs. He also talked about taking personal responsibility to be competitive by saying "if it [AI] takes my job it is because I didn't learn about it, and I didn't train myself to deal with it". He argued that if we do not learn this technology, we risk becoming obsolete.

Professor Oxman viewed that job loss due AI automation has been misrepresented. Using architecture practice as an example, she stated that the idea of physical robots replacing human beings at the workplace is misleading:

> When we talk about AI changing the field of architecture and taking over jobs, it is not those robots are going to take overs human jobs completely, but it's the fact that the algorithms that we will be using in software like

> Autodesk or others are going to change the nature of how we do things and the job loss will be because people will not keep up with new software.

She continued to say that the job loss due to AI is not inevitable and we can prepare for this change through training and education. However, the number and the speed by which educators and people in the field are catching up with AI technologies must increase drastically. Currently, there is a large gap between how fast technology is being developed and the rate at which people in various fields are adopting and learning how to apply it.

Blue-Collar or White-Collar Jobs?

Among the faculty who were more concerned about the AI's impact on employment, Professor Turing provided a distinctive perspective by considering AI as a categorically different type of technology from technologies of the past. He described that historically, technology had been used to support what humans do. Although machines have become more sophisticated over the years, "they have always required a person to run and operate them, they have made a person a bit stronger, more productive or faster". However, they have not fundamentally taken over what people can do, whereas AI has the capacity to eliminate labor entirely. He explained that:

> AI is changing the equation on which society has been built for centuries by eradicating the clear distinction between labor and capital… I think AI is changing the nature of this relationship because it's making labor fungible. It's basically transforming labor into capital, which completely changes the game with regards to how society should be structured… I think that's really the fundamental impact that AI is having on the economy.

Professor Turing explained that modern political economy theories consider that "power is distributed between people who are mainly doing labor versus people who

have capital and have control over that." He stated, this is not clear to him how elimination of labor as a result of AI will implicate those power relations. He argued that we as a society do not know how to deal with this issue yet.

Professor Marshall shared this view by addressing the current debates among the experts and economists whose models provide significantly different predictions on AI's impact on jobs. He argued that if 50% of job loss predictions come true, it will have a massively destructive impact on people's livelihood. Current unemployment rates are very high, especially among younger people in countries like Spain, Russia, and Ukraine, as well as in larger regions such as Africa and the Middle East. Additional job loss due to AI automatization in these areas has the potential to be economically catastrophic.

> If half of the jobs are destroyed or changed, like [if] all the driving jobs are gone, all the cashier jobs are gone, and the front desk jobs are gone, that will change so much of society. If dispute resolution moves to machine learning, instead of lawyers and courts, let's say 90% of the civil disputes are resolved by AI that would destroy a lot of legal jobs.

He stated that this could have a Luddite impact of displacing human beings and pushing society to either limit the growth of AI or develop a basic income structure to ease the impact. He continued to say, if these predictions are wrong and the job loss is not as significant as the technology protagonists suggest, we will see changes that are similar to the past ten years:

> Increasing returns to big capital and largest technology and media conglomerates, to the PhDs who work for them, and then the quants [quantitative analyst] who trade their stock, and the professionals who service their needs… stagnation in other sectors will not be that different than we've already seen.

This means that we will probably have a "continuous reduction in economic capacity of the minimum wage workers as there has been no wage increase in the past ten to fifteen years", a decline in the median household income or middle-class squeeze resulting a decline in living standards and an exponential increase in the top incomes.

On the issue of which jobs are most vulnerable to elimination or replacement by AI automation, faculty offered different perspectives. For example, Professor Engelberger believed that because we are far from understanding how the human mind works, blue-color jobs will be safe:

> I think white-collar jobs are much more likely to be replaced than blue-color jobs … it will be easier to replace a lawyer than a construction worker… picking up a brick and demolishing work involves motion control and dexterity which is harder to automate.

Engelberger assessment of the vulnerability of white-collar jobs reflected the statistics and the ongoing adoption of robots (bots) with AI that have the capacity of judgment and human interaction. However, this was in contrast with the view of several other faculty. For example, Professor Menges argued that blue-color workers are among the first group that will see the impact of AI automation:

> Today, a low-skilled person with no education can go and find a job somewhere. He can go stack goods in Walmart or go to work at McDonald's. There are many things that he can do. This has always been the case up to this point and most likely in the near future. However, many of those jobs, if not all, are going to be completely replaced. They are going to be far fewer of them. For example, if robots take 10 jobs in construction, perhaps one job is created for someone to monitor the robots that are on the construction site. I think that is going to be true for a lot of industries.

This view on the impact of AI on blue-color workers is supported by the role that automation has played in the manufacturing jobs in the past. Professor Menges believed that the integration of AI with robots that have learning ability, sensing, and

dexterity would intensify the historical job loss due to automation. He stated that it would be challenging to stop heavy augmentation or replace humans in manufacturing and construction will more intelligent robots.

Professor Linnaeus was in agreement and stated that he sees massive job loss in blue-color industrial jobs. He used an example of a family member who work at amazon:

> He now works in one of those huge warehouses where they serve everybody. He and three other people work with 24 robots. All the people are gone. He puts in orders in a computer, and a robot goes down the rows and grabs all the things for that zip code, puts them on a pallet, and his only job is to wrap it up and put the pallet out by the truck. That's his only job…this could have been the job of 100 people, but now they're all robots.

Professor Linnaeus continued to say that this will not be the case for white-color jobs. He stated that based on new reports from the National Academy of Sciences, NSF, and other federal agencies, jobs in bioeconomy and quantum computing would grow, and having big data and AI skills will become a requirement of new jobs.

A third perspective was offered by Professor Blum, who believes that AI will bring disruptive changes to both blue-color and white-color jobs. He used the example of a recent event that could have led to massive layoffs of one of the major retailers' workers. A few years ago, one of retailers contracted a robotics start-up company to develop robots with integrated artificial intelligence:

> The plan was to automate logistics, filling shelves and reporting inventory among other service tasks in some of that retailer's stores. However, they canceled the contract. The retailer announced the cancellation was based on cost calculations and finding more efficient ways to manage the stores.

Professor Blum’s perception was that political considerations were another reason behind voiding the contact, stating that the retailer may not want to remove

thousands of jobs during a pandemic since they pride themselves as a job creator in their country of operation. However, this is most likely a short-term decision, and he thinks that in order to be competitive, sooner or later, retailers will move to intelligent automation. This may take some time and some articles suggest up to a decade for this process to be fully automated.

In expressing concerns on the impact of AI on white-color jobs, Professor Blum used computer science and teaching jobs as examples (the two fields in which he is personally engaged). He predicts that in the next two decades Google will not be hiring software engineers as AI algorithms will become smart enough to fill these roles, "with an AI program, you just feed data, and it will provide you with the software or with the code that you need". He stated that this does not mean that you do not need a few people for debugging and making sure the system is working properly, but it reduces the number of jobs significantly. On his assessment of future of teaching jobs, he predicted that in 30 years we may not need any instructors:

> Although we have online courses now, they are not interactive enough, I think the students still want to interact with the instructor in the class, but AI goes beyond that by providing an environment that students can feel as if they are in the class … I think AI is going to change the paradigm for the entire education system.

Professor Blum was the only faculty who believed that AI would eliminate the need for teachers as it would do a better job. He discussed the capacity of AI to provide full interaction with the content through visuals and verbal feedback, which provides a more engaging environment than the traditional face-to-face classrooms. He also talked about the ability of AI for continuous performance evaluation of students as an input to the learning process.

Professor Hopper talked about her own experience in developing virtual health agents. She explained that she has been working with health care agencies to develop virtual agents to meet the demand for behavior counseling and clinical psychotherapists. She added that there are not enough behavioral health workers because we have not developed enough capacity to train or pay them sufficiently:

> With my [AI] health agents, you can reach many more people, for example, in the Midwest, there are no experts on behavior change concerning addiction. I can build a virtual character that actually knows how to talk to people with addictions and what kind of questions to ask and what kind of follow up to suggest and all that."

She continued to say that virtual agents also have the advantage of being accessible 24 hours via the web without making appointments. "It is also more likely that people will communicate adverse behavior, drinking, sex, smoking, and drug use more freely with virtual agents as they can remain anonymous." Potentially the agent will know much more about the problem, therefore it can be more effective.

