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05. Computer Science

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An Investigation into Weather's Effect on Aerosol Particles Using WRF and MAPSS

Hayden Webb

Abstract

In this research, we examine the effects of weather phenomenon on the distribution of aerosol particles. Our work method involves using NASA's MAPSS database along side NOAA's WRF software. Our work-environment for this research is on OU's Schooner system. We plan to conduct a historic study of the Tsunami that struck Fukushima in 2011, as well as a local study of the Stillwater area. We expect our results to show that weather events play a substantial part in the distribution of aerosol particles.

ThunderStore: A cheap & effective cashierless system with RPi

Shi Zhe Ting & Ri Hao Yong

Abstract

The average time spent grocery shopping is 41 minutes. It amounts to over 50 hours a year spent in a grocery store. The implementation of a cashierless store would be able to reduce the time spent at a store by half. This not only increases overall productivity but also quality of life. Our project implements the cheapest and most effective way to create a cashierless system with Raspberry Pi.

Building Social Media Applications to Incentivize Real World Human Interaction

Caleb Power

Abstract

The rise of easily obtainable computing machinery and cost-effective internet access has led to the development of various social media platforms and e-commerce sites. This has led to the decline in both the amount of time that individuals spend interacting with other people in public and the amount of in-person business that companies receive, harming small businesses. The objective of this project is to provide a solution to both problems by using location verification techniques to give individuals opportunities to earn and redeem rewards at local businesses, thus incentivizing individuals to interact with each other in person. We've developed this solution by building a mobile app with Google's Dart programming language, Flutter UI toolkit, and Firebase backend platform to ensure usability, security, stability, and low maintenance costs.

Leozene: A Spotify Inspired Music App That Caters to Your Genre-specific Needs

Ri Hao Yong

Abstract

Leozene is a mobile app that's developed specifically to help users upload, store, stream and most importantly categorize songs into countless different unique genres. The app is developed specifically to satisfy each user's need to have their treasure trove of old songs stored in genre-specific playlists. Flutter SDK is responsible for the app's front-end for Android and iOS devices compatibility, while the back-end of the app utilizes Google's Firebase Cloud platform. Leozene utilizes a few services in the Firebase's family which includes Firebase Authentication, Firebase Cloud Firestore, and Firebase Cloud Storage. With Firebase Authentication, users are able to sign up and sign-in to the app with an email password combination. With Firebase Cloud Firestore, user's personal information regarding their Leozene's account, song details including song title, artist, genre, et al., and playlist details including playlist title, genre, et al. are stored in a NoSQL Firestore database. With the usage of Firebase Cloud Storage, big files like the user's profile image and songs could be uploaded and stored in it. The process is designed in a way that uploading files, and updating image/songs URL on Cloud Firestore are both performed consecutively. In conclusion, Leozene helps keep user's favorite songs in the cloud while organizing them into their personalized playlists. Streaming and vibe-ing to the right songs at that right mom

LeolexaPi: An Alexa Housed Raspberry Pi to Make Home Automation a Breeze With Leolexa Home

Ri Hao Yong

Abstract

With a simple idea in mind to create a virtual assistant that you could interact with and help automate various functions and tasks at home, LeolexaPi was born. LeolexaPi is a fusion between Alexa and the Raspberry Pi where Alexa is directly housed in the Raspberry Pi and used to control your lights, alarm, and temperature at home. To simulate that environment and process, in addition to having Alexa downloaded, tweaked, and install on the Raspberry Pi, a breadboard was also set up with multiple LEDs (Light Emitting Diodes), a DHT-11 (Temperature and Humidity Sensor), and an Active Buzzer (Alarm) to represent various amenities we could see and control in our own home. With just your voice (or text if chosen), LeolexaPi is at your command and could help turn on lights in different rooms, sound the alarm in situations of emergency, and check the indoor temperature and also humidity, all in the vicinity of your home with ease and efficiency.

