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Adoption of Artificial Intelligence in Tourism Industry: A Systematic Literature Review

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I hereby declare that the work submitted is mine and that where I have made use of another's work, I have attributed the source(s) according to the Regulations set in the Student's Handbook.

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Abstract

This dissertation was written as part of the MSc in Management at the International Hellenic University.

Information and Communication Technologies (ICTs) in tourism, started a new era in contemporary tourism, and hospitality industry. Enterprises in a variety of sectors might utilize AI to steal in yearly revenue from their less-informed competitors and there is no denying the widespread use of AI. There are a variety of ways in which artificial intelligence (AI) is put to use in the tourist sector, including the enhancement of individualization, the provision of more specific suggestions to clients, and the assurance of speedy responses even when human operators are unavailable.

The goal of this study, is to find, analyze and evaluate the spread of published articles (reports, case studies, dissertations etc.) in the literature about the influence of Artificial Intelligence in the tourism industry and also specifically in Greece. We conducted a "Systematic Literature Review" approach with the use of Prisma Methodology. The search was done in the Web of Science database from 01/01/2000 until 12/31/22 with these the key words "AI and Tourism", "Artificial Intelligence and Tourism", "AI Applications and Tourism".

According to the study's results, the benefits of the newly developed AI approach include "increased accuracy of classification and prediction," "development of smart tourist platforms," and "quick operations under unanticipated events. Greek applications seem to focus mainly in the machine learning department and artificial neural networks with some references to the use of Big Data and a single reference about Customized AI Apps.

Keywords: (up to 5) AI, Tourism, Applications

Sofia Iliadi

15/01/2023

Preface

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Introduction

"I think there is not much difference between what can be reached by a biological brain and what can be reached by a computer. It therefore follows that computers can, in theory, emulate human intelligence, and exceed it."

Stephen Hawking

The advent of information and communication technology signaled the beginning of a new era in the hotel and tourism sectors (ICTs). Researchers were able to quickly evaluate tourist behavior using intelligent systems because of ICTs, which enabled them to handle massive volumes of data created by tourists and destination parties. ICTs also had a significant influence on how visitors drank, purchased, and shared their experiences (Buhalis, 2003). In a 2006 research (Gretzel et al.), both tourists and service providers benefitted from increased mobility and decision-making ability, which enabled them to more readily and correctly access information necessary to a fulfilling trip (Gretzel, 2011). Given recent advancements in information and communication technologies (ICTs), the tourism industry is turning to artificial intelligence (AI) as its next evolutionary step (Bowen & Whalen, 2017; Gajdok&Marci, 2019; Kazak et al., 2020). Artificial intelligence (AI) is well-known for its better computing skills due to its ability to handle complex linkages and issues involving several ideas (Pannu, 2015) and because it is straightforward to employ when dealing with enormous amounts of data (Inanc-Demir & Kozak, 2019). In principle, an AI system may receive input from the outside world, analyse it, act to fulfill objectives specified by itself, and then learn from its failures (Ferràs et al., 2020).

"Do you know whether there are any thinking robots out there?"

Alan Turing proposed this idea 70 years ago, which resulted in the development of the "Imitation Game" and the "Turing Test" to distinguish between computers and humans based on intellect.

Since the invention of computers, scientists and engineers have been concerned about whether artificial intelligence would ever achieve the same level of development as human intellect. Traditional AI advancement forecasts have been exaggerated, but it's not unreasonable to believe that producing completely artificial intelligence is a distant and impractical objective at this moment (Bostrom, 2014). Indeed, it has been prophesied that sophisticated artificial intelligence would one day outperform human intellect, resulting in a "technological explosion" (Tegmark, 2017; Yeoman, 2012).

Looking at AI in 2020 illustrates how prevalent technology has grown in a wide range of applications, from business and tourism to daily life (Tussyadiah & Miller, 2019).

In light of the above, we set out to discover how AI has impacted the travel industry throughout time and how it will change the industry in the future. This generated the topic of how to best pick among the several artificial intelligence (AI) methodologies and technologies that offer promise for improving decision-making in the travel and hospitality industries. This study will look at the influence that AI and other developing technologies are having on the tourism industry and the sector's overall future, while emphasizing customer requirements. The topic of whether the Greek tourism sector is ready to embrace artificial intelligence will be tackled straight on.

Literature Review

The term "tourism" is well-known to all people. Reviews of the literature highlight the complexity of tourism by pointing out the many definitions that may be applied to the phenomena. Here are a few of its more popular and well-chosen definitions. Held identified tourism as one of the world's most significant forces in the expansion of cultural homogeneity in 2000, seeing it as a driver of globalization. It is obvious that the word "tourism" may apply to a wide range of activities. In order to standardize the terminology used in the tourist sector, the United Nations World Tourism Organization (UNWTO) developed a set of guidelines between 2005 and 2007. His definition of tourism (Chung et al., 2008) reads as follows: Tourism is the migration of individuals to locations outside of their normal surroundings for economic, cultural, and social reasons.

Whether or whether they are citizens of the host nation, tourists are anybody who travels for leisure. The two most frequent justifications for traveling are for pleasure and for work. For the purposes of this definition, a person must travel more than 80 kilometers from their regular place of residence and spend at least 24 hours away from home (Fotis et al, 2011).

The "great tour" that the young aristocrats took in the 16th and 18th centuries is seen to have been the precursor of modern tourism. Their maturation, the passing of their youth, and learning to accept their position in society were the initial objectives. Young men who had reached the legal drinking age and had a burning desire to see the world set off on this epic journey as a rite of passage (Chung et al, 2008). However, as time went on, the focus on pleasure and leisure altered, and a new paradigm known as "travel as art" evolved. Some tours began in England and went on to other nations throughout Europe. The program's trips to the many historical sites in Italy were its high points, but stops in other important cities throughout the globe, including London, Paris, Amsterdam, Madrid, Munich, Vienna, and Prague, were also widely attended. The journey's goal was to teach the young aristocrats basic social graces and etiquette, therefore they visited royal courts and aristocratic homes (Xiang et al, 2010).

The "bildungsreisen" (literally, "educational travels") taken by the (upper) middle class during the Enlightenment and early Modern periods were a critical turning point in the development of tourism. Famous philosophers and intellectuals including Jean-Jacques Rousseau (1712-1778), Charles Baron de Montesquieu (1689-1755), Johann Wolfgang von Goethe (1749-1832), Gotthold Ephraim Lessing (1729-1781), and Johann Gottfried Herder were often present on the journeys of the educated middle classes (1744-1803). They all went to France or Italy in pursuit of wisdom, and they all published books, travelogues, and novels about their experiences there. Educational tours have been broadened to accommodate more visitors in less time. In order to get a better knowledge and appreciation for the world around them, people rode in carriages, traveled through rural and urban areas, and went to historical sites. Additionally, it contributed to the development of a brand-new middle-class tourist model that emphasizes business, science, and technology rather than merely education and the arts (Ye et al, 2009). These operations are clandestine intelligence gathering actions that are motivated by financial and professional concerns. Corporate middle class people visited France, the UK, and Germany to learn about the

most recent advancements in science and business. They sought out new human connections in order to learn more about the state of the art in the areas of commerce, agriculture, industry, technology, and manufacturing.

According to conventional opinion, the "early," "pre-," or "developmental" stages of contemporary tourism occurred in the 18th and early 19th centuries. The only visitors of the day who could afford to travel extensively were the affluent aristocrats and well-educated professionals. They saw traveling overseas as a sign of their social status, which gave them access to chances for professional development, financial gain, social recognition, and relaxation. In particular, education lost its significance in favor of the pursuit of pleasure, and the rich middle class sought to behave in a hierarchical manner similar to that of the wealthy upper classes (Hashim & Murphy, 2007). As a result, the aristocracy began to attend increasingly exclusive entertainment venues in an attempt to avoid mingling with the commoners. This is shown by the fact that they created "swimming holidays," a fresh kind of travel, and visited gorgeous spa towns that had just added casinos. These places, such as Baden-Baden, Karlsbad, Vichy, and Cheltenham, are known for their social events, banquets, dances, horse races, adventures, and gambling. Businessmen and industrial owners "overwhelmed" even the nobles. They altered the standard beach resort holiday to better fit in. The British nobility often traveled to Brighton and the coast as well as to Malta, Madeira, and Egypt for winter vacations.