However, Professor Hopper expressed deep concerns about deploying these agents in health care jobs, worrying that they will lead to significant job losses in this economic sector. She explained that one of the healthcare companies that she works with is interested in developing virtual behavioral psychologists to treat suicidal patients in hospital emergency rooms. She described that "in an emergency room triage is very difficult and stressful and the argument is that rather than having a person it is better to use the character for dispatching the suicidal patient." She explained that she finds this idea strange and illogical a suicidal patient should not be dealing with a virtual agent. She was concerned about this idea and its potential harm to people, in addition to its impacts on jobs.

As an entire group, the faculty provided convincing arguments on how AI can lead to job displacement in both white-color and blue-color job markets in the coming years. While embracing AI for positive change, many provided examples and shared their perspective on the disruptive effect of AI on the economy.

Ownership and Oversight

The participants discussed how AI is financed, developed, and managed in different countries. They talked about AI ownership by a handful of large corporations, including Google, Amazon, Facebook, IBM, Microsoft, and Apple, and the consequences of monopolizing this technology. They discussed the role of government oversight and provided recommendations on how AI should be managed and controlled. They provided insights on revising existing regulations and restricting corporations' access to personal data and requiring permission to collect data from personal devices. They also provided guidance for conducting ethical research, raising awareness of data bias and privacy issues with AI.

Role of Government and Corporations

Professor Turing believed that the U.S. government does not actively manage AI. He stated that "In the U.S., we do not control AI; although there are some regulations, they are not nearly enough." He argued that several European countries are doing a much better job regulating and setting boundaries on this technology.

Professor Marshall compared China and United States to describe different approaches to the financing and management of AI:

> In China, they have a five-year plan, and they can trickle down policy from the planning office to the companies that are either controlled by the state or linked to the military … because of this, they have a more integrated control over how AI is rolled out.

He explained that although there are some differences in how China and the US handle the technology, there are also many similarities:

> Here in U.S., we have some of that, people who go from the government to be on the board of directors of a private company, and the CIA invest in companies... but in general, there is more of a line between the private and the public. The military has their own AI plans, most of which is through private contractors. There is a revolving door between the military, the government, and the private contractors.

To clarify, he continued to say that the U.S. government subsidizes private corporations to drive innovation, "the copyright and the patent system basically gives them [corporations] a limited monopoly to develop new technologies…Google got started with a cash payment from the NSF to research digital libraries… which gave them the capital to invest in projects like AI." He claimed that most of IBM's capital comes from the military, "IBM has been working closely with the military since World War Two for providing technology, engineering and consultancy so, there's a direct subsidy there".

In explaining how people move from the private corporations to work in the military or government, he used the recent example of Patrick Shanahan, a former Boeing executive, who became the Acting Pentagon Chief and moved to serve as the Acting US Secretary of Defense in 2019:

> This provides channels by which contracts are given to corporations, and the products and outcomes are bought back by the government… they all operate within a legal structure that subsidizes and rewards their work. They are also indirectly working for the United States, even though they're a private entity. They're working within our copyright laws and our national security laws… everything is happening within a legal structure that shapes their activity and rewards some and punishes others, but maybe not to the same extent of control as China.

He continued to describe how this interconnection between the military, government, and private corporations provides latitude and freedom of action for US corporations, resulting in potentially dangerous trends that impact the public. However, he believed that this does not mean that the US corporations are exempt from the law:

> This [freedom] could lead to harm the public if unregulated… but it's also possible to apply all the regulations we already have… just because you do something with an algorithm or a model, doesn't mean it's exempt from the law.

Professor Marshall further elaborated that we have policies that prohibit discrimination and misconduct regardless of how it is implemented. For example, discrimination in hiring is subject to penalty by law. Just because someone has used machine learning algorithms to discriminate, it does not make it exempt- it is subject to the same legal regime. The difference is that it harder to prove discrimination because of the lack of transparency in the AI algorithms.

A few faculty discussed AI control issues by distinguishing between the ownership of data and ownership of the algorithms used for training data. Professor Lovelace argued that potential problems with unregulated AI technologies arise from data ownership:

> Many people are concerned about the monopoly of five companies that own AI algorithms. However, if you look into the literature and online resources, most of the methods are available. Even much of the algorithms and actual codes are open-sourced. So, I do not see that as a big issue. The problem arises on who holds the data and where the data is stored. Because AI algorithms rely on massive data sets, access to data is critical.

Professor Lovelace stated that the ownership of data by a handful of large companies has made it very difficult for small companies or individuals to get a hold of data for training

algorithms. She argued that technology is not the problem. It is how data is managed, collected, and owned that presents the problem with AI.

Professor Menges offered a different perspective on the availability of open-source AI algorithms. He argued that although open-source libraries are commonly available online, there is no guarantee that they will be available in the future:

> Currently, large tech companies are holding all the cards as they have monopolized this revolutionary technology. Although Google, Facebook, and Tesla have their online opensource libraries where people can access codes and upload their codes to push the research forward, it is not clear how long they will continue providing them free of charge. It seems, for now, they are benefiting from people using and contributing to these libraries. It is entirely up to these companies on how long they will support these libraries, and at any moment, they can be announced as private resources.

He argued that we are at the mercy of a few developers who control AI and are monopolizing this revolutionary technology. When these corporations decide that their open-source technology should not be available anymore, the impact on smaller companies and individuals who use them will be significant. These corporations are moving the technology in the direction that serves them best. Without limiting their control and influence, others cannot access and participate in developing this technology.

Regulations and Oversight

The need for government oversight for regulating AI was shared by many faculty. Some faculty talked about developing new policies to protect the public, and others advocated enforcing existing laws and regulations. Professor Marshall argued that it is possible to apply our existing laws for regulating AI, but potential issues may be difficult to detect due to a lack of transparency and trade secrets hidden by

companies developing and deploying AI. There is no shortage of ideas on the governance of AI. Professor Neumann stated:

> Some scholars say, we need to change the trade secret laws to make it easier to force the disclosure of the code and the data training algorithms, some have suggested that we need a special agency like the Food and Drug Administration for algorithms, and some say we need to have a more publicly transparent system under public control instead of our current copyright and patent system paid that is paid by the government.

Professor Neumann went on to suggest that social media should be treated as a utility company to protect vulnerable people from its influence:

> I think we should classify social media as a utility because it has become so important to human life. Like landlines, cellphones, and electricity, it should be regulated differently than other free-market enterprises. If we classify the internet and social media platforms with more than 100 or 50 million users as a utility, it will go a long way toward regulating and having some oversight over them.

He elaborated that this means Facebook would be required to open their algorithms to public scrutiny and become responsible for the appropriateness and impact of their algorithms on individual citizens and society. He suggested that we have existing regulatory tools that we can build on:

> We're not starting from scratch, the nuclear technology space has dealt with regulation issue for many decades, and we can learn from how we have regulated a technology that has great benefits, but can also cause great harm. We should not reinvent the wheel.

Professor Neumann stressed that we have regulations in place for other technologies that could be adjusted to address the challenges we are facing with the internet and the corporations that are acting irresponsibly. We need to revisit our regulatory tools and gauge their appropriateness for AI and the current practices of internet corporations. He concluded by expressing his hope that we can control the harmful impact of AI with regulation.

Professor Lovelace's comments were focused on regulating how data is collected and used. She argued that data governance is critically lacking in our society as most of the big data sets reside on servers at Google, Apple, and Microsoft:

> We need to look at who should own and manage this data as a society... In addition, the average citizen should be educated on how personal data is collected and used every time an application on a phone, a computer, or any digital device is used.

She argued that people need to know that their data is being sold to provide massive revenues to large corporations and they should learn how to protect and manage their data. In addition, we need regulations and laws that support individual privacy, holding corporations accountable for benefiting from selling people's data without their awareness.

Research Policies

In addition to discussing their ideas on regulating AI at the government level, many faculty expressed the need for regulating AI research at the university. Professor Linnaeus expressed concern that in the past academic research outcomes have been used for purposes and in ways not intended by the researchers. AI is no exception. He used the example of an ethically questionable project by a faculty who recently joined FIU:

> [Faculty member X] does some things that, from a militaristic perspective, could potentially be really bad for people. I mean, [they] help to design instruments that could really backfire if they got into the wrong hands"

He elaborated that we as the university have the means to stop or put limits on research that could be dangerous and harmful to the public:

> Would we put in a policy that said FIU will not take on research contracts associated with AI that may in fact result in information being used in a harmful way. Thinking if down the road [a faculty member] is going to do some kind of research or create an algorithm for artificial intelligence that will enable somebody to build a COVID virus and just release it because they will have enough information on virus genomics… Are we going to have policies that try to preclude this kind of research? The difficulty is that I don't know that we're omnipotent enough to be able to foresee what leads to problems."