Virtual Reality Tower Defense Game

Ren Jian Lee

Abstract

The aim of this research project is to create a unique style of gameplay for traditional tower defense games. This project includes a first-person perspective in tower defense gameplay by implementing it in virtual reality. This allows the player to control a character that can assist the turrets in eliminating waves of enemies. Unity provides many helpful tools to accomplish this and is utilized throughout the course of this project. The game includes features such as wave spawns of enemies, a shop for turrets, and currency. The enemies have set health values and movement speeds; the turrets have set costs, fire rates, and damage values. The waves of enemies increase in number as each round is completed. This project involves numerous scripts that provide various functions such as animating the bullet projectiles and explosions, camera movement, spawning of enemy waves, menus, and a NavMesh agent that the enemies use to find their pathing. Design patterns were used to control the enemies' behavior and centralize references to shared resources. Some enemies can shoot at the player, creating an exciting experience for the player. The player must navigate the map and purchase turrets to kill the enemy units before they travel to the end of the path and reduce the player's health. The results of this project are a rarely-seen style of tower defense gameplay that could prove to be enjoyable and a better understanding of Unity game development.

Skiing Through VR: Creating and Using Unity and Android VR

Chase Minden

Abstract

Unity is a very diverse engine, and it's no surprise that it comes fully equipped to handle creating VR games. That is what I was challenged to do for the spring 2019 semester: create a unique VR experience using Unity and Android's software development kit (SDK). Starting off was the hardest with thinking of ways to make an experience that would really capture the VR aspect. When creating a sample scene, I found a few models for some snowy mountains, and from there I decided on making a skiing simulator of sorts. With a bit more experience in my pocket from working with Unity in the fall 2018 semester and a few tips I picked up from ORD 2019, I was able to start my vision relatively easily. Unity made setting up a player character easy with their presets, adding forces on a global scale was as simple as adding a component, and using navmeshes to create pathfinding AI was only a download away. All I had to do was piece a few of the components together, code up some arrays of locations for the AI to find and make some UI for the player to read the environment, and my vision was done. Of course, there was a lot of trial and error in this process, but looking back on how simple it was to create something like this in VR has me excited to continue working with it and see what else is possible.

HHL Algorithm: The Power of Quantum Computing

Jiahao Zhao

Abstract

Research on quantum computing shows the potential that computation complexity can be much faster. In 2009 the professor Seth Lloyd created an algorithm called HHL that can solve the linear system faster than a classic way. Quantum computing uses the idea qubit that can do two computations at the same time. Instead, to find the exact solutions, the big picture is to find the inverse of the eigenvector of the original matrix, come up with those qubits. The result shows that we can solve the system of the linear system in the big O of a multi-log complexity, where the classic way can only solve it in big O of polynomials. In that case, quantum algorithms are much faster than the classical algorithm when solving a linear system. However, unlike the classic algorithm, the drawback of the HHL algorithm cannot tell us explicitly answer, the answer can only be represented by the inverse of the eigenvector.

Housing Price Prediction

Bibek Roy

Abstract

We are going to analyze and predict the price of housing. We use the housing dataset of Ames, Iowa to train and test the machine learning model. The technologies we use are Python language, Github, Kaggle, Google Colab. The part of supervised machine learning we use is regression and different techniques.

Using Machine Learning to Predict Student Success Rates

Sean Gausman & Jicheng Fu

Abstract

This research explores using machine learning to identify student enrollments that will potentially lead to failure. Failure, in our case, refers to a grade of 'D' or below. Withdraws are also considered a failure.

This software could be used to inform students, advisors, and more. Interventions will be made in a timely manner to help the students by support staff and tools. The advisors could use the data to help a student enroll in a successful schedule.

The goal of this research is to improve the accuracy of our intelligent model as much as possible by using feature selection, different training techniques, combining multiple machine learning algorithms, and creation of advanced features. In particular, creating advanced features includes combining certain features to create new features, such as Average Grade Anomaly.

Super Education for Supercomputers

Ezgi Gursel

Abstract

Supercomputing is growing at a rapid rate. From government agencies to hospitals, many organizations rely on supercomputers for a variety of purposes. Marked by their potential to solve highly technical and complex problems, supercomputers could be considered the future direction of the information age. However, the growth of supercomputing poses the problem of training qualified individuals for the supercomputing industry. This poster aims to answer the question, how does supercomputing training occur? This material is based upon work supported by the National Aeronautics and Space Administration under Grant No. NNX15AK02H NASA Oklahoma Space Grant Consortium.