1. The foundations of Modern Tourism

1.1 AI in tourism

McCormick et al. predicted that by 2020, enterprises in a variety of sectors might utilize AI to steal \$1.2 trillion in yearly revenue from their less-informed competitors (McCormick et al., 2016). Manufacturing, the automotive industry, banking and financial services, healthcare and life sciences, insurance, telecommunications, energy, travel, tourism and hospitality, media and entertainment, and even the entertainment industry have all seen increased use of artificial intelligence in recent years. Artificial intelligence (AI) is having an ever-increasing impact on markets throughout the globe (sites.tcs.com, 2019, p. 6). Artificial intelligence (AI) is gaining traction in the corporate sector as a means to foster creativity and reduce reliance on human

labor for menial jobs. There is no denying the widespread use of AI across many company functions, from customer care and sales to marketing and finance (sites.tcs.com, 2019, p. 6).

As a result of technological development, the amount of human effort needed to carry out the sector's various tasks has decreased significantly. The travel sector has been quite receptive to AI since it is one of the most commonly utilized technologies (World AI Show, 2019). With the potential to help marketers in a highly competitive industrial climate optimize procedures and simplify firm operations, artificial intelligence has entered the commercial scene. After first being used to streamline marketing processes, artificial intelligence (AI) is now permeating every facet of the tourism sector, from initial contact to follow-up (World AI Show, 2019). There are a variety of ways in which artificial intelligence (AI) is put to use in the tourist sector, including the enhancement of individualization, the provision of more specific suggestions to clients, and the assurance of speedy responses even when human operators are unavailable. The broad use of AI in business has led to its application in a growing number of customer-facing roles, raising the bar for customer engagement (revfine.com, 2019).

This paper is important because it collects a large amount of papers that describe specific applications of AI in tourism, which has not been found in the previous literature, while also focusing on Greek applications, which has not been done before.

1.2 Elements of the Tourism Industry

The most important elements of the tourism industry are accommodation, the transport, attractions, travel agents and ancillary services. Considering these elements one can be led to a better understanding of the tourism industry (Chung et al, 2008):

- **Accommodation:** Accommodation includes the place where the tourists are going to spend their travel time in the form of hotels, resorts etc. It can be provided either individually or as a package. Accommodation sometimes includes meal services.
- **Transport:** The transporter can be airlines, railway companies, car rentals etc. The choice of transport means of tourists often depends on their budget, the quality of the trip and the time as well as the purpose of the tour.

- Attractions: When it comes to forms of tourism such as cultural or environmental, attractions play an important role when choosing the desired destination. An interesting and attractive destination is more likely to absorb a greater number of visitors.
- Travel agents: a travel agent offers information to potential tourists about various travel destinations, informs them about available vacation packages that suit their budget and preferences, and outlines their travel plan.
- Ancillary Services: Also known as information and guidance, they include many services such as banking, tour guides, insurance, tickets and more.

The combination of all the above elements requires strategic tactics, knowledge marketing, as well as high social skills.

1.3 Definitions of important elements

Intelligence Artificial

The term "artificial intelligence" is used to describe the capacity of a computer to do tasks often associated with human intellect. By using AI, robots can 'understand' their surroundings, find solutions to issues, and take action to achieve a goal. The computer takes in information (either previously prepared or gathered through sensors like a camera), analyzes it, and then acts accordingly (Borghi et al, 2020).

In certain cases, AI systems may modify their behavior on their own based on the results of their analysis of the situation and the solutions they find. Many cutting-edge innovations have emerged in the field of artificial intelligence in recent years. With the aid of these innovations, we were able to provide our consumers something really special. Examples of such innovations include Google Maps with built-in AI, language translators, automatic speech recognition, virtual reality apps, chatbots, robots, and more.

Neural Networks

The field of neural networks is a recent one in the natural sciences; its discovery and subsequent development occurred just within the past forty years or so. There has been a significant increase in the number of scientists working on these problems and the visibility of their work thanks to the significant progress that has been made in this field in recent years. As a result, they generate a lot of attention in the technical sciences (Claveria et al, 2015). Neural networks have its origins in the neurological systems of animals and humans, but their research and use have evolved well beyond this. They are now routinely employed to find solutions to a wide variety of computer-related issues. Though they have some similarities with traditional computers, their underlying principles are very distinct. Their purpose is to unite the analytical capabilities of the human mind with the precision of mathematics. Thus, we use concepts formerly ascribed only to human mind, such as a network learning and training, remembering or forgetting a numerical value, etc., in neural networks. Of course, they can and do use sophisticated mathematical procedures and a wide range of analytical instruments (Claveria et al, 2015).

Due to the perishable nature of many items, and the nature of tourism accurate forecasts have taken on more significance in the tourism industry. There has been a plethora of studies devoted to forecasting and modeling in recent years. Quite a few of these studies used neural networks to model and forecast vacationer demand. Training a neural network using a back propagation strategy has been demonstrated to enhance forecasting accuracy compared to regression models and time-series models, and this finding is supported by data (Claveria et al, 2015).

Machine Learning

Machine learning is the name of the field of computer science that studies the creation of algorithms that "learn" without being programmed with specific rules. In other words, these algorithms use data to discover patterns and relationships in order to make predictions or make decisions (Claveria & Torra, 2014). References to machine learning have been around since the

1960s, but the use of these techniques increased rapidly after the 1990s as a result of the development of computer science disciplines such as file digitization, data mining, and supercomputing (Claveria & Torra, 2014).

These are the backbone of voice assistants like Siri, Cortana, Bixby, and Alexa, and provide targeted advertising and the prediction of customer behavior, an important element in Tourism. They provide several services such as process improvement, email spam filtering and categorization, fraud prevention, all very important in hotel management. Moreover, social media users routinely use ML technology without even being aware they are doing so, which is very important in hospitality marketing (Samala et al, 2020).

Chatbots

Chatbots, also known as messenger bots, are programs built to have conversations with users through messaging platforms like Facebook, Twitter, and more. A chatbot's responses to a customer's inquiries may be mapped out in advance using a "conversation tree." Alternatively, they may find the best potential solution for a given circumstance by looking for keywords in user messages (Filiari et al, 2021).

When implemented properly, chatbots may dramatically enhance your approach to client interaction and support. A messenger bot provides another another means of communicating with your target demographic across several platforms, including social media, SMS, and website development (Filiari et al, 2021).

Every hotel attempts to provide its clients a memorable experience. Visitors are usually looking for information about the hotel's offerings. The usage of chatbots in this context is critical.

Personalization must be a critical component of marketing professionals' offerings. Voice-based chatbots, in particular, provide their customers a VIP level of personalized service. Customers may utilize it to make a variety of requests, including food delivery, taxi rides, message reading, task and appointment making, alarm clocks, cleaning, information on the hotel's services, and more (Gajdos'k and Marcis, 2019). Overall, it helps the tourist. Chatbots may really remember their users' prior actions and preferences in order to deliver personalised suggestions. The hotel

industry has observed an increase in customer engagement and enjoyment as a result of the adoption of voice-activated chatbots (Nagaraj and Singh, 2018; Singh and Nagaraj, 2019). Thanks to chatbots, the hotel industry may finally be able to give the best customer service possible. Marriott, Hyatt, and GRT are among the hotels that have used chatbots (Gajdos'k and Marcis', 2019; Seal, 2019).

2. Robotic Technology – Artificial Intelligence

The fast development of robotic technology in the tourism sector may be attributed in part to shifting customer preferences. Businesses like hotels and travel companies are looking into robotic automation because clients increasingly want self-service options. One kind of robot, chatbots, are finding more and more uses in the travel industry and beyond. Chatbots are conversational software programs that are programmed to interact with users in an online chat room or forum using text, voice, or both. Tech giants like Facebook, Google, and Amazon utilize similar apps to deliver voice-activated search, suggestion, and training. They may be able to replace human resources in a useful way because to their versatility and speed at which they may be used. Here are some specific applications of robotics in the tourism sector (Polyzos et al., 2020):

The Henn-na Hotel is the first establishment of its kind in the world to be run by robots. Dinosaur-shaped robots are used at the hotel's front desk, guest information kiosks, and luggage storage and sorting areas. The location of this hotel in Japan is Nagasaki. In addition, there are robots in the lobby and guest rooms, and visitors may use voice or face recognition to enter their rooms (Fotis et al, 2011).