Although others shared the view that AI technologies could be used in unethical and potentially harmful ways, they believed that there are several university mechanisms that could be used to manage AI. Faculty used examples of how ethical research is enforced in other fields, arguing that applying the same polices to AI research could be very effective. For example, Professor Neumann explained how faculty and students are trained for ethical research in scientific fields:

> If you're a science major and you go into research, you get a lot of that training through continuing education courses. You have to complete these trainings in order to do research. You can't do research on animals or human subjects, without doing those ethics courses. So, there's a system in place there that doesn't exist in AI research or machine learning and it should be.

He stressed that ethical training in AI should not be limited to faculty. Many of students, even undergraduates who leave the university to work in the private sector will support AI research and be in decision making positions. It seems that the university is the best place, if not the only place for ethical training of computer scientists.

Professor Mendeleev used his experience on how he is held accountable for the conduct of his lab with rules and guidelines:

> I have to take training for ethical behavior in research because I run a certified lab. We have ethics training every year to explain to people who work at the lab that if they falsify results there will be consequences. Even something simple like forgetting to take the temperature on that day and

> recording the same number as yesterday. That is an ethical violation…we are required to do all that in our line of business, all the time.

He elaborated by explaining the role of protocols like Institutional Review Board (IRB) for protection of human subjects or Institutional Animal Care and Use Committee (IACUC), which monitor human and animal research:

> If I want to study something in fish because they are organisms with a spine, and they do feel pain, I have to go through very specific permissions and protocols to make sure that I'm not harming the fish. So, if I were to teach the use of AI, I have the responsibility to disclose what are the negative outcome of using AI and how to prevent people to use it and give them guidelines of how this thing could be bad.

In this statement, Professor Mendeleev emphasizes the absolute necessity of imposing ethical codes on AI research like other established research areas. More importantly, he is referring to the existing systems that have shown their value over time, and their adaptation to AI technologies as low-hanging fruit for monitoring research in AI.

Professor Neumann also talked about the role of the IRB, suggesting that a combination of IRB and other approaches and policies can be useful:

> I don't think there is a silver bullet. There is not one thing that we can do to address all AI issues. It is a combination of more coursework for science major students, additional training for researchers, adjusting the IRB mechanisms to account for this new realm we live in, forcing scientists and researchers that are working in AI to think about their creations and the potential negative impacts of it.

In addressing the ethical issues in AI research, Professor Neumann believed that a single approach will not be effective as AI is complex. He suggested a multi-pronged approach consisting of course work, training workshops, and expanding the IRB process to all students and faculty involved in this field.

The faculty perspective on the subtheme of AI ownership was discussed under three different headings: a) the role of governments and corporations, b) regulations and oversight, c) research policies. These headings presented a summary of participants' perspectives, including the balance of power between government and private corporations in control and ownership of AI, the lack of government regulation on development and deployment of AI, and the lack of research policies.

Teaching AI in Higher Education

Another important part of the discussion with participants focused on teaching and research Another important part of the discussion with participants focused on teaching and research in AI. Faculty talked about two aspects of teaching this technology: “teaching about AI”, which focused on teaching the social issues surrounding the technology, and “teaching AI”, which focused on how to prepare students with the needed technical skills.

Faculty were in unanimous agreement that we should teach all students “about AI”, with some faculty expressing the need to teach faculty, as well. They talked about educating students on the consequences of disinformation in social media, algorithmic bias, and ethical handing of data. Several faculty stressed the need to teach these issues in a separate and/or required course which is dedicated to ethics of AI.

Professor Hopper expressed that all computer science students need to learn about algorithmic bias in a course which is devoted to this subject. Simply including some of this material as a component of a computer science course is not sufficient:

> Students need to know, but you can't teach this in an AI course per se, because that would be just one or two hours on this subject in the entire

> semester. But it's not enough. I think people need to fully understand the economic and social problem associated with AI.

She explained that computer science students do not know about ethics and AI. Raising awareness on how their decisions as future professionals can impact people's lives is critical:

> We should have at least one course, where students learn about the ramification of AI, I mean the deep ramification economically, socially, emotionally, and professionally because they are huge. We should teach about privacy issues and ethics.

Professor Hopper felt strongly about including the ethics of AI, its impact on the economy, and research policies and regulations into computer science curriculum. She also suggested teaching emotional intelligence to help students develop empathy in a structured way. She argued that if "we can teach computers emotional intelligence, we can teach it to students, as well."

Professor Johnson stated that we need to prepare students to help them understand the social consequences of their work as future professionals:

> It is very important for students to understand if their code is biased towards a group of people, to the society, or the community as it can have huge impacts which are very difficult to rectify. Taking care of those biases in algorithms is critical.

She said that many of these issues are being addressed and embedded in the existing curriculum of her home department. She described several courses that are either currently being taught or are in the design process. However, she argued that faculty and administration need to do more to educate students about the potential dangers of AI and provide the right tools for them to face the potential challenges posed by this technology.

Professor Brooks emphasized that we cannot teach AI algorithms and models without thinking about their ethical implications "Our students need to understand data security, integrity, and privacy rights of individuals. They need to learn how to manage data ethically." He argued that we also need to teach students how to manage their own data and protect their own privacy. By showing students how to manage and secure their personal data, they would understand the underlying privacy issues and be more responsible when handling other people's data.

Professor Lovelace believed that teaching about AI is a necessity, not just for computer science students, but for all students at the university:

> All students should learn about the history of AI and the history of technology to raise their awareness of bias, discrimination, and disinformation … ethics and the morals around AI could be vetted in AI courses themselves.

Lovelace, believed that we need to focus on teaching the ethical issues surrounding AI because this technology is very powerful, and its impacts can directly impact people's lives directly. We need to teach or educate the students about the dangers of AI tools and show them how they can use this technology to benefit society rather than causing harm.

Professor Neumann was also in support of developing courses for all students and argued that these courses should be taught by faculty in humanities. He said it is hard for technology faculty to teach about the ethics of AI because they are focused on technology, and many have not taken the time themselves to examine or learn about the problems surrounding AI:

> I think this is a problem that concerns humans right. It is not a technology problem. So, there should be sociology courses or anthropology courses, I'm not sure that computer scientists should be teaching these things. Could they be part of the conversation? no question about it… but you need to

> have somebody who can look beyond the technology and understand the impact of this. So having some type of psychology or anthropology background sociology background, would be helpful

Professor Engelberger, argued that we need to train faculty and raise awareness about potential problems with AI:

> I think training or informal talks at a steady pace are a good medium to discuss AI issues. I feel using case studies and concrete examples of what has happened with AI can be very effective. Talking about ethical issues in AI can be ambiguous to an engineering faculty. Workshops, series of seminars, and inviting AI ethics experts at the national level would be interesting to generate awareness among faculty and students could be a great start.

Both Professors Turing and Professor Johnson both emphasized the increasing need for social scientists who study and understand AI. Professor Turing, explained that we need to educate and involve social scientists in meaningful ways as their inputs and contributions are critical, arguing that the "University should invest in hiring social scientists and embed them in computer science and engineering schools".

Professor Lovelace also advocated for involving social scientists for teaching AI in a meaningful way:

> I think we have to invest not only in developing AI or bringing people who can work with it, but also invest in people who can envision the impact of AI on the society; people who study sociology, people who study history, people who study technology law. I think only focusing on training computer scientists is not enough. Focusing [exclusively] on computer science will take us on a very wrong path.

Dr. Lovelace believed that social sciences are not adequately involved with issues concerning AI and they are "lagging behind". In her view, the deep involvement of social scientists in teaching and addressing the ethical and legal issues surrounding AI is one of the most critical steps that Universities can take. She recommended that a course on "The Sociology of AI" would be good start.

Professor Mumford also believed that it was important to teach students about the ethical issues surrounding AI. He stated that even faculty who teach AI do not fully understand the ethical issues as they are focused on how the technology works. Providing faculty training is also a necessity. However, Professor Mumford was doubtful if universities were well-equipped to tackle this challenge. He explained that teaching about ethics of AI to all students may be quite difficult:

> I'm skeptical but not totally disillusioned. The skeptical part is that the programs and department at the university are not designed for what is socially beneficial. They are designed for what makes their students successful in their profession. And the incentives for the faculty are focused on publishing in their own areas, even if you look at NSF, the whole ethics part is hardly anything.

