AI IN TOURISM AND TRAVEL

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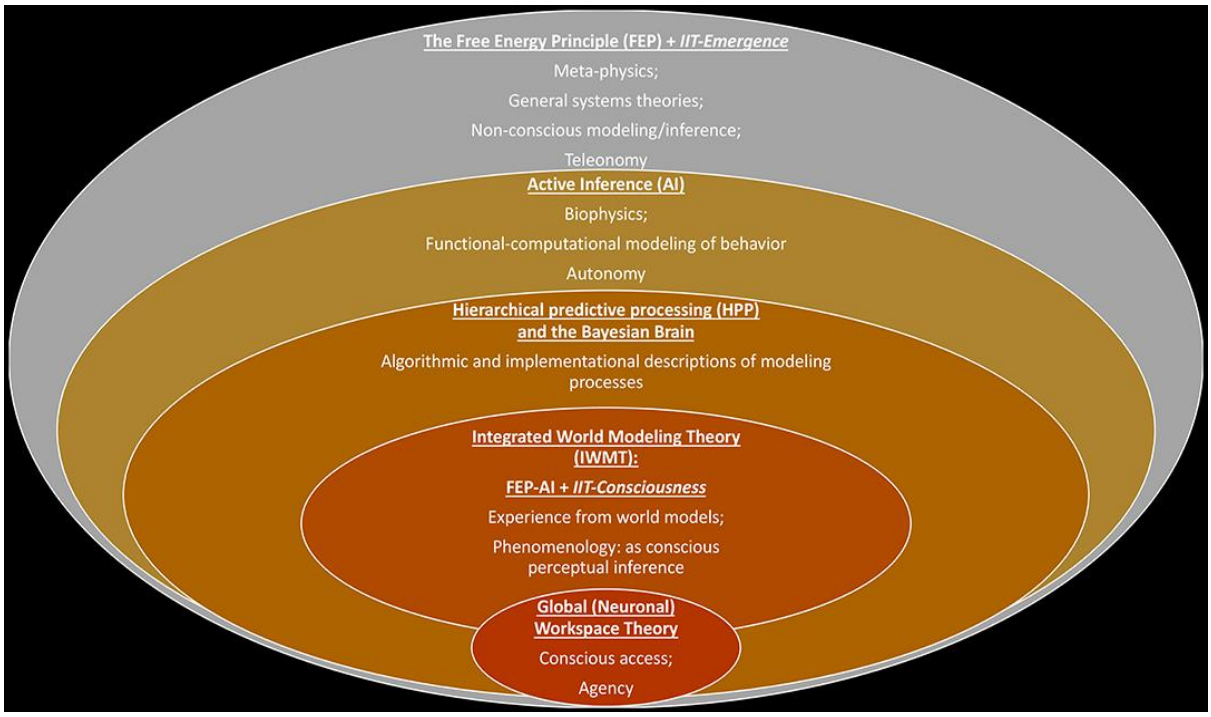
Abstract:

Artificial intelligence (AI) is currently present in almost every area of travel and tourism, appearing in different types of applications such as personalization and recommender systems, robots, conversational systems, smart travel agents, prediction and forecasting systems, language translation applications, and voice recognition and natural language processing systems. Recent improvements in big data, algorithms, and computing power have enabled significant enhancements in AI. In this chapter, we review how AI has changed and is changing the main processes in the tourism industry. We start with the IT foundations of AI that are relevant for travel and tourism and then address the AI systems and applications available in the sector. We then examine hospitality in detail, as a sector in which most of these systems are being implemented. We conclude with the challenges that AI faces in the tourism sector, a research agenda, and draw a scenario of the future of AI in tourism. Therefore, a bibliometric method was applied in this study to observe the progress of AI in the tourism field. A total of 102 papers were collected from Scopus database. Key factors such as most productive authors, collaborations and institutions were identified, and research hotspots were determined using co-occurrence network and most common author keywords. Progress of AI was visualized with thematic evolution analysis. Findings indicate that there is a progressive interest in AI after 2017, and average citations signify that papers are highly cited. Since this is the first study conducting a bibliometric on AI in the tourism context, it could be considered useful for academics and tourism professionals as it provides general overview of AI, demonstrates research trends and popular papers. People's need to travel faster, safer, and more efficiently has fuelled the invention of great technological solutions. During the last decades, the impact of technology on travel has become even more significant thanks to the application of new IT services, leading to the rise of the online traveling market and the increasing digitalization of travel industry. An important achievement behind the online travel experience dates back to the 1960s when the first global distribution system (GDS) was introduced. GDSs are online networks connecting suppliers - such as airlines, hotels, or cruise lines - to providers, like travel agencies and online travel agencies. Having access to the suppliers' inventory, like the number of seats or hotel rooms available, GDSs allow providers to access such information, helping customers book multiple travel services at once. In 2021.