Connie, IBM's robotic doorman, may now be seen at a number of Hilton hotels. It's possible that Connie may use voice recognition software to converse with guests and answer their inquiries.

Because it is an AI product, it not only keeps records of conversations but also "learns" from them to improve its future responses (Polyzos et al, 2020).

- Many travelers find it quite convenient to have bags they can't lose while away. As a result, engineers developed the Travelmate robotic luggage, which can safely navigate around its owner thanks to motion monitoring and 360-degree rotation (Claveria & Torra, 2014).
- Safety measures will be prioritized as a result of the growing presence of technology in the tourist sector. Mobile robots with motion sensors, cameras, and microphones are deployed in addition to standard airport security measures at New York's LaGuardia Airport.

Visitors seem to like these AI and robot-powered alternatives to the traditional service delivery system (Claveria et al, 2015).

The role of artificial intelligence in the tourism sector Artificial intelligence's ability to do jobs that have historically needed human interaction may ultimately be good for tourists, as it allows companies to save money, decrease mistake, and get more done in less time. The success of a hotel or resort depends on the quality of service they provide their customers, therefore this technology might be quite useful in a variety of ways. Now, AI is often utilized to communicate with consumers, "learn" from each transaction, and enhance future encounters with the same or similar customers. Artificial intelligence (AI) has the potential to aid hotel operators in many ways, including data analysis, computation, and issue solving (Hashim & Murphy, 2007).

Artificial Intelligence in Business

The role of artificial intelligence in the business world has grown dramatically over the last decade, and in recent years in particular it has become much more widespread adaptations in the travel industry. Below, we'll look at three of the most important ways technology is currently developing.

AI in online customer service

Online customer service is an attractive field of research for artificial intelligence in the hotel and tourist industry. Chatbots on instant messaging and social networking sites, for example, are now

supported. When applied in this manner, artificial intelligence has the ability to respond to client inquiries and give useful information even when a human customer support person is unavailable. Customers want faster replies on digital channels, and AI is assisting companies in ways that would be hard for humans to achieve alone. Second, establishing an immediate interaction with the consumer. While AI is often used for online customer care, a new advancement is to include the technology into face-to-face encounters with clients. This implies that waiting time is decreased or eliminated entirely, increasing efficiency. The Hilton hotel firm created the "Connie" artificial intelligence (AI) robot to serve as an example of this technology in action (Ramos et al, 2021).

This bot employs artificial intelligence and voice recognition to give consumers with useful travel planning information. Each encounter with a human aids the bot's learning, resulting in more effective discussions in the future.

Finally, it is critical to recognize that artificial intelligence has far-reaching implications in the tourism business that extend beyond conventional customer service. One of the most common applications is data collection and analysis to derive conclusions about consumers, corporate operations, and pricing strategies. When compared to the time and error possibilities of manually sifting through such huge volumes of data, the primary advantage of AI in this industry is its ability to do so swiftly and reliably. For example, the Dorchester Collection hotel has utilized AI to sift through client input in the form of reviews, surveys, and online polls to present a clearer, more up-to-date picture of guest mood. To summarize, AI is poised to evolve into a dependable and appealing commercial solution in the next years (Shin et al, 2021).

Research Question and Objectives

The goal of this study, is to find, analyze and evaluate the spread of published articles (reports, case studies, dissertations etc.) in the literature of "Tourism Industry", that will show to us the way to identify the influence of Artificial Intelligence in the particular sector of tourism industry.

The expected outcomes of our research is to prove that there is a great need for information and business intelligence in order to produce long-lasting, sustainable competitive advantages, which can be reached with the contribution of smart business management in which artificial intelligence play a key role. In doing this, three questions have been composed in order to guide the study.

These are as follows:

1. Which are the benefits from the use of AI in tourism industry?
2. Which applications of AI are mentioned in literature and will transform in the hotel & tourism industry in the future?
3. What are the applications of AI in the Greek tourism industry?

Importance and novelty of research

From the search this researcher conducted it was revealed that there are not available systematic literature reviews about the applications and benefits of AI in the hospitality industry, other than the systematic review of Doborjeh (2021) which does not include a special section for Greek hospitality, which we aim to cover in our review here. Additionally, Doborjeh (2021) does not provide the detailed tables with categorised benefits and specific AI applications that provide a comprehensive understanding to the reader. A systematic review by Minglong- Li et al (2021) deals only with elements regarding service management and AI (not management and prediction behaviour, which is included in our review). Both her study but also a study by Kamakshi Sharma

in 2022 do not include the broad search criteria of 2000-2022 that our research does and they do not include a specific section for Greece.

Methodology

For the realization of the research we will follow a “Systematic Literature Review” approach (Rethlefsen, 2021) with the use of Prisma Methodology (Abelha et al, 2020). The search was done in the Web of Science database from 01/01/2000 until 12/31/22 with these the key words “AI and Tourism”, “Artificial Intelligence and Tourism”, “AI Applications and Tourism”.

To be more precise, the steps aimed at this approach are as follows:

Inclusion Criteria

Articles published between 2000 and 2022 (given the fact that artificial intelligence took the shape that we know today in the last twenty years or so, these results were deemed more relevant than results of early artificial intelligence application (Duan et al, 2019)

Articles written in English

Articles including the set keywords “AI and Tourism”, “Artificial Intelligence and Tourism”, “AI Applications and Tourism”.

Articles in Web of Science database

Types of articles: published articles, case studies and published reports

Exclusion Criteria

Articles published before 2000 (given the fact that artificial intelligence took the shape that we know today in the last twenty years or so, these results were deemed more relevant than results of early artificial intelligence application (Duan et al, 2019)

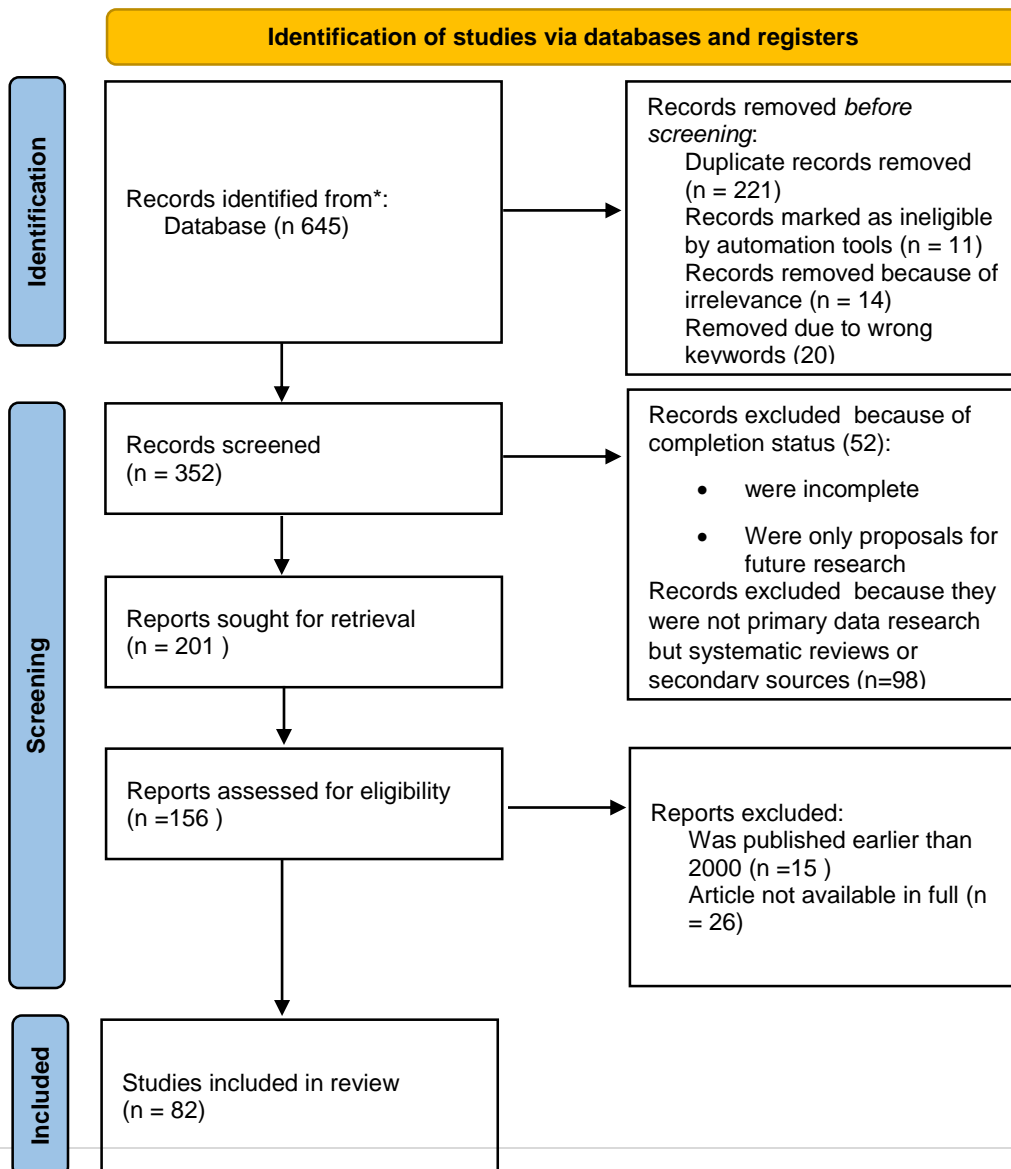
Articles written in languages other than English