He believes that universities are structured to respond to the demands of students and prepare them for their future professions, a far different goal than delivering social good. Therefore, teaching ethics of AI with rigor may take a concerted effort requiring a different set of incentives for both students and faculty.

Professor Linnaeus was also skeptical about the university's capacity to meet the challenge of teaching about the social and ethical concerns regarding AI:

> We have built a university system that is so predicated on departments in colleges that I don't think we're going to do a good job of teaching the importance of artificial intelligence or even talking about it, if we only have computer scientists and electrical engineers thinking about it, developing and applying it. We have to have the social scientists also engaged to think about the social ramifications and the human side.

He continued by stating that the current structure of the university and our academic system makes it very difficult to integrate the ethics of AI into the teaching curriculum successfully. However, besides rethinking the current structure, which

has been proven to be difficult, if not impossible, we need to do the best we can to educate our students.

When discussing teaching technical skills for AI, almost all participants, including the computer science faculty, believed that teaching AI should not be limited to computer science and engineering students. Professor Engelberger explained:

> We need to develop courses that can accommodate students from a wide range of disciplines. A general course teaching fundamental concepts in Machine Learning can be useful for many students as long as they have had a course in statistics.

He argued that an interdisciplinary approach to teaching AI is possible as it touches upon many fields such as business, economics, architecture, construction, and environmental science. He argued that we should open the teaching of AI to people outside of the computer science field by showing them how AI can help them in their future professions.

Professor Oxman speculated about a similar course for teaching the fundamentals of AI that could include modules on the history of its development, elementary technical skills, and a section on ethics. She stated that just having this course would go a long way in raising student awareness of AI and providing them with a broad understanding of the field. She argued further that:

> if you're studying chemistry, it doesn't make sense for you to take an AI ethics course as a separate course, but the introduction to AI fundamentals in a course obviously can tackle ethics issue and that should be good enough. I do not expect somebody studying marine biology needs to take a separate course in AI.

In addition, Professor Oxman spoke about the importance of understanding and managing data, suggesting that a course in data science can be very useful for all

students. “I feel as much as an introduction to AI course is essential for everybody, an introductory course in data science is also fundamental.” She argued that almost all students, whether majoring in architecture, biology, or chemistry, work with data. Teaching a data science course to all students regardless of their academic background could be very helpful in addressing data literacy in AI.

Like professor Brooks, Dr. Oxman, believed in the importance of teaching students about data management arguing that it is equally important as teaching AI. Professor Menges voiced concern about the lack of AI courses for undergraduates. He stated that universities are at a pivotal moment to examine their undergraduate curriculum holistically and consider phasing out courses that are not critical any longer and phase in AI courses:

> We are doing a disservice to students by sending them out into any type of profession without fundamental knowledge of AI, and for anybody to assume or think that this technology is not going to be disrupting their discipline, they’re very wrong. I think having a base level knowledge of AI can preserve people in their jobs or help their careers, but people without this basic knowledge will get phased out quickly.

He said that this does not mean that everyone needs to become an AI or automation engineer, but to have a fundamental knowledge of how AI works is necessary for moving forward. Without this knowledge, our students will not be able to compete for technology jobs in the future.

Professor Blum also felt the need to teach AI to undergraduate students. He described that building an AI knowledge-based early on can help students in their career changes over their lifetime:

> Let's say a student becomes a successful architect but after five years she will need to use this new technology in her practice... our job is to at least prepare her mind with some background so when this technology is in full

> swing, she won't resist it. She can adapt and learn quickly with the proper training. Therefore, this transition is not a big deal for her because she has been exposed to these concepts.

By providing students some basic knowledge in AI that could be delivered in one or two undergraduate courses, we can prepare students for future advances in technology that they may face in their professional lives. Professor Blum considered providing a basic responsibility of AI to students as a major responsibility for faculty teaching in computer science.

In summary, faculty advocated for teaching all students and faculty about the ethical issues surrounding AI including raising awareness of algorithmic bias, ethical data management, understanding data security and privacy rights, helping students develop emotional intelligence, raising awareness of disinformation, reviewing anecdotal case studies, and conducting formal and informal conversations about the ethics of AI.

They also made a case for involving social scientists in teaching both faculty and students about the impact of AI. Faculty recommendations on teaching the technical aspects of AI was aimed toward developing interdisciplinary courses for teaching fundamentals of AI and incorporation small modules in other classes.

Chapter Summary

This chapter explored faculty discussions surrounding the impact of AI on job markets and projections on the short-term and long-term implications of AI on employment. Faculty provided their views on which jobs may be most vulnerable to automation and which kinds of new jobs may be generated due to AI automation. The faculty also discussed the role of government, military, and private corporations in managing, developing, and implementing AI. They provided examples of how

different countries manage and finance this technology and provided insights into how existing regulations or the development of new policies can lead to better management of AI.

In addition, the faculty addressed questions about the research and teaching of AI at the university. They discussed research policies for ethical conduct and talked about how and to whom we should teach AI. The discussion on teaching AI was presented in two separate categories of "teaching about AI," which focused on teaching ethical issues, and "teaching AI," which focused on the technical skills associated with AI. Faculty recommendations ranged from hiring faculty in humanities to teach about AI to developing a fundamental concept course that teaches AI skills to all students.

CHAPTER VI

IMPLICATIONS AND CONCLUSION

The impacts of the broad-based application of AI and automation technologies have become pronounced in many aspects of our daily lives. While AI has launched significant leaps forward in advancing scientific research, healthcare, business, and manufacturing, it has also led to many social and economic challenges.

Because of the vast implications of AI, the role of higher education in steering its progress is critical. Universities are the sole source of educating and training computer scientists, engineers, and other experts who lead and drive AI advancement. By taking a responsible approach, universities can drive the process by which these technologies are developed, commercialized, and applied in a direction that expands social and economic opportunities for all people.

This study explored faculty perspectives at the forefront of teaching, research, and developing AI technologies. Through in-depth interviews with faculty and disciplinary experts at FIU, the study focused on answering the following research questions: 1) What are faculty perspectives on social and economic impacts of AI, 2) What are their views on how AI is managed? 3) What type of policies and organizational changes can support a responsible use and development of AI at the university?

In addressing these three research questions, the study examined the implications of AI on social, economic, and theoretical contexts. The following sections of this chapter present a summary of participant responses to research questions and discuss the theoretical implications of the study.

Summary of The Study

Implications of AI have been increasingly studied in the past few years. There are significant debates among the experts regarding the social and economic benefits of AI on the one hand and its dangers on the other hand. Many argue that AI will change people's lives for better by improving how we work and live. Others believe AI is causing significant harm by amplifying social problems such as bias, discrimination, and surveillance.

On the economic side, many argue that AI will cause significant disruption to job markets and lead to massive long-term unemployment as intelligent machines will augment and replace both blue-collar jobs and white-collar jobs. Others argue that this disruption will be short-lived, and AI will not only lead to new jobs, but better ones by eliminating dull, dirty, and repetitious jobs.

Although these studies reflect the ongoing debates among scholars and views from social science and economics standpoints, there are not any studies that explore the perspectives of people who are actively teaching and researching AI. Thus, this study addresses a gap in the current literature by conducting a qualitative study that examines the viewpoints of university faculty.

Qualitative Research provides a critical approach for examining complex problems of higher education (Pasque, & Lechuga, 2016). This approach provides a context for understanding issues with interpretive materials, which helps make sense or interpret the condition in terms of its meaning to the participants (Creswell, 2017, p.7 & Denzin and Lincoln, 2011).

Using a qualitative case study has enabled me to gain a contextual understanding of how faculty perceive the challenging issues surrounding AI

technologies. In addition, it has provided the opportunity to discuss the underlying reasons for the participants' opinions and their motivations. This approach has also allowed me to look beyond the simplistic discussions about the implications of AI and get a first-hand understanding of the involved issues from the people who are actively teaching, researching, and implementing AI.

I recruited 16 participants from informal networks of faculty and program directors at FIU to conduct the study. These participants came from a wide range of disciplines, including architecture, biology, business, chemistry, computer science, engineering, law, and public administration. This group constituted a purposeful sample as participants were especially well informed and experienced with AI applications at FIU. Using semi-structured and open-ended interviews, I interviewed each faculty for 60 to 90 minutes once and went back to 4 faculty for a second interview for further clarification.