Depths of Deep Learning

Dr. Jawad Drissi & Jesse Tobias

Abstract

Neural networks are able solve problems that previously were beyond our reach. This was possible due to the work of Yann LeCun describing the creation of Convolutional Neural Networks (CNN), Geoffrey Hinton who demonstrated Error Backpropagation. This presentation will give an overview of neural networks and how they function. The hidden layers will be explained with types of neurons and algorithms that are commonly used in deep learning. Also, we will provide links between artificial intelligence, machine learning, and deep learning. We will explain how LSTM nets will improve malicious code detection in IDS systems. Though the outcome is promising in both detection and decrease in detection delay there are still several variables that can influence system performance and need to be researched further.

The Expected Safety in Self-Driving Cars Technology

Joseph Gudger

Abstract

This presentation describes the implementation of autonomous vehicles (AVs) or self-driving cars into our society from developments in the past, the present and the expected safety of self-driving cars technologies. Remote controlled vehicles have been around since 1926. In 1980, major advances in autonomous vehicle technology was made by Mercedes-Benz with the advent of its vision guided Mercedes-Benz robotic Van with the focus being on the vision guided systems using LiDAR (radar, GPS and computer vision) to control the vehicle. The technology developed from this autonomous vehicle help advance the technologies in the present modern semi self-driving cars like adaptive cruise control, anti-locking braking system, blind spot vehicle detection, steering assist, lane parking, and other new features. In this presentation, we also describe some safety issues dealing with how AVs must learn how to negotiate driving pattern involving both human drivers and other AVs, the decision-making systems, and cyber security concerns.

The Workings of Blockchain

Carlton Harris

Abstract

Blockchain is a new technology defined as an open ledger that offers decentralization to the parties. In addition, it also offers transparency, immutability, and security. It has many features including being open, distributed, ledger, P2P and permanent. Blockchain also creates privacy and security for the Internet of Things (IoT) domains, A.K.A the Internet of Everything (IoE). We will describe how the blockchain functions and the different systems of blockchain. We will show you some applications of Blockchain like bitcoin, banking ledgers, and medical transcripts.

Security in Drones

Reginald Dozier & Dr. Jawad Drissi

Abstract

The use of unmanned aerial vehicles (UAVs)/ Drones has increased exponentially over the last decade for a broad range of applications. The recent commercial availability of a new generation of small UAVs/drones has emphasized the growing threat posed by these machines. This paper will discuss the security threats posed by UAVs in areas such as terrorist attacks, illegal surveillance and reconnaissance, smuggling, electronic snooping, and mid-air collisions, in addition to discussing on the categories of UAV intrusions in terms of intention and level of sophistication of the operators. The focus here is to raise awareness about the security, privacy, and safety aspects associated with the deployment of civilian drones into the national airspace.

Overview of 3D Printing

Jackson Holloway, Dr. Jawad Drissi, & Marilyn Li

Abstract

3D Printing, also known as additive manufacturing, is the process of physically creating an object by taking a model created in or scanned in through the 3D modeling software and constructing it by extruding materials in successive layers using specific hardware. This paper will present an overview of 3D printing technologies and their capabilities. The flexibility and low barrier to entry of 3D printing technologies are a catalyst for innovation and reduction of costs of manufacturing. These 3D printing applications are being used in a wide range of fields, such as the automotive, aviation, health care, and electronic industries.

Simultaneous Localization and Mapping Analysis

Jacob Miller

Abstract

Simultaneous Localization and Mapping (SLAM) is an open research area in the field of robotics. SLAM is how many robots navigate an unknown environment, but there are several approaches used today. This project has found three algorithms in common use and compared them using a simulation. Robot Operating System (ROS) was used for both the SLAM algorithms and the simulation software. Additionally, the algorithms are hoped to be deployed and tested on hardware using a custom built Turtlebot. This research was funded in part by the Dr. Snowden Memorial Scholarship with the NASA Oklahoma Space Grant Consortium. This material is based upon work supported by NASA issued through the OSGC.

Upcoming Methods Used to Process Big Data

Brayden Harris & Dr. Jawad Drissi

Abstract

Big Data encompasses a lot of different data and data types, as information technology continues to evolve so must data analysis. This in turn has caused Big Data to push data analysts to find better and better ways to analyze the data being collected. The purpose of this research is to look into the algorithms and other methods that are being used to make analysis easier. Some of the methods include clustering of data in order to look for hidden patterns through grid-based clustering. Use of MapReduce and Hadoop, which receive and process data in parallel in order to deal with huge volumes of data. And by organizing it through a mixed framework in order to truly create a thorough level of organization that allows for the best data analysis. This paper will describe these new methods used to process data that have enabled organizations to deal with problems related to Big Data.