Articles with no application to tourism/hospitality

Editorial Letters

Prisma Strategy

As mentioned in Page (2022):



Removed due to wrong keywords (20) – focus was not on our keywords, too many other keywords included that were not relevant to the hospitality industry

Results

From the 82 articles 20 of them used AI technology to predict/forecast demands and behaviors, 23 articles used AI technology to improve customer experience, 4 articles wanted to determine behaviors, 7 articles examined behaviors, 10 articles evaluated possibilities of this technology, 4 articles focused on production management and customer interaction, 10 articles focused on virtual tours, 3 articles focused on tailored strategies that enable the creation of individualized profiles, and 2 articles focused on developing new management tactics through AI technology.

Benefits	Number of Papers	Refs Examples	Application Examples
predict/forecast demands and behaviors	20	Yao et al Pai and Hong	predict categorization and forecasting of tourist data predict visitor arrival issues
improve customer experience	23	Noone and Coulter Tung and Au	improve production management and customer interaction improve robot hotel services report having better and more rewarding experiences
determine behaviors	4	Zhang et al Bi et al	determining likelihood to travel

			determining characteristics for becoming an Airbnb Super-host
examine behaviors	7	Aluri et al Zhang et al	examining the activities of visitors examine a huge amount of data obtained from tourist photographs (such as location preference and habits)
Evaluate possibilities of this technology	10	Goodfellow et al	evaluated neural networks for their accuracy in forecasting the demand
Enhance production management and customer interaction	4	Noone and Coulter Tussyadiah et al	Use robotics to manage more effectively and cheaper
Create tailored strategies that enable the creation of individualized profiles	3	Lado-Sestayo and Vivel-Ba	develop management solutions for individual needs of companies
developing new management tactics through AI technology	2	Van Gerven and Bohte Chang et al	Support contemporary travel writing develop management solutions with AI decision trees

Cluster Analysis – Machine Learning

Below is a table about the articles found on machine learning applications.

Name	Date	Subject	Specific application-purpose
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1. Yao et al	2004	machine learning	predict categorization and forecasting of tourist data
2. Pai and Hong	2005	machine learning	predict the demand for visitors
3. Zhang et al	2014	machine learning	determining likelihood to travel
4. Donaire et al	2014	machine learning	tourist gaze profiles
5. Hopken et al	2018	machine learning	determining spatial mobility and patterns of point-of-interest
6. Aluri et al	2019	machine learning	examining the activities of visitors
7. Giglio et al	2019	machine learning	identify the geographic regions that received the most visitors
8. Aluri et al	2020	machine learning	defining the value or purpose of a place
9. Bi et al	2020	machine learning	determining how a site has evolved
10. Alpaydin	2020	machine learning	predict visitor arrival issues
11. Ramos-Henrquez et al	2021	machine learning	determining characteristics for becoming an Airbnb Super-host
12. Xie et al	2021	machine learning / Big Data	predicting the demand for Chinese cruises

In the field of hospitality and tourism studies, cluster analysis has been used in a number of different ways. These fields make use of the clustering approach in their operations. This involves defining the value or purpose of a place (Bi et al., 2020), examining the activities that visitors have participated in over time (Aluri et al., 2019), and determining how a site has evolved over time (Bi et al., 2020). (Donaire et al., 2014). An investigation on the correlation between the

psychographic and demographic characteristics of Chinese individuals and their likelihood to travel was carried out by Zhang et al. (2014) in a controlled experiment (Zhang and Zhang, 2014). The authors of this paper examined four machine learning (ML) methods that are regularly used: logistic regression, neural network, neural network ensemble, C4.5 Rule, and C4.5 Rule-PANE. They did this by using approaches that include twice-learning. According to the authors of the study, C4.5 Rule-PANE performed better than the other techniques in terms of accurate prediction performance. In the research conducted by Donaire, the Ward approach was used to examine tourist photographs that were shared on social media in order to locate evidence of tourist gaze profiles (Donaire et al., 2014).

In addition, Giglio et al. (2019) gathered a total of 26,392 photographs that were related to six different Italian municipalities in order to investigate clusters that were located close to significant sites (POI). This study used a technique called the Density-based Spatial Clustering of Applications with Noise (DBSCAN) approach to automatically identify the geographic regions that received the most visitors (Giglio et al., 2019).

In their study, Hopken et al. (2018) looked at visitors' spatial mobility and patterns of point-of-interest (POI) visits using 13,545 photographs taken in 2015. (Hopken et al., 2020). DBSCAN was one of the clustering methods that were used here. Techniques of classification and forecasting used in the field of tourism and hospitality research: The most well-known machine learning (ML) approaches that are used in the literature for the categorization and forecasting of tourist data are the Support Vector Machine (SVM) and Multiple Linear Regression (MLR) methods (Yao et al., 2004).

Pai and Hong (2005) were the ones who first suggested using the SVM approach in tourism-related situations to anticipate the demand for visitors (Pai et al., 2005) (Mavromatti et al., 2019)(Salsidou, 2021). According to what Pai has demonstrated, using the Back-Propagation Neural Networks (BPNN) model in conjunction with the Multifactor Support Vector Machine Model (MSVM) might make it possible to improve the accuracy of forecasting tourist arrivals for numerical and non-linear discrete dependant variables.

Since that time, SVM and BP have been merged together in order to better predict visitor arrival issues. An SVM training approach produces a model that classifies incoming instances into one of two groups using a collection of training samples. In order to do this, the initial data input space is transformed into a space with a higher dimension, and the data vectors (support vectors) that distinguish the regions of samples belonging to two or more classes (categories) are placed in this higher-dimensional space (Alpaydin, 2020).

The Boruta algorithm for feature selection and the Support Vector Machine (SVM) for predicting the most relevant characteristics for becoming an Airbnb Super-host were recently combined into a single machine learning (ML) approach by Ramos-Henrquez et al. (2021). A methodological framework for big data in hospitality and tourism was recently provided by Xie et al. (2021), and it has the potential to deliver important predictors for predicting the demand for Chinese cruises. They employed the Least Squares Support Vector Regression (LSSVR) model to anticipate visitor demand. Using the Gravitational Search Algorithm (GSA), the hyper-parameters of the ML technique were tweaked to produce the maximum possible accuracy of prediction (Xie et al., 2021). (Xie et al., 2021).

Artificial Neural Networks to the Tourism and Hospitality Industry

Below is a table showing articles about neural networks applications.