During the interviews, I collected data by recording the conversation, making observations, and taking notes. I analyzed the data from interviews with NVIVO software to structure and organize the study. The data was simultaneously coded, which required using descriptors to tag and bundle them into categories. These categories were then used to link and compare data in order to develop a better understanding of the participants perspectives and views. Coding the data led to the emergence of two overall themes of 1) *Social Implications of AI* and 2) *Economic Implications and Management* of AI, which comprises chapters IV and V of the study.

In discussing the social implications of AI, faculty talked about positive impacts of AI, particularly on their research as well as its negative implications from

several different aspects. These discussions were grouped under the subthemes of (a) *AI for Social Good* and (b) *Adverse Impartations of AI*. Discussions under these subthemes included the capacity of AI for revolutionizing research for curing diseases, improving the healthcare system, mitigating climate change impacts, revamping education, and improving physical infrastructure.

While analyzing discussions on the adverse impacts of AI, two subthemes of (a) *Bias and Discrimination* and (b) *Social Media, Privacy, and Surveillance* were developed. In each of these subthemes, faculty discussed multiple social challenges posed by AI, including algorithmic bias, use of AI in social media for deception, and AI enable surveillance technology.

Chapter V of the study presented faculty believes on economic impacts and the process by which AI is developed, managed, and regulated. Faculty discussions in this chapter were categorized under three subthemes of (a) *Employment Implications of AI and Automation Technologies*, (b) *Ownership of AI*, and (c) *Teaching AI in Higher Education*.

Faculty discussions on the AI impacts on employment were discussed under the subheadings of (i) *Job Loss or Job Gain* and (ii) *White-Collar or Blue-Collar Jobs*. Each of these headings summarized participants' views on how AI will affect the job markets both in terms of the availability and the types of jobs.

In discussing the ownership issues associated with AI, faculty discussions fell into the three subthemes of (a) *Role of Governments and Corporations* and (b) *Regulations and Oversight*, and (c) *Research Policies*. These subthemes presented a wide range of faculty views on the role of government, military, and private corporations in managing, developing, and implementation of AI.

Finally, faculty discussions on all related matters to higher education were presented in the subtheme of *Teaching AI in Higher Education*. In this subtheme, faculty discussed their Perspectives on why we should teach AI, whom we should teach AI, and discussed the best ways of teaching AI. As this qualitative research is a case study, it may be indicative of the faculty views at other Universities, however the results are not generalizable and further studies and additional research is needed to make this research generalizable.

Findings

The following section presents faculty responses to the central research questions of this study. Answers to each of the three research questions are provided to establish a clear description of faculty understandings, views, and sentiments with respect to each question.

Social and Economic Impacts of AI

In terms of social implication, the faculty in my study generally had a positive outlook on the social impacts of AI. Many participants expressed excitement on how AI has enabled them to think differently about their research problems and have helped them conduct research more effectively. They talked about the potential of AI for curing disease, increasing work productivity, enhancing human life, and mitigating climate change.

Faculty also discussed many challenges surrounding AI, including 1) unintentional and intentional algorithmic bias that has amplified gender, race, and social status discrimination, 2) face recognition technology which has implicated the criminal justice system and created an unfair treatment of the citizens, 3) violation of the public and individual privacy rights by large internet corporations, 4) predictive

analytics and algorithmic decisions based on flawed data and faulty processes, 5) surveillance of citizens through the collaboration of corporations with the governmental institutions, 6) social media's role in microtargeting for political deception, 7) lack of transparency or black box AI, 8) mistakes resulting from training algorithms on limited data impacting people's lives, 9) concentration of resources in large corporations who have monopolized AI and its development, and 10) lack of diversity in people who design and write AI algorithms.

Faculty discussions on social issues revealed that "data ownership" is at the center of most of the challenges presented by AI. Data collection is at the core of face recognition and predictive analytics, which has amplified bias, discrimination, and surveillance. Because AI feeds on data to thrive, the ability to continuously garner data is critical for developing and implementing AI. The exercise of unlimited power to collect and analyze data by a handful of corporations has given them ownership rights to the public data. As regulations for protecting privacy rights have lagged, these corporations' control and power have grown significantly.

Another significant issue raised by faculty was how AI had changed the role of social media. Many expressed concerns about manipulation of the public with algorithmically controlled advertisements, experimentation with private information, exerting political influence, and contributing to political divide and extremism. Faculty discussed these issues also in terms of the ability of several large corporations to collect data from clicks, facial expressions, likes, and dislikes of the individuals spending countless hours interacting with social media without their knowledge.

Many of the issues brought up by the faculty are echoed in the current research and literature that has documented AI challenges. For example, there is significant documentation on AI amplifying bias in race, gender, and social status (Mirken, 2021, Müller, 2020, Gebru, 2020, Nelson, 2019, Whittaker et al., 2018, Endo, 2018, O'Neil, 2016, Burell, 2016, Stone, et al. 2016, Van Dijck, 2014, and Rubinstein, 2012). Another well-documented area of AI's impact is the violation of public and individual privacy rights by large internet corporations for financial or political gain using deceptive practices in social media. Researchers have written about data collection from online engagement and transaction records of citizens by large internet corporations like Google, Facebook, Amazon, eBay, Microsoft, and Yahoo (Muller 2020, ur Rehman, 2019, Helbing, 2019, Flibeli, 2018, Hern, 2018, Heproplrschel & Miori, 2017, Harris 2016, Richards, & King 2014, and Rubinstein, 2012). These researchers have shown that the use of big data and predictive analytics by these corporations have led to significant power and financial gain at the cost of individual privacy rights.

Another well-established area on the precarious use of AI by large corporations and governments is surveillance technology. Automated surveillance powered by AI has become ubiquitous in public and private spheres, resulting in violations of citizens' ethical and constitutional rights (Connor, 2021, Feldstein, 2019, Macnish, 2018 and Marx, 2002). In addition, the increased use of AI-enabled surveillance for managing workers in measuring productivity, hiring, firing, and overall monitoring has been well documented and discussed in the past few years. Private corporations increasingly use machine learning and Natural Language Processing to measure thousands of daily activity points to measure productivity with

a score that can automatically decide their employees' faith (Prodoscore, 2020, Crawford 2019, Harwell, 2019, and Wright & Schultz, 2018).

In terms of economic impact, the faculty perspectives on the impact of AI on the job markets reflected the ongoing debate among experts who disagree on the net effects of AI on employment. Although, the majority of participants believed that AI would not lead to massive unemployment in the long term. Using the industrial revolution as an example, they argued that AI would lead to many new jobs, some of which we cannot imagine yet. Therefore, as educators, preparing people for future jobs should be a priority.

A smaller group of faculty believed that looming advances in AI might result in substantial unemployment if we do not develop appropriate policies and prepare people for new jobs. They argued that AI is a categorically different type of technology from technologies of the past that were designed to help people conduct their jobs. AI has the capacity to eliminate labor entirely and completely change the economic foundations of society.

Furthermore, they argued that AI's capacity to take over jobs is not limited to blue color jobs, and it will also claim many white color jobs. They argued that job loss would lead to a continuous reduction in the economic capacity of the minimum wage workers, a decline in the median household income or middle-class squeeze resulting in a decline in living standards, and an exponential increase in the top incomes. Therefore, heavy regulation and government intervention would be required to sustain society.

The participants' insights on the types of jobs most susceptible to AI automation also corroborated the experts' work showing that both white-collar and

blue-collar jobs are vulnerable to full automation or augmentation with AI. For example, Chelliah and others have argued that automation is most impactful on jobs such as judicial law clerks, cost estimators, market research analysts and marketing specialists, civil engineering technicians, medical transcriptionists, technical writers who traditionally bring middle-income wages. They have argued that this automation has already started and has led to income polarization by stagnating the middle-class incomes (Chelliah, 2017, Frey & Osborne, 2017, Autor 2015, Abel and Deitz, 2012).

The impact on blue-collar jobs is also well documented by studies such as the one conducted by McKinsey Global Institute, reporting that the majority of future loss will be due to automation of routinized tasks. Production jobs in manufacturing which account for eight percentage (Bureau of Labor Statistics Current Employment Survey May 2021) of non-farm employment in the U.S., are exposed to further robotic automation as AI-driven robots surpass human physical ability (Webb, 2019, West 2019, Acemoglu & Restrepo, 2018, and Lost, 2017).