Introduction:

In the technology-driven times, Artificial Intelligence technology is one of the most innovative inventions that have revolutionized various industries all around the globe. Artificial Intelligence (AI) can be referred to as the development of computer systems that can perform tasks and activities which require human intelligence (Russell and Norvig, 2016, p. 4) . Artificial Intelligence first made its appearance during the year 1956 in John McCarthy's Dartmouth Summer Research Project. Over the years, many successes of AI have followed in the form of heuristic searches, character recognition, facial recognition systems, the processing of natural language, and the concept of mobile robotics. By the year 1980s, considerable conceptual progress has been made in the technology-driven field, and its application has increased significantly (Issa et al., 2016). During the 1990s, the technological setting made significant progress, especially in the field of Artificial Intelligence. The growth was mainly because advanced and new kinds of technologies allowed engineers to use large volumes of data, build robots in an efficient manner, and work on improved computing powers. Since then, the AI concept has come a long way and transformed the power of technology. In the 21st century, Artificial Intelligence has reached a climax, and it has the potential to have a profound impact on individuals, organizations, and industries to a significant extent. In the digitalized era, Artificial Intelligence technology is being used in various industries and not just the Information Technology industry (Nagaraj, 2019, 2020). For example, one can come in contact with AI in self-driving vehicles, robotic nurses, navigation systems, chatbots, human versus computer games and various other fields (Russell and Norvig, 2016, p. 5). According to a prediction by McCormick et al., due to the rise in the use of Artificial Intelligence by businesses across different industries, they will be able to steal almost $1.2 trillion in a single year from their less-informed rivals by 2020 (McCormick et al., 2016). Some of the major industries where Artificial Intelligence has made its presence are the manufacturing industry, automotive industry, banking, and financial services, healthcare and life sciences, insurance, telecommunications, energy, travel tourism and hospitality and media and entertainment. Rapidly, AI's footprint is expanding in a greater number of industries all across the globe with each passing day (sites.tcs.com, 2019, p. 6). The popularity and application of AI technology are increasing in the industrial setting as it increases the level of innovation and minimizes the processes and activities that are carried out by human factors. In many industries, AI is being used in various functions of organizations such as sales and marketing, customer service, and finance (sites.tcs.com, 2019, p. 6). In the 21st century, the tourism industry has seen incredible growth and prosperity at a global level. The international tourist arrivals have increased from 528 million in the year 2005 to 1.19 billion in the year 2015 (www.statista.com, 2019). Today several people are willing to spend money on tourism and traveling. This spending has boosted the demand and overall performance of the industry. Thanks to the growth of the travel and tourism industry, it is regarded to be one of the world's largest sectors that have the power to shape the economic health of a nation. Technology has entered the industrial setting and boosted its performance and quality of service delivery (www.statista.com, 2019). AI has invaded the tourism and hospitality setting, and it is being used to gain a competitive advantage in the dynamic market. The graph presented below shows that various kinds of AI strategies are being used in different industries including the tourism and hospitality industry.