Facial Recognition Using the Viola-Jones Algorithm, PCA, and ANN

Antoine Charles

Abstract

What allows smart technology to capture our many distinct facial features is a process of complex algorithms working in real time to provide up to ninety percent accurate identification of faces. The Viola-Jones algorithm, principal component analysis (PCA), and artificial neural network (ANN) offer their own solution to facial recognition. Viola-Jones algorithm has the distinct advantage of providing the most accurate rate of recognition with the fastest facial tracking. PCA while only able to produce an accuracy rate of seventy-two percent and ANN with ninety-two percent coupled together as a proposed method it is possible to bring accurate facial recognition to ninety-four percent. This paper will bring forth a proposed methodology that could drastically increase facial recognition accuracy and the speed at which it algorithms are able to identify a human face.

Keywords: Viola-Jones, Principal Component Analysis (PCA), Artificial Neural Network (ANN)

Spaceship VR: Varied Movement and Dynamic Terrain with Unity and Android VR

Chase Minden

Abstract

Spaceship Run VR: Varied Movement and Dynamic Terrain with Unity and Android VR

The idea for this project didn't come from me, my girlfriend had told me about her idea to play a first-person Temple Run type game, and she told me I should try making that possible. I started the project with a simple 3D Unity template, and after working on it for a full semester I'm surprised at how little the game required asset wise, but it did require a lot more scripting wise. By using some downloaded prefabs from the Unity store, I was able to start modeling the pieces I needed, which I decided to make space-themed just for fun. The first challenge was dealing with the movement input for the Unity first-person controller, which is normally done by joystick input and camera look angle. I wanted to make the game as joystick free as possible, so I set the speed to constant and left the camera. This caused problems whenever the player could look back and move back because I wanted to keep them moving forward. To solve this, I thought about locking the movement vector when in hallways to keep the player moving, so they could still look around without affecting movement. By using box colliders set as triggers, I was able to accomplish this goal with a lot more modifications to the PlayerMovement script Unity provides. Overall, I am very happy and proud that I was able to complete a very beginning version of this idea and am excited to move on.

Investigating the relationship between Human Development Index and Corruption Perception Index for all countries.

Imuseoluwa Obembe

Abstract

ABSTRACT

A random sample of 35 countries were selected and data were collected for the countries. The two sets of data collected for the selected countries were the Human Development Index (HDI) and the Corruption Perception Index (CPI). The research was to see if there was any relationship between the Human Development Index of a country and its Corruption Perception Index; the Human Development Index as the independent variable (x) and the Corruption Perception Index as the dependent variable(y). Our hypothesis was that there would be a positive linear relationship between the HDI and the CPI. We used a normal correlation, a scatter plot, a residual plot and a histogram to check the relationship between the two quantitative variables. Based on our analysis of the results, our hypothesis was true. The scatterplot shows a linear relationship between the HDI and CPI, the residual plot shows no funneling and the histogram is unimodal and approximately symmetric. These findings proved our thesis to be true.

When Voting Theory Methods Produce Different Winners

Elizabeth Wissler

Abstract

Demand is rising for distance learning options, which has created a need for large libraries of problem sets. Creating these libraries manually is time-consuming and effort-intensive, which is an opportunity for automation. The availability of a virtually unlimited number of problem sets for a given topic gives teachers the ability to quickly create new example, homework, and test problems without the need to purchase pre-made problem sets. This can be particularly difficult when setting up complicated problems with the intent of finding a specific outcome, such as finding the original conditions that lead to voting methods producing different winners.

In this project, we worked toward determining required initial conditions that lead to the Plurality, Instant-runoff, Condorcet, and Borda Count voting methods all producing a different winner. Oftentimes, there is no majority winner, hence the concept of determining a "fair" winner is objective. This demonstrative problem intends to encourage students to think critically about political fairness.