Name	Date	Subject	Specific application-purpose
1. Golmohammadi et al	2011	Artificial Neural Networks	predict the level of happiness experienced by travelers
2. Liu	2011	Artificial Neural Networks	predicting the number of visitors

3. Claveria and Torra	2014	Artificial Networks	Neural	evaluated and contrasted neural networks for their accuracy in forecasting the demand
4. Claveria et al	2015	Artificial Networks	Neural	evaluated and contrasted neural networks for their accuracy in forecasting the demand
5. Goodfellow et al	2016	Artificial Networks	Neural	evaluated neural networks for their accuracy in forecasting the demand
6. Zhu et al	2018	Artificial Networks	Neural	anticipating tourism demand
7. Van Gerven and Bohte	2018	Artificial Networks	Neural	Support contemporary travel writing
8. Li and Cao	2018	Artificial Networks	Neural	predicting the number of tourists that will visit an area
9. Law et al	2019	Artificial Networks	Neural	evaluated accuracy in forecasting the demand
10. Zhang et al	2019	Artificial Networks	Neural	examine a huge amount of data obtained from tourist photographs

11. Lado-Sestayo and Vivel-Ba	2019	Artificial Networks	Neural	predicting hotel profitability
12. Chang et al	2020	Artificial Networks	Neural	develop management solutions
13. Zhang et al	2020	Artificial Networks	Neural	predicting dynamic monitoring of visitor flows
14. Al Shehi	2020	Artificial Networks	Neural	predicting the procedure of reserving hotel rooms
15. Karathanasopoulos,	2020	Artificial Networks	Neural	predicting the procedure of reserving hotel rooms
16. Sanchez et al	2020	Artificial Networks /Big Data	Neural	predicting the factors for hotel booking cancellations
17. Kwon et al	2020	Artificial Networks	Neural	finding the elements that impact customers' choices to improve their dining experience
18. Chang et al	2020	Artificial Networks	Neural	evaluated neural networks for their accuracy in forecasting the demand
19. He et al	2021	Artificial Networks	Neural	predicting daily visitor demand data
20. Wu et al	2021	Artificial Networks	Neural	predicting daily visitor demand data

The use of ANNs modeling, a technology based on artificial intelligence, has become commonplace in modern travel writing (van Gerven and Bohte, 2018). The computational components of an ANN are represented in its architecture as layers of artificial neurons.

These nodes may take input and evaluate network activity based on the value of a threshold set by an activation function (Kasabov, 1996). The input layer, followed by one or more hidden layers, and lastly the output layer, make up the fundamental structure of an ANN. As the number of hidden layers, neurons in each layer, and connections between them increases, it's possible that the models' complexity and problem-solving efficacy will also increase (Kasabov, 1996). Our research indicates that Multilayer Perceptron (MLP), Radial Basis Function (RBF), Back Propagation (BP), Genetic Algorithm (GA), Generalized Regression Neural Network (GRNN), Elman Neural Network (Elman NN), Neural Network Autoregressive Neural Network (NNAR), and denoised neural networks are the most popular ANN models employed in tourism research (Silva et al., 2019).

Most often, ANN algorithms have been used to the travel, hotel, and transportation industries, as well as those concerned with maximizing customer happiness and maximizing revenue. These strategies use time-series forecasting to get insight from longitudinal data. In order to forecast how many individuals will go to Weifang, China, Liu (2011) used the BP algorithm (Liu, 2011). The results not only exhibited robust model adaptability, but also enhanced prediction accuracy in comparison to earlier machine learning approaches. Using a mixed neural network model, Golmohammadi et al. (2011) were able to predict a person's level of enjoyment of a given travel experience. For accurately predicting vacationers' levels of contentment, the suggested hybrid neural network has been tested (Golmohammadi et al., 2011). The quantity of visitor interest in each tourist market in Catalonia was also predicted using ANN. Different methods for forecasting tourism demand were evaluated and contrasted, including Multiple Linear Programming (MLP), Radial Basis Function (RBF), and Elman networks.

Research shows that MLP and RBF models perform better than Elman networks (Claveria and Torra, 2014, Claveria et al., 2015). Zhu used an ANN in his study, which resulted in a more in-depth analysis of the current and future demand for tourism in Singapore over the next 19 years. In order to better predict tourism demand, the author investigated the interdependence pattern of visitor arrivals (Zhu et al., 2018). Tree decision-based algorithms, C5.0 and random forest, support vector machines (SVM), and evolutionary algorithms were used with ANN techniques by Sanchez et al. (2020) to determine the most important factors in hotel reservation cancellations

(GA). According to research from 2020 by Sánchez-Medina and Eleazar, using GA to enhance ANN increased accuracy by around 0.95 percentage points. Similarly, Kwon's study employed ANN to evaluate the value of consumers to restaurants by determining what variables impact customers' choices with the goal of bettering their dining experience. With the goal of bettering the customers' dining experience as a whole, this was done (Kwon et al., 2020). Kwon conducted a precise analysis of the time series data using a regression strategy and natural language processing technology based on machine learning.

Neural networks for use in deep learning applications in the hotel and tourist industries

According to the experts working for Tratica, deep learning techniques now have the largest revenue share, with an expected total of \$308,4 million in 2016 and a forecasted total of \$16 billion by 2025.

Deep Learning (DL) is an ANN strategy that consists of several layers of artificial neurons and learning algorithms. This approach is used to extract complicated patterns from a huge number of data samples. ANN is an abbreviation for "Artificial Neural Network." It's possible that adding a method for automatically extracting features will make the DLmodel's performance more accurate (Goodfellow et al., 2016, Chang et al., 2020). Recent developments in DL methodology have made it possible to provide more accurate projections of tourist demand (Law et al., 2019). Long-Short-Term Memory (LSTM) and Recurrent Neural Network (RNN), in particular, are capable of digesting complicated time series data as well as acquiring long-term connections (Wu et al., 2021, He et al., 2021). The DL technique gives considerable advantages in recognizing high-dimensional, massive structural data variables with more accurate prediction and detection when compared to ML and statistical methods.

These benefits include better overall accuracy (Zhang et al., 2020). Li and Cao (2018) investigated the efficacy of employing BPNN, Autoregressive Integrated Moving Average (ARIMA), and LSTM approaches to anticipate the number of tourists that will visit an area. According to the results, the LSTM is less complicated, more efficient, and more accurate than the alternatives. The authors of this study also shown that DL is capable of simulating stochastic and nonlinear properties, which cannot be described by previous linear models (Li and Cao, 2018). Researchers

Chang et al. (2020) investigated hotel evaluations using deep learning-based natural language processing (NLP) in order to develop management solutions by combining a number of criteria. A feature vector was given to the convolutional neural network model in this particular model, and various basic non-linear activation functions were used in order to produce a complicated, all-encompassing model that improves classification accuracy. The research conducted by Zhang made projections for the daily visitor flow by making use of user search data and the DL.

The findings of this research have been very beneficial for businesses related to tourism because of the contribution that the LSTM model has made to the dynamic monitoring of visitor flows. This monitoring is vital for reducing safety issues in tourist destinations, which is why the findings of this research have been so beneficial (Zhang et al.,2020). Al Shehi (2020) used the DL approach in order to forecast the procedure of reserving hotel rooms in a number of sites within the Gulf Cooperation Council. The author investigated four different DL techniques, including the Seasonal Autoregressive Integrated Moving Average (SARIMA), the Restricted Boltzmann Machine as a Deep Belief Network Model, the Polynomial Smooth SVM Model, and the Adaptive Network Fuzzy Interference System (ANFIS) Model. According to the data, the accuracy of the price forecasts provided by the ANFIS was much higher than those provided by other models (Al Karathanasopoulos, 2020).

However, as of late, researchers have started making use of the SARIMA-LSTM model in order to anticipate daily visitor demand data. According to the researchers, the model was able to absorb both linear and nonlinear data characteristics when it was supplemented with LSTM layers, which resulted in an increase in the predicted accuracy of the model (He et al., 2021, Wu et al.,2021). Zhang et al. (2019) used the DL approach to do an analysis on a huge amount of data obtained from tourist photographs collected between 2008 and 2012 in order to make predictions on visitor behavior, attitudes, and destinations. They examined what was captured in the images that had been shot by visitors by using DL scene recognition. This was the first research to illustrate the use of spatiotemporal data and the DL technique for more accurately forecasting the behavior trajectory of site visitors, and Zhang's study was the one that did so (Zhang et al.,2019). In addition, researchers developed a multi-layered neural network that made use of DL methods in order to forecast the profitability of hotels between the years 2005 and

2011 by analyzing spatiotemporal data on tourist destinations and hotels. The suggested model revealed a great potential to assess hotel profitability in comparison to current ML approaches (Lado-Sestayo and Vivel-Ba, 2019). In order to use a statistical machine learning technique, hand-crafted features are necessary. The creation of these features is both time-consuming and expensive. On the other hand, the topology of a deep learning neural network is one that automatically extracts significant aspects from the input and is able to grow with enormous amounts of data. Techniques based on artificial intelligence that may be used in the tourist and hospitality sectors It would seem that the travel and hospitality sectors are being revolutionized by new AI applications in the form of chatbots, augmented reality and virtual reality robots, and other similar technologies.