Scope of AI in tourism as an industry



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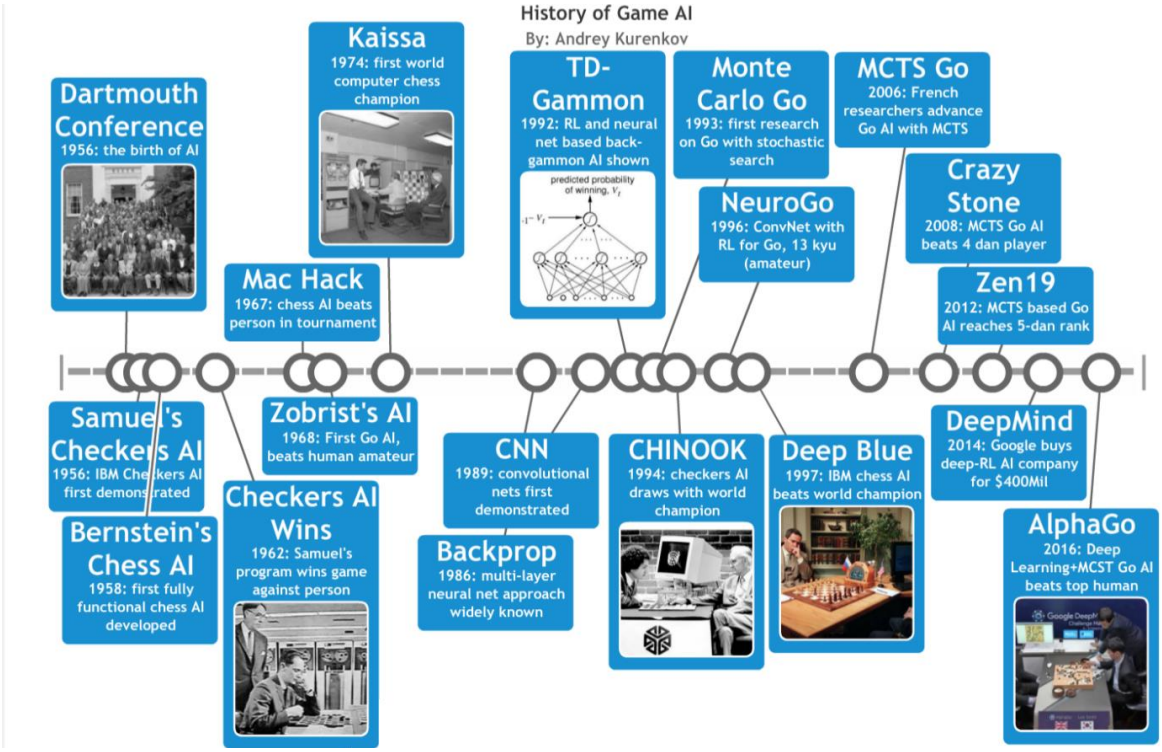
Although the Artificial Intelligence (AI) is a contemporary issue, there are few interesting findings that trigger the usage of AI in the Travel, Tourism & Hospitality Industry. There were few studies conducted in the recent past, on the usage of AI in Travel, Tourism & Hospitality Industry by companies like Tata Consultancy Services, Google Travel, Trip Advisor, etc. (Viglia et al., 2014). These studies revealed some of the important findings that are advantageous to the Travel & Tourism companies. A survey done by Tata Consultancy Services (TCS) founded that 85 per cent of the travel & hospitality service providers use Artificial Intelligence in their business (Anurag, 2018). Studies report that this may be because of the rapid rise in digital travel sales, which are expected to cross $800 billion by the year 2020 (Chawla, 2019). Google Travel & Trip Advisor founded that 74 per cent of the customers plan their tourism trips using the Internet, in which more than 45 per cent of customers plan using smartphones (Peranzo, 2019). Other surveys indicate that 85 per cent of customers decide their travel activities, after reaching their destination (thinkwithgoogle. com, 2016). 36 per cent of customers prefer the Interactive booking process & 80 per cent of them choose self-service technologies over traditional services (Peranzo, 2019). 90 per cent of the customers expect relevant information about the trip while they travel to the destination spot (thinkwithgoogle.com, 2016).

Taken together, these results would seem to suggest the customers' tendency towards internet & self-service technologies. These findings would tempt the marketers to incorporate Artificial

Intelligence in the form of interactive & self-service technologies to deliver enhanced customer experience. The finding of these surveys not only suggests the customers' tendency towards the technology but also infer the aspect of "Timeliness". The customers are so particular about the timeliness of the services, which they receive (Kim et al., 2014). Majority of the customers are not ready to accept the services before the travel, rather they expect these services at the time of their travel. Findings also reveal that the majority of the customers prefer self-service technologies over traditional services. These self-service technologies are largely possible, by the usage of Artificial Intelligence (Ivanov and Webster, 2017; Ivanov et al., 2017). Besides, these factors, there are several other factors that influence the travel, tourism & hospitality industry. Important factors that influence the selection of the Tourism, Travel & Hospitality services include Natural Resources, General Infrastructure facilities, Tourist Infrastructure, Destination tourism infrastructure (Beerli and Martin, 2004). Natural Resources include scenic beauty, lakes, mountains, deserts, variety & uniqueness of flora & fauna, weather conditions (temperature of the region, rainfall, humidity, etc.). General Infrastructure facilities include road, public & private transport. Tourist Infrastructure includes hotel & accommodation facilities, restaurants, bars, discotheques, clubs, theme parks, entertainment & sports activities, water parks, zoos, casinos, trekking, adventure activities, shopping malls, etc. Destination tourism infrastructure includes human resources, safety measures at that place (Beerli and Martin, 2004; Kaushik et al., 2010; Seyidov and Adomaitiene, 2016).

Artificial Intelligence can provide a wide range of information on all the key factors such as Natural Resources, General Infrastructure facilities, Tourist infrastructure facilities, Destination tourism infrastructure facilities, etc. AI technology can surpass human performance by offering a wide range of information on all the key factors within no time. Given these circumstances, the Artificial Intelligence may outperform human services. Artificial Intelligence easily addresses the requirements of the customers by providing timely information to customers on the key factors such as Natural Resources, General Infrastructure facilities, Tourist infrastructure facilities, Destination tourism infrastructure facilities, etc. This information can be in the form of interactive messages, self-service technologies, chatbots, audio tours, virtual tours, interactive booking process, facial recognition technologies, language translations, cross-selling & up-selling, competitive pricing,

shopping, etc., which are discussed in the later sections in detail.