Management of AI

Faculty discussed management of AI terms of 1) the role of governments and corporations, 2) regulations and oversight, and 3) research policies. Many participants saw a direct connection between AI ownership by a handful of large corporations such as Google, Amazon, Facebook, IBM, Microsoft, and Apple and the significant social challenges posed by AI. They discussed the balance of power between government and private corporations for control and ownership of AI. A few argued that large corporations are gaining more power with unlimited access to massive public data which has been traditionally in the preview of the government.

Participants also criticized regulations in the U.S. as either lacking or not enforced. A few faculty talked about how subsidizing large corporation by the U.S. government, and the military has provided additional latitude and freedom resulting in dangerous trends impacting citizens' rights and has blurred the boundaries between private and public.

There were also concerns about the monopolization of AI algorithms by large corporations. Some faulty argued that although these corporations currently allow limited online access to open-source AI algorithms, there is no guarantee that they will do the same in the future. They felt that we are at the mercy of a few developers who control AI and are monopolizing this revolutionary technology. Faculty argued that these corporations are moving the technology in the direction that only serves them best. Without limiting their control and influence, others cannot access and participate in developing this technology.

Faculty positions on the role of the private sector and government on deployment AI were supported by current research. Researchers have shown that lack of regulations, deregulation, increased tax breaks reinforced by corporate lobbying of legislators has led to a significant increase in the power of internet corporations. These corporations are using their wealth to monopolize the market either by purchasing smaller companies and shelving superior technologies or adding to their assets. The continuous purchase of smaller innovative companies by a handful of large corporations has consolidated their power and has left the control of AI in the hands of few (Fiegerman, 2016, Mannes, 2016, Stiglitz, 2015, Suarez-Villa, 2012).

Implications for Policy and Practice

One of the primary goals of this study was to provide insights into how academics and disciplinary experts perceive their responsibilities in deploying AI and how higher education can mitigate its adverse impacts on society. The findings of this study have implications on research, teaching, and implementation of AI in higher education and government. These recommendations are described below.

Recommendations and Guidelines

Faculty believed in the critical role of higher in conducting research and teaching AI. There was a complete agreement that ethical issues associated with AI research are not apparent and most faculty who research and teach AI are not aware of them. They expressed concern that the university does not have any regulations on AI research. They also voiced concern about the lack of courses or extensive training on AI ethics. While several faculty were encouraged to embed the teaching of AI in FIU's Quality Enhancement Plan (QEP) as an extracurricular activity, they suggested that more training and courses were required.

Faculty recommended a multipronged approach for conducting ethical research and raising awareness of issues such as data bias, discrimination, and privacy issues with AI with a series of policies, workshops, and courses are listed below and summarized in Table 1.

1. Establish a criterion to evaluate and limit harmful and dangerous AI research. This could be achieved by expanding the existing university mechanisms for ethical conduct in other fields to AI.
2. Expand or develop a new IRB protocol to include ethical training for AI. This should be mandatory for all faculty and students who are involved in research

projects. Certification for completion of training should be required before conducting research.

3. Invest and develop new carrier opportunities for social scientists with a focus on AI. This could be achieved by educating faculty and students with new courses, certificates, or majors on the ethics of AI.
4. Hire social scientists to participate in research and teaching the impacts of AI on society. These faculty should be embedded or work very closely with computer science and engineering schools (MIT model).
5. Develop informational workshops and seminar series for all faculty and students to raise awareness of AI ethical issues. The workshops should include nationally recognized AI ethics experts to discuss critical issues. These should be open to all and faculty should be incentivized to participate.
6. Develop informational workshops on data protection and management techniques. This should incorporate lessons on how faculty and students can protect and manage their data.
7. Develop workshops and mini courses to improve critical thinking and emotional intelligence. These should be available to all students.
8. Develop a course on AI ethics for computer science students. This course should enable students to understand how codes and algorithms they produce can impact society. The course should cover data security and integrity, algorithmic bias, and privacy rights. This course should be taught by faculty from social sciences.
9. Incorporate teaching small modules, anecdotal case studies, and informal conversations on AI ethics in computer science courses focused on AI.

10. Develop an interdisciplinary course for teaching fundamentals of AI to all students. This course should include sections on the history of AI, elementary technical skills, and ethics.

Participant Recommendations	
Category	Recommendation
Research policy	Establish a criterion to evaluate and limit harmful and dangerous AI research.
Research policy	Expand or develop a new IRB protocol to include ethical training for AI.
Investment Priority	Invest and develop new carrier opportunities for social scientists with a focus on AI.
Investment Priority	Hire social scientists to participate in research and teaching impacts of AI on society.
Training Workshops	Develop informational workshops and seminar series for all faculty and students on a continuous basis to raise awareness of AI ethical issues.
Training Workshops	Develop critical thinking and emotional intelligence.
New course	Develop informational workshops on data protection and management techniques.
New Course	Develop a course on AI ethics for computer students.
New Courses	Develop an interdisciplinary course for teaching fundamentals of AI to all students.
Existing Courses	Incorporate teaching small modules, anecdotal case studies, and informal conversations on AI ethics in computer science courses with a focus on AI.

Faculty recommendations at the governmental level revolved around the protection of individual privacy rights, as they saw breach of privacy as a major AI

impact. These include:

1. Developing new laws and enforcing compliance with existing laws and regulations on discriminatory practices using AI. This would include revision of existing regulations in response to advances in AI which have amplified bias in gender, race, and social status, and changing trade secret laws to provide transparency of AI algorithms, to reveal bias.
2. Restricting access of corporations to personal data by requiring permission to for data collection from people's interaction with their personal devices and online engagements. This could require regulating and monitoring data management in internet corporation and institutions engaged with data collection. One faculty suggested declaring internet a utility company so it could be regulated as such.
3. Prohibiting AI surveillance by social media, large corporations, and the government. This would include regulating image recognition and sensor technologies, social networking interactions, and geolocation tracking. A few faculty suggested incentivizing corporate social responsibility.

Future Research

Considering findings of this study and its limitations there are a few areas which could be addressed by future research. First, the study did not explore how AI is used by higher education for administrative purposes. In recent years universities have collected massive amounts of student data. University collaboration with consultants, businesses, and think tanks for managing this data have opened new possibilities for commercialization and politicization. Williamson writes that student learning analytics are "being politically re-purposed as technologies of performance

measurement, comparison, and competition, as well as being appropriated into commercial expansion across the higher education" (Williamson, 2019, p. 2795). The tension between new ways of learning through performance analytics enabled by AI, and its enormous data infrastructure exposed to commercial and political manipulation, will become an increasingly challenging issue for higher education.

Second, the study did not examine the implications of military applications of AI for surveillance, drones, and lethal robotic systems. Crogan writes that advances in AI technology are leading to a reimagination of military operations and human-weapon relations. He argues that "future deployment of autonomous systems that amounts to a less restrained, less deliberative, less controllable, and less understood mobilization of lethal force than what exists today in accepted military doctrine" (Crogan, 2019). As academic funded research projects by the military and their private sector collaborators increase, understanding the perspectives of faculty who partake in the military projects is critical.

Finally, the experience and perception of faculty on their role in the responsible deployment of AI have not been thoroughly examined. As this study was limited to a bounded case study with a focus on a public University in Florida, additional research in other intuitions with diverse missions and geographical locations will enrich our understanding of implications of AI in higher education and beyond.

Theoretical Implications

During the interviews, the faculty expressed a broad range of opinions and ideas about AI that could be framed within the predominant theories of technology. The majority of faculty expressed their views on AI from an instrumentalist point of

view, while a small group of faculty described their understanding of the issues from a critical theory perspective.

Instrumental Approach

Instrumentalists consider technology as a neutral tool detached from social and political contexts. Thus, faculty who perceived AI as an independent value-free tool, ambivalent to the political and social context, reflected an instrumental view of technology.

In the formulation of his critical theory of technology, Feenberg argues that instrumentalism offers an excessively narrow conception of technology, the environment in which it functions, and its operators. Within this line of thinking, technology can never be understood as neutral, nor can it be completely removed from its context; technology is therefore inherently political (Feenberg, 2010). He writes:

> Modern technology is no more neutral than medieval cathedrals or The Great Wall of China; it embodies the values of a particular industrial civilization and especially of its elites, which rest their claims to hegemony on technical mastery" (Feenberg, 1991, p. 3)

In the context of this study, decontextualization of AI from its operational environment and upholding its fundamental neutrality positioned an argument for the rationality of technology at the center of some of the discussions. Faculty with an instrumental perspective attributed the challenges of developing and deploying AI in a fair, equitable, and unbiased manner to technological inefficiencies, inaccuracies of data, improper use, or typical challenges for new and emerging technology. Thus, in addressing the problems surrounding AI, their solutions were primarily technological.