Robotics

Below is a table showing articles with robotics applications.

1. Noone and Coulter	2012	Robotics	improve production management and customer interaction
2. Tung and Au	2018	Robotics	improve robot hotel services report having better and more rewarding experiences
3. Ivanov et al	2019	Robotics	improve Increased operational efficiency
4. Tussyadiah et al	2020	Robotics	improve production management and customer interaction
5. Choi et al	2020	Robotics	improve production management and customer interaction
6. Zemke et al	2020	Robotics	improve expenses associated with manpower
7. Zhong	2020	Robotics	Evaluate the influence that

			robotic hotel services had on the purchase intentions of customers
8. Itani and Hollebeek	2021	Robotics	Evaluate robotic service providers during pandemic
9. Jiang and Wen	2020	Robotics	Evaluate robotic service providers during pandemic
10. Seyitolu and Ivanov	2021	Robotics	Evaluate robotic service providers during pandemic

One of the most recent advances in artificial intelligence that has an effect on the hotel and tourist industries is robotics (Tussyadiah et al., 2020, Tussyadiah, 2020, Park, 2020). "a robot that performs activities for people or equipment without the use of industrial automation," according to the definition provided by the International Federation of Robotics (IFR, 2016). The majority of robotics applications may be found in the hospitality and tourist sectors, where they are employed to improve production management and customer interaction in settings such as airport operations, hotels, and restaurants (Noone and Coulter, 2012, Ivanov et al., 2019a, Tuomi et al., 2019, Borghi and Mariani, 2020, Choi et al., 2020). It is possible that the use of robots in the tourist and hospitality sectors may result in improved customer service, decreased expenses associated with manpower, and increased operational efficiency (Ivanov et al., 2019a, Zemke et al., 2020). According to the findings of a research conducted by Tung and Au, hotel guests who are supplied with robot hotel services report having better and more rewarding experiences overall (2018). (Tung and Au, 2018). The robots at the hotel have cognition and behavior that are similar to that of humans, which enables them to recognize and predict the wants and needs of the guests, which in turn enables them to provide greater service. This is corroborated by the study that was conducted by Zhong (2020), which looked at the influence that robotic hotel services had on the purchase intentions of customers (Zhong et al., 2020). Noone and Coulter (2012) conducted research on the potential benefits of robotics advancements for the operations of quick-service restaurants, using Zaxby's as a case study (Noone and Coulter, 2012). This system

keeps track of when customers come, begins cooking as soon as they do, and communicates with staff members to give them specific instructions on how to speed up cooking and service, hence cutting down on wait times. After that, this information is combined with data on previous sales to get an estimate of future demand for certain food products. In recent years, customers have shown a greater willingness and capacity for tolerance toward robotic hotel services that provide one-of-a-kind and individualized experiences (Ivanov et al., 2019b; akar et al., 2020). There is a possibility that the current pandemic (COVID-19) may bring about a shift in the tourist and hospitality sectors toward an increased reliance on robotic service providers (Itani and Hollebeek, 2021, Jiang and Wen, 2020). Since the robotic service system delivers a service that is physically and socially remote, the World Health Organization (WHO) states that customers and service providers alike will need to adjust to it in order to take advantage of the benefits it offers. During times of pandemic, it may be possible to use robots to effectively maintain a physical boundary between those who are hosting and those who are visiting (Seyitolu and Ivanov, 2021).

Virtual Reality

Below is a table about virtual reality applications.

1. Guttentag	2010	Virtual Reality / Artificial Reality	provide customers the "virtual tour"
2. Han et al	2014	Virtual Reality / Artificial Reality	provide customers the "virtual tour"
3. Dieck et al	2018	Virtual Reality / Artificial Reality	Improve experience in tourism attractions
4. Lau et al	2019	Virtual Reality / Artificial Reality	Improve experience in tourism attractions
5. Jiang et al	2019	Virtual Reality / Artificial Reality	Improve experience of visitors
6. Tsi	2019	Virtual Reality / Artificial Reality	improve visitor satisfaction
7. Lau et al	2019	Virtual Reality / Artificial Reality	examine the experiences of visitors
8. Wei	2019	Virtual Reality / Artificial Reality	provide customers the "virtual tour"
9. Samala et al	2020	Virtual Reality / Artificial Reality	enables customers to virtually travel an

			aircraft and choose a seat in the cabin
10. Loureiro et al	2020	Virtual Reality / Artificial Reality	provide customers the "virtual tour"
11. Slevitch	2020	Virtual Reality / Artificial Reality	provide customers the "virtual tour"
12. Huang et al	2020	Virtual Reality / Artificial Reality	taking part in virtual hotel tours increased customer pleasure
13. Subawa et al	2021	Virtual Reality / Artificial Reality	taking part in virtual hotel tours increased customer pleasure
14. Lyu et al	2021	Virtual Reality / Artificial Reality	virtual booking interface

More and more hotels and resorts are using VR-like technology to improve guests' experiences (Han et al., 2014, Loureiro et al., 2020). These companies use a 3D film to provide their customers a "virtual journey," "hotel tour," and "booking interface" (Guttentag, 2010, Slevitch et al., 2020, Wei, 2019). In the case of virtual hotel tours, for instance, visitors are shown photos and videos of the hotel's interior and amenities in three dimensions. Virtual reality experiences are thought to cause more time dilation and arousal in customers than tourist VR activities. People who have taken virtual hotel tours report feeling more satisfied as a consequence (Huang et al., 2020, Subawa et al., 2021). The research also concluded that females are more affected by virtual reality than males (Lyu et al., 2021). Another example might be a booking interface where consumers may virtually board an aircraft and choose a seat, combining real and simulated elements (Samala et al., 2020). Unlike virtual reality (VR), which is a realistic reproduction that allows users to interact with a made-up environment, augmented reality (AR) adds virtual 3D pictures to enable connectivity with virtual visuals (Lau et al., 2019). Using augmented reality, students may participate in constructivist learning by making connections between theoretically dense yet practically relevant subjects (AR). Augmented reality does this by prioritizing information above instruction (Tsai,2020). Parks, city tours, and museum exhibitions are just few

examples of the many tourist destinations that have used augmented reality. (Dieck, Tom, et al. 2018). 2019 (Lau et al). (Lau et al.).

Understanding and using VR is predicted to provide compelling immersive experiences, enhancing and broadening the travel experience in ways that contribute to environmental and social-cultural sustainability. (Shin and Jeong, 2022). Using downloadable augmented reality (AR) software on smartphones, Jiang et al. (2019) performed a research on 323 tourists visiting a popular attraction in the Shangri-La National Park. 2019 (Jiang et al). (Jiang et al.). There is a statistically significant correlation between respondents' preferences for the AR experience and their assessments of its social and practical significance. These results suggest that augmented reality may be utilized to protect national parks while also improving the experience for visitors. Tsi (2019) found that location-specific augmented reality technology may improve tourists' experiences at popular Beijing landmarks (Tsai, 2020).

Virtual reality (VR) art museum visitors outperformed non-VR visitors in terms of knowledge gained, satisfaction, value shift, creativity, and physical activity, according to study by Dick (2018). (tom Dieck et al., 2018). Augmented reality (AR) has the ability to increase event efficiency while also improving the attendee experience. Examples include a study of 161 stakeholders' use of a popular augmented reality (AR) app to evaluate their interest in attending two major conferences (Lau et al., 2019). (Lau et al., 2019).

This research adds to our understanding of the potential benefits of AR in the tourism sector as well as the kind of information and features that future customers will be looking for.

Chatbots

Below is a table about chatbot applications.