The Revolutionary Technology of Virtual Reality

Christina Sivasankaran & Dr. Jawad Drissi

Abstract

Virtual reality (VR) immerses users in a computer-simulated world and has been used for a variety of practical and entertainment purposes. VR is able to create a virtual environment that allows pre-med students to practice risky procedures, prepares astronauts for space explorations, mission planning and execution of military exercises, trains pilots on new fighter jets, and allows architects to create and view a structure before they break ground. With virtual reality, we can experience and learn how to explore dangerous situations without the concern of actual danger. In addition to these practical applications for VR, it is also a popular form of entertainment providing immersive and exciting gaming experiences for users. In this paper, we will touch upon the history of virtual reality, delve into the diverse classes of VR systems, examine the technicality of its hardware, software, framework, algorithm, and discuss the future of virtual reality.

Honeypots

Hagan Holsapple

Abstract

Honeypots, in simple terms, are a computer defense mechanism to track unwanted activity on a network. Mostly used for businesses this can help protect against cyber-attacks which can result in client information being stolen, shutting down the network, or sensitive company files stolen. Depending on which type of Honeypot you need to deploy can vary on the difficulty. My research will look into the different types of honeypots and the easiest way to deploy these to a network.

Using K-Nearest-Neighbor to Classify the Angle of Impact of Individual Bloodstains in a Crime Scene

Alexander Mullis & Jicheng Fu

Abstract

This objective of the proposed study was to create a system using K-Nearest-Neighbor algorithm to determine the angle of a blood drop on a surface. With this research, bloodstain pattern analysts can take photos of a victim's bloodstains and determine the angle of impact quickly and accurately, in some cases, more accurately than what they would be able to achieve on their own. With this system, bloodstain pattern analysis can be more automated, allowing analysts to focus on other elements of the crime scene. By using a photo of an isolated blood drop on a surface, the system is able to determine the angle in 10 degree increments from 10 to 90 with 70, 80 and 90 degrees being grouped together. The system creates an hdf5 file with all of the test and train images. These images are 32 x 192 grayscale individual blood drops. The system then loads this file and begins the KNN process of determining angles. The results show an 80%-85% average success rate. Individually, some of the angles are identified at super-human performance. In our further research, we will tune the system and collect better/more blood drop images to improve the overall accuracy and individual angle accuracy.

Performance Comparison between B-tree and LSM-tree

Dr. Gang Qian

Abstract

B-tree and LSM-tree (log-structured merge-tree) are two different types of data structures used in data management systems to implement indexes, which support efficient query operations. B-tree is a traditional technique, which is widely used in relational databases, while LSM-tree, a relatively recent development, is more frequently used in non-relational databases. In theory, LSM-trees tend to be superior at writing while B-trees are better at reading. In this project, we compared the insertion and search performance of the two tree structures. These experiments utilized some existing open-source implementations developed in C++. The implementations were customized so that the trees used comparable parameters in the study. Insertion, searching and a mixture of the two operations were included in the experiments.

Security Robot

Rad Alrifai

Abstract

This project derived from an interest of having a robotic home security surveillance system that could be maneuvered around a house for live video streaming. The system allows the user to remotely navigate throughout their home and see what is happening in the various rooms. The robot implements a Raspberry Pi to create a webserver and capture the video via a connected camera. An Arduino Uno is also utilized to control the motors of the robot. The webserver was developed using Python, HTML and JavaScript. C# was used to write code for the Arduino.

Utilizing Machine-Learning to Uncover Hidden Factors Contributing to Obesity among Hispanic Preschoolers

Leif Nevener, Jicheng Fu, Shashank Ranga, & Keerthi Kancherla

Abstract

Childhood obesity increases the risk for children to develop type two diabetes, cardiovascular disease, and cancer later in life. The United States Health Department found that Hispanic children are the most at-risk demographic among children for childhood obesity. However, few research studies are available to explain why this ethnic group suffers from such a high obesity prevalence. This project focuses on uncovering the hidden components related to obesity in Hispanic preschoolers ranging from 2-5 years old through the use of cutting-edge machine-learning techniques. The data to be utilized in this study is obtained from a previous study, where 238 Hispanic families were involved. Qualitative and quantitative data gathering methods were employed to study the health habits of Hispanic families and different attributes that indicate healthy lifestyles. We will need to overcome significant challenges inherent in this dataset, such as missing values and a substantial number of variables (> 300). Particularly, variables irrelevant to childhood obesity may adversely impact the learning quality of machine-learning techniques. To address these challenges, we will employ statistics, unsupervised learning, and deep neural network techniques in combination to identify relevant variables and construct an intelligent model to accurately predict the possibility of childhood obesity.