For example, a few participants considered the challenge of Black Box AI a consequence of a technology that is not yet fully matured. Their position was that the opacity of AI algorithms would be addressed with "explainable AI," which is a new branch of research under development.

Critical Theory Perspectives

In contrast to the group of faculty presenting an instrumentalist point of view, several faculty ascribed to a critical theorist perspective of technology. Critical theory provides a critique of the rationality of technological systems. It assumes that control is implied in technological rationality, and technology can only be judged based on efficiency by technologists and scientific experts. Feenberg writes:

> Technology is a two-sided phenomenon: on the one hand the operator, on the other the object. Where both operator and object are human beings, technical action is an exercise of power. Where, further, society is organized around technology, technological power is the principal form of power in the society (Feenberg, 2008, p. 32).

Considering technical action as an exercise of power, rejects the instrumentalization of technology and rationalization of its challenges which could only be addressed by privileged technologists. The critical theory opens the possibility of questioning technology beyond efficiency logic, involving the public to critique its impacts on social interest.

In this study, faculty who did not subscribe to technological rationality addressed the use of AI for data mining, surveillance, and manipulation of the public by scrutinizing the practices of social media platforms and large internet corporations. They attributed many of the discriminatory and social challenges posed by AI to the power of these corporations to operate in an environment with no explicit prohibitions, forbidden paths, or regulations. As a result, their

recommendations were aimed at establishing regulatory frameworks and proposing policies that would protect the public.

In their assessments of the implications of AI on the economy, jobs, and employment, faculty with a critical theory perspective also had a different outlook. Rather than focusing on new AI jobs in the technology sector, they reflected its impact on the broader economy. They discussed the potential of a fundamental shift with massively destructive levels of job loss on the entire economy as AI could render vast groups of workers obsolete. Addressing nuanced aspects of labor automation, they spoke about how the restructuring of work is likely to harm lower-wage workers disproportionately. They called for proactive policy measures to protect the livelihood of people who are not in technology job markets.

Situating AI in Critical Technology

AI is a complex technology with vast economic and social implications. However, the instrumental treatment of AI in this study by the majority of the participants left many questions unanswered: How can more advanced algorithms that detect bias in decision making also detect manipulation or misuse of data by its developers? How can the application of more advanced algorithms in social media curtail or eliminate deceptive practices? How can technological solutions challenge data manipulation for political gain with algorithms that are deeply tied to their developers' control and profits? How can *explainable AI* explain the algorithmic decisions designed to preserve the competitiveness of its developers? How can AI provide the transparency that will lead to holding its developers accountable?

Because critical perspectives of technology are concerned with its social, economic, and political implications, they open the possibility of probing questions

beyond technological means. Critical theories of technology built on the work of Karl Marx (1818-1883) and Michel Foucault (1926-1984) questions of power and its distribution in society. Feenberg writes that examining technology within the framework of power relation offers the potential of change by substituting control from below for control from above (Feenberg, 2012, p.123).

AI is concealing a new power structure whereby power is not only exercised by bureaucratic institutions and governments but also by the large internet corporations and social media platforms that provide services to the masses in entertaining and appealing environments. Because the exercise of power is not readily seen and surveillance for harvesting data is disguised in alluring settings, there is a general complacency by the public to continue using their services.

In addition, the use of AI to access and analyze personal data by private corporations is shifting the balance of power. Schermer writes that AI has weakened the monopoly of information by governments from which they derive their power and has reallocated this power to the private sector (Schermer, 2007). This has resulted in a significant increase in partnerships between governments and private technology corporations in recent years, particularly companies building AI systems. Predictably, this has led to the development of more advanced surveillance technology (Feldstein, 2019).

AI is also serving as a normative medium for the exercise of power by corporations and governments. By delegating decisions to machine learning algorithms, biased choices towards the interest of these institutions are legitimized. Automated decisions deepen the gap between those who hold power and the people who are subject to power (Feenberg, 1994).

By considering technology in the context of power relations, critical theory reveals the broader range of influences on technological design and processes. Questioning technology beyond technical rationality and efficiency, exposes the interests of power embedded in its development and opens it to debate. Public participation in developing appropriate policies and alternative technologies can challenge the existing power relations, leading to the alternative direction of technological development.

Closing Remarks

Today we are facing existential crises. The alignment of the destructive impacts of global warming leading to scarcity of resources, the vulnerability to diseases as demonstrated COVID-19 pandemic, the economic, moral, and political issues posed by automation and AI technologies define this moment and our foreseeable future. In the past several decades the lack of active governance, deregulation, and unchecked practices of a handful of large corporations has led to dangerous approaches to technological development. The continued impacts of these challenges will have devastating consequences on human health, food and water security, and the performance of our economic and political systems.

Because technology is a social process made up of people who undertake its development and people who use it (Feenberg 1991), our ability to choose which technologies should be pursued, developed, and deployed is imperative. However, our capacity (as a society, academics, or as citizens) to act and choose pathways that lead to sustainable, democratic, and just societies has been undermined by large corporations and their government partners worldwide.

In the case of AI, research priorities and agendas have led to algorithmic discrimination, violations of privacy rights, surveillance, and mounting inequality (Connor, 2021, Feldstein, 2019, Macnish, 2018 and Marx, 2002). As Zuboff argues we have entered a new era of "surveillance capitalism," where human experience is harnessed as raw data for predicting and shaping behaviors that are transformed into capital accumulation for privileged groups. She writes that powerful internet corporations including Google and Facebook "thrive at the expense of human nature and will threaten to cost us our humanity" (Zuboff, 2019, p. 12).

More importantly, corporations have mobilized AI technologies for market dominance using an interconnected network consisting of government intelligence agencies, businesses, and social media. This has led to the enactment of legislation that not only secures their profit but also shields them from democratic revisions (Kapczynski, 2019, p. 1514). Kapczynski argues that the new corporate power is rooted in recent legal developments for the protection of trade secrets that insulate corporations from liability by claiming that they are "purveyors of speech protected by the First Amendment" (Kapczynski, 2019, p. 1466).

Although the ownership of digital power by corporations has brought unfair economic and social changes for the masses, the future of AI is neither a technological nor an economical certainty. Building a future that is fair and inclusive depends on the educational systems, economic policies, and regulatory frameworks we develop today.

As Feenberg argues technology, its form and its development are a social and political choice (Feenberg, 2008). Thus, a deeper understanding of the economic, social, and political context of AI is increasingly important. Furthermore, with AI

and automation technologies depending on more advanced levels of training and universities serving as the prime site for their development, the role of higher education is crucial.

This study explored the implications of AI and automation technologies from faculty perspectives. Because university faculty are vested in research and educating engineers, scientists, and ultimately corporate leadership responsible for developing these technologies, they have an essential voice that should be heard as we consider how to steer the future direction of AI technologies.

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APPENDICES

APPENDIX A

Invitation to Participate in the Study

Dear Professor _____,

I am working on my PH.D. dissertation, "Exploring the Role of Higher Education in Responsible Deployment of Artificial Intelligence". As a part of my research, I am interviewing FIU faculty and administrators who are directly involved with teaching, research, development or examining AI's social and economic impacts. My goal is to enhance our understanding of how faculty perceive their role in implementation of AI technologies.

As you research and scholarly work is focused on AI, you are in an ideal position to provide valuable first-hand insights from your own experience. Your participation and input in this project can lead to a better understanding of the role of higher education in implementation of AI.

The interview will take about 1- 1.5 hours and is very informal. Would you be available for a Zoom interview at your convenience? I have included a one-page summary of my project and the consent form as per FIU's Internal Review Board (IRB) requirement. I appreciate your time immensely.

Shahin Vassigh, Doctoral Candidate: Higher Education Administration

APPENDIX B

Interview Protocol

Exploring the Role of Higher Education in Responsible Deployment od Artificial Intelligence

1. How are you engaged with AI at the University? Please elaborate on your teaching and research areas
2. What do you see as the major impacts of AI on the economy?
3. What do you see as the major impacts of AI on the society?
4. What do you see as the major impacts of AI on the University?
5. To what extent higher education bears the responsibility for mitigation of AI impacts?
6. How AI technology is managed? who controls this technology? and What are the ramifications to HE?
7. What are some of the ethical challenges that you (as a faculty or administrator) face with expanded deployment of AI?
8. How FIU (faculty/administrators) can play a role in responsible and ethical deployment of AI?
9. What is the nature of AI (reflecting on theories)?
10. What should students know about AI?