1. Ukpabi et al	2019	Chatbots	Services available 24/7/365
2. Lv et al	2019	Chatbots	Improve experience in hospitality
3. Melián-González et al	2019	Chatbots	Improve experience for hospitality
4. Pillai and Sivathanu	2020	Chatbots	Improve experience in hospitality voice-activated chatbots

5. Boiano et al	2019	Chatbots	Improve experience in hospitality traveling chatbots program
6. Samala et al	2020	Chatbots	audio tours Improve experience in hospitality

Chatbots and other kinds of artificial intelligence are being used in the hotel and tourist industries. A chatbot is software that simulates human interaction by using natural language. Another term for it is a virtual assistant (Ukpabi et al., 2019). Gartner performed a research in 2020 that revealed that by 2025, 85% of consumers would contact firms without engaging with a live person. Chatbots have benefited the hotel and tourist industries significantly in recent years. Hotels and other businesses that cater to visitors may profit from having chatbots accessible 24 hours a day, seven days a week through social media and instant messaging systems. 2019 (Ukpabi et al) (Ukpabi et al). (Ukpabi and colleagues).

In the tourist business, three types of chatbots are currently commonly used: travel chatbots, voice-based chatbots, and emotion-based chatbots (Lv et al., 2021; Melián-González et al., 2019). Voice-activated chatbots are developed to respond to user enquiries. At a hotel, they may, for example, make room service orders, cab calls, read notes, set alarms, organize their day, contact housekeeping, and more (Pillai and Sivathanu, 2020). Developers have recently established a customer-centric, rather than developer-centric, chatbot platform in order to construct a chatbot that can effectively detect and comprehend its users' behaviors, thoughts, and objectives. The objective is to create a chatbot that is very useful to people (Pillai and Sivathanu, 2020).

A chatbot that can replicate human emotions is known as an emotional chatbot. Recent advancements in the technology behind emotion-transmitting chatbots have enabled virtual assistants to communicate emotions. Customers may trust on the traveling chatbots app to take the wheel anytime they choose. This makes sense given that the roaming chatbot that delivers narration for each region might hypothetically be put in the car. This option, sometimes known as an audio tour, is popular with lone travelers and people who want their own space while on vacation (Boiano et al., 2019, Samala et al., 2020).

Other Uses

Below is a table about other applications.

1. Yao et al	2021	Other	Gathering spatial and temporal information – predict travel
2. Doborjeh et al	2019	Other	deep models predict travel
3. Kasabov	2012	Other	examine visitors' high-level behavior

Analysis of Spatial and Temporal Data Tourist behavior is always interpreted in relation to its environment. In addition to the passage of time, the sites have an impact on visitors' travel habits (Yunxian et al., 2020). Spatial and temporal information that may be studied to get a better knowledge of tourist activities, behavior, mobility, and distribution is referred to as "spatiotemporal data" in the tourism industry (Yao et al., 2021). However, one of the most challenging issues in tourism research remains to be successfully fusing spatial and temporal data into a logical model. The great majority of the existing techniques for building models that are now accessible in the tourism literature include processing the geographical dimension and the temporal dimension of data separately. To examine the relationships between geographical characteristics in time-series data, all features' temporal components must be included into a single, coherent computer model (Doborjeh et al., 2019). The interpretability of deep models is another issue with the statistical and machine learning analytical methods that are now accessible for the study of spatiotemporal data (Kugele et al., 2020). Understanding the relationships between the temporal patterns of the inputted variables and the anticipated consequences over time is necessary to achieve this (Doborjeh et al., 2021a). An effective technique to learn about visitors' high-level behavior may be to build an artificial intelligence (AI) model that is motivated by the computational brain. Spiking neural networks (SNNs), which belong to the third generation of neural networks, are a possible design for producing new knowledge depending on spatiotemporal input. The human brain served as a model for these networks. These particular computational models are considered as an appropriate approach for analyzing multimodal data, where both time and spatial components must be combined. This is

due to the need of integrating and researching both temporal and space components (Kasabov, 2012). Spatiotemporal analysis, as opposed to purely spatial or time-series analysis, has many advantages in the study of tourists. This capacity allows researchers to investigate the evolution of behavioral patterns while highlighting dynamic changes across time. Better understanding of visitor behavior and perception, more precise data interpolation, and increased precision in applications requiring the forecasting of tourist demand will all be the outcomes of this method.

Neurotourism

Below is a table about neurotourism applications

1. Doborjeh et al	2018	Neurotourism	Affect consumer behavior
2. Lv et al	2021	Neurotourism	examine influences on the choices and emotions of consumers
3. Tosun et al	2016	Neurotourism	examine behaviors that affect visitors' responses in tourism destinations
4. Li et al	2021	Neurotourism	examine and classify tourist choice and behavior

In the tourist and hospitality sectors, data collection is mostly focused on surveys, focus groups, and direct observation of visitors' thoughts, emotions, and actions, according to a review of the relevant academic literature. However, it is fair to utilize these established approaches to shed light on the deliberate considerations and decisions made by visitors. Travelers' choices are the outcome of a complex interplay between cultural conventions, individual preferences, and psychological influences. Additionally, the unconscious memories of past events have a significant impact on human behavior, preferences, attitudes, and intentions (Doborjeh et al., 2018a). Methods that can offer information that is both more particular and more objective are needed in order to understand and uncover these behaviors. Collaboration within academic disciplines opens the door to a greater understanding of the characteristics of consumer behavior and the potential influences on the choices and emotions of consumers (Lv et al., 2021). The

introduction of fresh technologies for examining the neurological basis of cognition and behavior has motivated the fields of tourism and hospitality studies to be open to cognitive neuroscience and, more specifically, to brain imaging data.

Brain imaging techniques enable the investigation of the neurological mechanisms behind the behaviors that affect visitors' responses in tourism destinations (Tosun et al., 2016). This covers techniques including Magnetic Resonance Imaging (MRI), Event-Related Potentials (ERP), and Functional Magnetic Resonance Imaging (fMRI). Spatiotemporal Brain Data is the abbreviation for this kind of data (STBD). Modern AI technologies that were inspired by the brain may be used to model and investigate brain data in order to analyze the cognitive responses of tourists to different tourism-related stimuli. As a result, a thorough understanding of the cognitive and emotional mechanisms behind visitors' behavior may be gained. These findings from several sectors might one day provide the groundwork for a brand-new branch of tourism research called neurotourism (Tosun et al., 2016).

This project brings together the disciplines of traditional tourism, psychology, neurology, and information technology. Using time-series data from human neurocognitive and behavioral features, neurotourism suggests conducting research into the neural mechanisms underlying tourists' behavior and creating data collection techniques in order to provide a wealth of information about tourists' emotional perceptions, levels of satisfaction, and levels of acceptance. To learn from the trend of the data and identify pertinent patterns in order to effectively estimate and classify tourist choice and behavior, AI and machine learning techniques may be employed further (Li et al., 2021).

This might be further developed to create a sophisticated tourism system that can forecast demand for travel at different areas and times.

Customised AI Applications

Below is a table about custom applications.

1. Doborjeh et al	2021	Customised AI Apps	Improve experience tailored strategies that enable the creation of
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			individualized profiles
2. Doborjeh et al	2019	Customised AI Apps	Improve experience tailored strategies that enable the creation of individualized profiles
3. Hopken et al	2020	Customised AI Apps	Improve experience tailored strategies that enable the creation of individualized profiles

One study indicates that consumers' views regarding customized services and engagement have recently become more open, which has helped to raise their overall level of satisfaction with their experiences. When adopting tailored strategies that enable the creation of individualized profiles of visitors, individuals may be targeted with tourism marketing and management services considerably more successfully (Doborjeh et al., 2021b)(Arguopoulou et al, 2018).

A developing technique called personalized modeling creates a model for each individual based on the data of a group of individuals who share certain characteristics (Doborjeh et al., 2019). By simply learning from the datasets that are most relevant to a particular traveler, personalized modeling, as opposed to global modeling, which is employed by typical AI systems, offers a greater accuracy of classification and prediction of a specific passenger's behavior. Additionally, it increases the model's effectiveness by enabling artificial intelligence learning techniques to be applied to a smaller subset of the vast amounts of data that are accessible (Doborjeh et al., 2019). Platforms for smart tourism may be created using tailored modeling and AI-driven technology. These platforms may gather information about a person's lifestyle and past travels in order to recommend the best services and design a customized travel plan for each person (Pliakos &

Kotropoulos, 2014)(Refanidis et al, 2014). This article provides a thorough analysis of a wide range of popular and current AI techniques in the global hospitality and tourism business.