Extending the Supercomputer User pipeline to SWOSU

Andrew Roberts

Abstract

Supercomputers have been a key enabler to many technological advancements.

The pipeline to develop capable supercomputer users is years long.

Getting started with a supercomputer can be difficult.

As a part of the XSEDE EMPOWER Learner program, this research focuses supercomputer user development.

SWOSU students do not have working code for many of the training modules available for learning supercomputing.

This research details the development of these codes based on materials provided by the National Science Foundation, Shodor Foundation, and National Center for Supercomputing Applications.

The result of this research is a better understanding of supercomputing training and more tools available to SWOSU students.

Bringing SLAM and ROS to middle and high school students

Jacob Miller & Clark Kurtis

Abstract

Simultaneous Localization and Mapping (SLAM) is an open research area in the field of robotics, SLAM is how many robots navigate an unknown environment. There are several approaches of SLAM used today. Robot Operating System (ROS) software is used to control both SLAM and a simulated environment that SLAM operates in. The process to implement these into a virtual machine and a TurtleBot is a complicated process. The goal of this project is to build a simplified tutorial for middle to high school level students to work them through the process step by step. As well, to allow them to understand each step in the process and what is happening. This research is funded in part by the Dr. Snowden Memorial Scholarship with the NASA Oklahoma Space Grant Consortium. This material is based upon work supported by NASA issued through the OSGC.

Increasing Student Participation in Virtual Class Meetings for Computer Science Classes

Teko Bekkering

Abstract

Virtual Class Meetings (VCMs) are classes delivered over the Internet synchronously but location-independent. Compared with traditional face to face classes, VCMs offer multiple two-way communication methods that increase student participation in the class. We show our most effective methods.

Neural Networks: A study on how it came about and everything else

Shi Zhe Ting, Ri Hao Yong, Norbert Puchala, & Ren Jian Lee

Abstract

The goal of this review is to compile information about the history, idea, and future of neural networks. Articles were found using the IEEE and ACM databases. Articles used in this review are dated from the mid-1900s which are used for explaining base topics of neural networks to more recent articles from the 2010s to show current and possibly future trends of neural networks. Advancements in hardware has allowed for practical applications of neural networks. Changes in the structure of neural networks has allowed for faster and more accurate classification.

The review has compiled information from the base units of neural networks to current research being done to make them more efficient. In this review we included information regarding topics that span from the perceptron to hardware used to make neural networks more efficient such as the Tensor processing unit. We conclude through our review that neural networks are an important and ever-growing advancement.

Rabbit Pet Simulator in Augmented Reality

Ren Jian Lee

Abstract

The aim of this research project is to create a pet simulator using augmented reality. Utilizing a mobile device's camera, a player will be able to place a pet rabbit in whatever environment they are in and interact with the rabbit. Unity and Google ARCore provide many helpful tools to accomplish this and is utilized throughout the course of this project. The pet simulator includes features such as spawning a rabbit, enlarging it, rotating it and tapping to make it move. The rabbit has animations when it is idle and when it is moving. This project involves several scripts that provide various functions such as detecting the ground plane, instantiating a pet rabbit, controlling the movement of the rabbit, and removing the rabbit from the scene to start over again. The player will be able to enjoy having a rabbit in the room virtually without any real-life responsibilities; this application might be used to experience what it might be like to have a pet at home before getting a real one. The results of this project are a pet simulator with cool features, more experience with Unity game development and a better understanding of augmented reality application development.

Take Back Your Power: Five Things Everyone Must Know About Mental Illness

Oscar Garcia

Abstract

Mental illness is becoming more common in the United States. Statistics show that 1 in 5 adults are victims to some type of mental illness. The presenter, Oscar Garcia, will discuss about anxiety disorders, the types, signs, and symptoms of mental illness, and the long-term effects of mental illness if it is left untreated or ignored. Oscar also hopes to raise awareness among his audience members on how people with mental illness can find relief from their symptoms and discover ways to cope effectively.