11. Who should we teach about AI? should the focus be STEM majors, or should we have a more interdisciplinary approach?
12. How do you see AI changing research at the university?
13. What kinds of policies FIU can implement to mitigate the adverse impacts of AI?
14. Could you suggest another faculty who is working with AI for my interview?

APPENDIX C

FLORIDA INTERNATIONAL UNIVERSITY

ADULT CONSENT TO PARTICIPATE IN A RESEARCH STUDY

Exploring the Role of Higher Education in Responsible Deployment of Artificial Intelligence

SUMMARY INFORMATION
Things you should know about this study:

- **Purpose:** The purpose of the study is to understand how University's key personnel who teach and conduct research on Artificial Intelligence (AI):
  1) understand significant impacts of AI on the society,
  2) perceive economic and ethical issues caused by expansive deployment of AI,
  3) understand how AI will change university's teaching and research, and
  4) their plan to address these challenges.
- **Procedures**: If you choose to participate, you will be asked to answer several questions in an interview format.
- **Duration:** This will take about 60-90 minutes of your time.
- **Risks**: The main risk from this research may be discomfort in answering a question (s) which you could refuse to answer.
- **Benefits:** The main benefit to you from this research is gaining insights on the impact of AI and the role of higher education in mitigating those impact.
- **Alternatives:** There are no known alternatives available to you other than not taking part in this study.
- **Participation:** Taking part in this research project is voluntary.

Please carefully read the entire document before agreeing to participate.

PURPOSE OF THE STUDY

Higher education is the key driver in teaching, research and development of AI and automation technologies as it bears responsibility for training engineers, scientists, taught leaders and technologists who lead in this field. The purpose of this

study is to understand how academics and disciplinary experts at Florida International University (FIU) perceive their role and responsibility in the development, commercialization and application of AI technologies.

NUMBER OF STUDY PARTICIPANTS

If you decide to be in this study, you will be one of 15 people in this research study.

DURATION OF THE STUDY

Your participation will involve 60-90 minutes.

PROCEDURES

If you agree to be in the study, I will ask you to do the following things:

- To Participate in a Zoom call
- Answer several questions in an interview format
- Reviewing my summary of the conversation to approve or disapprove

RISKS AND/OR DISCOMFORTS

The study has the following possible risks to you: you may not be comfortable in answering a question which you can refuse to answer. There is no other foreseeable risk in this study.

BENEFITS

The study has the following possible benefits to you: The study's findings may benefit you in the way you approach teaching and research of AI.

ALTERNATIVES

There are no known alternatives available to you other than not taking part in this study.

CONFIDENTIALITY

The records of this study will be kept private and will be protected to the fullest extent provided by law. In any sort of report, we might publish, we will not include any information that will make it possible to identify you. Research records will be stored securely, and only the researcher team will have access to the records. However, your records may be inspected by authorized University or other agents who will also keep the information confidential.

All records will be destroyed upon completion of the study.

USE OF YOUR INFORMATION

Identifiers about you might be removed from the identifiable private information and that, after such removal, the information could be used for future research studies or distributed to another investigator for future research studies without additional informed consent from you or your legally authorized representative

COMPENSATION & COSTS

There are no costs to you for participating in this study. (*If costs are associated, please state*

RIGHT TO DECLINE OR WITHDRAW

Your participation in this study is voluntary. You are free to participate in the study or withdraw your consent at any time during the study. You will not lose any benefits if you decide not to participate or if you quit the study early. The investigator reserves the right to remove you without your consent at such time that he/she feels it is in the best interest.

RESEARCHER CONTACT INFORMATION

If you have any questions about the purpose, procedures, or any other issues relating to this research study you may contact Shahin Vassigh at PCA 370A, MMC, Tel: (716) 698-3000, email: svassigh@fiu.edu

IRB CONTACT INFORMATION

If you would like to talk with someone about your rights of being a subject in this research study or about ethical issues with this research study, you may contact the FIU Office of Research Integrity by phone at 305-348-2494 or by email at ori@fiu.edu.

PARTICIPANT AGREEMENT

I have read the information in this consent form and agree to participate in this study. I have had a chance to ask any questions I have about this study, and they have been answered for me. I understand that I will be given a copy of this form for my records.

_____ _____

Signature of Participant Date

_____

Printed Name of Participant

_____	_____
Signature of Person Obtaining Consent	Date

VITA

SHAHIN VASSIGH

1994	Master of Architecture, Department of Architecture University at Buffalo, The State University of New York
1994	Master of Urban Planning, Department of Planning University at Buffalo, The State University of New York
1983	Bachelor of Science in Civil Engineering, Department of Civil, Structural & Environmental Engineering University at Buffalo, The State University of New York
2018-present	Director of Technology Research Development College Architecture+the Arts, Florida International University
2015-2018	Associate Dean of Research and Faculty Affairs College of Architecture+ the Arts, Florida International University
2012-present	Professor, Department of Architecture Florida International University

SELECTED FUNDED PROJECTS AND PUBLICATIONS

Preparing the Future Workforce of Architecture, Engineering, and Construction for Automation and Robotic Processes, C-Accel Pilot - National Science Foundation
Principal Investigator, Grant funding: $973,000, 2019-2020

Strategies for Learning: Augmented Reality and Collaborative Problem-Solving for Building Science, Improving Undergraduate STEM Education: Education and Human Resources, National Science Foundation
Principal Investigator, Grant funding: $219,000, 2015-2018

Building Literacy: The Integration of Building Technology and Design in Architectural Education, U.S. Department of Education
Fund for the Improvement of Postsecondary Education, Comprehensive Program
Principal Investigator, Grant funding: $553,000, 2007-2011

Igniting Innovation's Incubator Award
Robotics Academy, Igniting Innovation's Incubator Award from the American Council for Technology and Industry Advisory Council, 2019

Vassigh, S., Tubella, J., Alhaffar, H., Ramirez, J., & Pezeshk, S. (2019). Situated Learning Through Robotics Processes. Building Technology Educator's Society, 2019 (1), 27.

Achievement Award
To recognize a specific creative achievement in teaching, design, scholarship, research, or service that advances architectural education.
Association of Collegiate Schools of Architecture (ACSA), 2018

Top Scholar Award
For Research and Creative Activities, Florida International University, 2018

Vassigh, S. (2018), *Complexity of Sustainable and Resilient Building Design and Urban Development*, In K. Çalıyurt & Said (Eds), Sustainability and Social Responsibility of Accountability Reporting Systems: A Global Approach(pp.65-79)

Vassigh S., Davis D., Behzadan A.H., Mostafavi A., Rashid K. (2018), T*eaching Building Sciences Using Virtual and Augmented Reality: Design, Implementation, and Assessment*, International Journal of Construction Education and Research, Taylor and Francis, 1-17

Vassigh, S. (2018), *Exploring Structures*, 5th International Conference on Architecture & Built Environment, Venice, Italy

Vassigh, S., Ortega, F., Barreto, A., Tarre, K., and Maldonado, J., (2018), *Use of 3D Human-Computer Interaction for Teaching in the Architectural, Engineering and Construction Fields,* 12th International Conference on Universal Access, Las Vegas, NV

Vassigh, S. (2017*), The Changing Higher Education Research Environment: New Opportunities for Architectural Research*, Technology Architecture + Design, 1(1), 22-26.

Vassigh, S., Mirshahidi, S. (2015), *Collaborative Learning: An alternative pedagogy for teaching structure,* Building Technology Educators' symposium, Salt Lake City, Utah

Vassigh, S., Newman, W. E., Mostafavi, A., & Behzadan, A. (2015), *Hybrid Technologies for Interdisciplinary Education*, Journal of Civil Environmental Engineering, 5(201), 2

Vassigh. S, Spiegelhalter, T. (2014), *Towards Resilient Best Practices: Net-Zero-Energy Building Designs,* The Grand Renewable Energy Conference Tokyo, Japan

Vassigh, S., & Spiegelhalter, T. (2014), *Integrated Design Pedagogy for Energy Efficient Design: Tools for Teaching Carbon Neutral Building Design*, Energy Procedia, 57, 2062-2069

Vassigh, S., Newman, W. E., Behzadan, A., Zhu, Y., Chen, S. C., & Graham, S. (2014) *Collaborative learning in building sciences enabled by augmented reality* American Journal of Civil Engineering and Architecture, 2(2), 83-88