These techniques range from better data processing and analysis to better customer service and experience. The appropriate use of AI methods and algorithms with relation to the kinds of multimodal datasets utilized in the hotel and tourism sectors has never been examined before, and this study is the first to do so. Additionally, it offered the authors' (from an AI perspective) expectations for possible future uses of AI algorithms in multidimensional datasets utilized in settings linked to hospitality and tourism. The following will compare several AI approaches and explore how they may be used to perform analysis and pattern mining in different application scenarios. According to our study, the hotel and travel sectors have been using machine learning algorithms most often to cluster, classify, and forecast data. ML demonstrated that methods like K-mean and DBSCAN were often used to analyze picture data and find POIs. They made relatively good predictions of the actions of tourists and aimed to evaluate the interests of visitors and their travels within the cities. (Hopken et al., 2020).

Below is a table about Greek only applications.

Data from Greece			
Name	Date	Subject	Specific application-purpose
1. Pliakos, &Kotropoulos	2014	Machine learning	Improve experience tourism destination recommendation
2. Mavromatti et al	2019	Artificial Neural Networks	Predicting tourism demand
3. Argyropoulou et al	2018	Customised AI Apps	Improve experience PERSONALIZED TOURISM DESTINATION DISCOVERY AND MANAGEMENT
4. Lazoglou& Angelides	2020	Artificial Neural Networks	Develop spatial decision support system

5. Saltsidou	2021	Machine learning	Predicting tourism demand
6. Stroumpoulis et al	2022	Machine learning/Big Data	Predicting tourism demand
7. Refanidis et al	2014	Customised AI Apps	Improve experience Personalized itinerary planning system
8. Ntaliakouras et al	2019	Artificial Neural Networks	Predict forecasting tourism demand

Greece seems to have a variety of case studies with artificial intelligence applications but the first result found in literature emerges after 2014, which indicates that Greece has been a late bloomer in the adoption of this technology in the hospitality industry.

Greek applications seem to focus mainly in the machine learning department (Pliakos & Kotropoylos, 2014 ; Saltsidou, 2021; Stroumpoulis et al, 2022) and artificial neural networks (Ntaliakouras, 2019; Mavromatti et al, 2019, Lazoglou & Angelides, 2020) with some references to the use of Big Data (Stroumpoulis et al, 2022) and a single reference about Customised AI Apps (2014).

This study investigates the usage of relevant AI and robotics applications in tourism, and tourist scenarios. This review paper for the widespread use of technologies in tourism research, such as "Neuro-Tourist" and "Spatio-Temporal Data." According to the study's results, the benefits of the newly developed AI approach include "increased accuracy of classification and prediction," "development of smart tourist platforms," and "quick operations under unanticipated events (e.g., Covid).

Hotels are looking to replace front desk services to avoid traditional guests lingering in the lobby, speeding up wait times and limiting exposure to other loved ones and staff. Chains such as Hilton in some hotels service robot concierges to offer suggestions, directions and information about the hotel, while mobile apps can also allow women to skip the lines, offering an efficient yet personalized experience, which is an obvious benefit.

On the other hand, leveraging the loyalty profile, data and the latest technology allows for a highly personalized approach to the room each chooses for their stay. When a loyalty club member returns by checking in, the room can be automatically set to their preferred temperature, play their favorite music and have the curtains open to enjoy the rooftop view just the way they like it, this has the benefit of making the experience more attractive and personalized.

The use of AI (artificial intelligence) technology and voice through various in-room aids further enhances the experience, allowing friends to manage their environment completely hands-free and avoid various touch points such as the radiator, light switches and the remote control. This has the benefits of giving more control on the hotel experience.

AI can also offer guests the ability to make requests for towels, pillows or food to be delivered to their rooms, outside the door without human contact. For example, the Mercantile New Orleans has robot butlers to deliver snacks, coffee or the morning paper to citizens. This has the benefit of making the customer interaction easier.

Research has shown how technology may moderate and, to some extent, enhance tourist experiences by influencing visitor behaviors in—and interactions with—tourism destinations. These benefits are obvious, allowing the hotel to attract more customers. New technologies for and with tourism have been developed and employed in Greece. However, the change will go beyond what has previously been foreseen in tourism literature when technology enters the realm of visitor experiences and replaces human touch.

Although their contributions have been limited so far to descriptions of current usage and potential future implementations and consequences, tourism researchers in Greece have started to show an interest in artificial intelligence, robotics, and automation. Empirical studies have been limited to the analysis of online evaluations and testing using robots with second-hand competence due to the narrow scope of intelligent automation application in tourism and hospitality up to this point. Few studies have been undertaken in the country that go deeper into

the change in tourism practices from the perspectives of those involved in its production and consumption.

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As a result, this article promotes additional research on intelligent automation in tourism by outlining crucial goals for the study that are based on an analysis of the pertinent literature and current developments in the use of artificial intelligence and related technologies in the travel industry. In order to further future study in this area, it is essential to identify the (automated) future of tourism as a social phenomena and an economic activity.

Discussion

For the realization of the research we will follow a “Systematic Literature Review” approach with the use of Prisma Methodology (Abelha et al, 2020). The search was done in the Web of Science database from 01/01/2000 until 12/31/22 with these the key words “AI + Tourism, Artificial Intelligence + Tourism, AI Applications + Tourism.

According to the study's results, the benefits of the newly developed AI approach include "increased accuracy of classification and prediction," "development of smart tourist platforms," and "quick operations under unanticipated events (e.g., Covid). This is in line with the findings of

Shuckert et al (2015) findings. The focus especially seems to be forecasting demand and behavior and this also corresponds with the findings of Wu et al (2017). Big data also seems to play a big role in enhancing customer experience, which is in line with the findings of Mariani (2019).

Greece seems to have a variety of case studies with artificial intelligence applications but the first result found in literature emerges after 2014, which indicates that Greece has been a late bloomer in the adoption of this technology in the hospitality industry.

Greek applications seem to focus mainly in the machine learning department (Pliakos & Kotropoylos, 2014; Saltsidou, 2021; Stroumpoulis et al, 2022) and artificial neural networks (Ntaliakouras, 2019; Mavromatti et al, 2019, Lazoglou & Angelides, 2020) with some references to the use of Big Data (Stroumpoulis et al, 2022) and a single reference about Customised AI Apps (2014).

Conclusions

Managerial implications

By shedding light on the proper use of AI algorithms in the advancement of hospitality and tourism applications to accurately forecast future business conditions and revenues as well as identify current and potential trends in guest/tourist demand, this research contributes to the body of knowledge in the fields of hospitality, tourism, and technology. Future theoretical directions in AI that may lead to new applications in tourism research include the development of novel data collection, analysis, and modeling techniques in order to have a deep knowledge representation that communicates the essence of the data in a precise, condensed, and understandable manner.

The findings of this study may be utilized by researchers, practitioners, and decision-makers, including private organizations and commercial firms, to identify the most successful

methodologies and algorithms for researching AI in diverse tourist and hospitality situations. This study might serve as a foundation for future cross-disciplinary studies on how AI can be used to facilitate the growth of the hospitality and tourist industries, especially in the post-COVID-19 age.

The future of AI in tourism is open. Businesses will be able to understand their customers better and the customers from their side will organize trips more quickly and then will enjoy holidays full of comforts etc.; leading businesses to gain customer's satisfaction and loyalty, which is a key pillar of the tourism industry.

Research Limitations and Opportunities

Understandably, every research output has limitations. Similarly, this article has certain limitations. First, the research team carefully selected the keywords while keeping the study's topic and scope in mind (from the perspectives of AI and tourism). As a consequence, examining AI using various bibliometric methodologies may be advantageous. However, these key-words are not many and quite restricted the scope. Second, the methodology of the research was based on the ranking list of hospitality and tourism periodicals at hand, accessed either freely or through academic subscriptions. Future research might look at various methods for assessing literature that would allow for a larger number of articles to be analyzed. A final limitation is the use of a single data base, namely Web of Science, which restricts the research.

The final section of the article focused on the need for future research on a more interdisciplinary approach to tourism and hospitality that includes a diverse range of academic study subjects in order to fully comprehend the distinct field of neuro-tourism and the application of appropriate AI algorithms to make sense of data. Future research may also look at the significant concerns of using AI algorithms to manage corporate operations in a number of tourism-related industries and businesses.

Another area that future research should focus on is the challenges that might arise from the use of AI in the hospitality industry. Limitation such as the cost and the reliability of this technology should definitely be examined.

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