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Problem Statement:

The objective of AI in Tourism and Travel is to provide recommendations based on previous searches on website, analysis the traffic on website to provide best recommendation for Traveling packaged recorded information on the users' preferences, previous Purchases, browsing behaviour, geographic location, language and other personal information.

In the hospitality and tourism industry, service quality is a very important element that can determine the success of the organizations in this industry (Lockyer, 2003). It has been proved by numerous researches that when organizations provide its customer with high levels of service quality, it follows that a high level of customer satisfaction would accrue to customers, which then leads to increased loyalty and improved competitive eness of the organization (Lockyer, 2005a), (Mack, Mueller, Crotts and Broderick, 2000). There are many examples of hotels not giving enough attention and focus towards providing superior service quality to its customers, perhaps because they do not understand the link between providing service quality and organizational competitiveness (Lockyer, 2005b).In the event that hotels are unable to provide their customers with high levels of service equality, it is likely that its customers would become dissatisfied with the organization and would not want to do business with it for the long term. This would put a dent in the ability of the hotel to retain existing customers and attract new ones. It would also have to spend more resources on creating promotional campaigns in order to attract new customers because of the ones that left because they were dissatisfied with the service quality of the hotel (Ryan and

Cessford, 2004). Hence, it is very essential that hotels in Kuala Lumpur strive to implement strategies to enhance the level of service quality the yare able to provide its customers and this would ensure that its customers are satisfied with its services and would become more loyal to the organization, thereby improving its competitiveness within the industry. In this study, the researcher would examine the role of the five dimensions of service quality in enhancing the level of customer satisfaction in hotels in Malaysia

Market/Customer/Business Need Assessment:

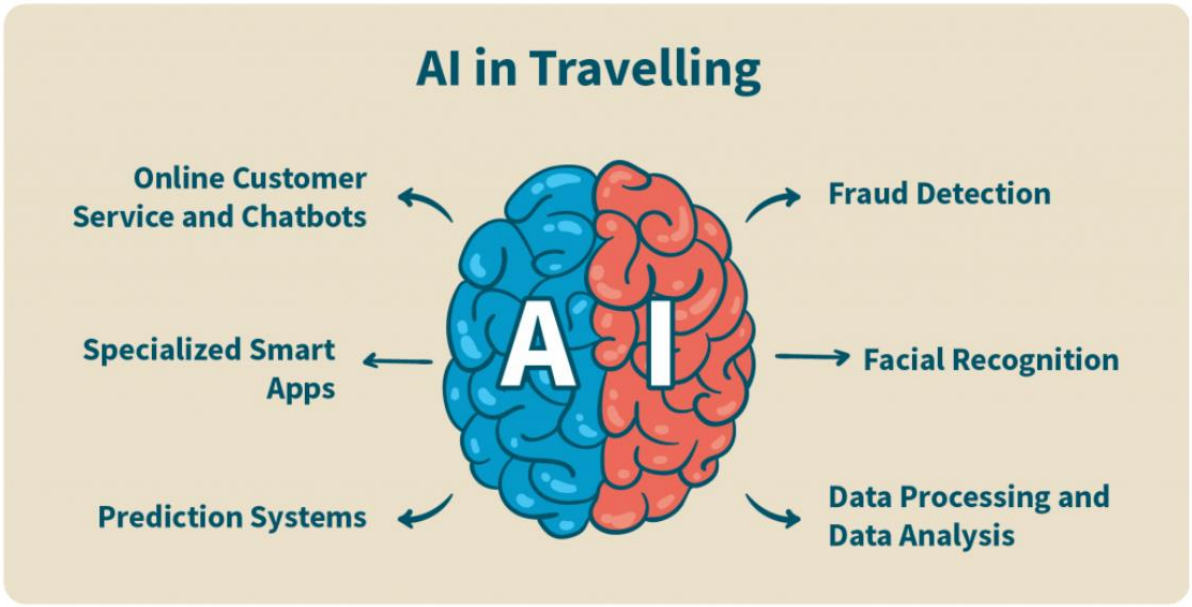
Target markets are the specific customer bases businesses organizations wish to sell their products and services. One of the most reliable target markets in the tourism industry the pleasure market. As it has been revealed, more than 60% of the US travellers reportedly engage in pleasure activities like seeing wildlife and visiting their friends, making businesses whose target markets are pleasure markets have higher chances of prosperity. Before engaging in the actual business activities, businesses should identify the specific customers' needs they intend to sell their services or products. Particularly, precise targeting of customers requires basic information about the market trends and conditions. As Belhaven (2008) reports, appropriate marketing strategy should target a certain market group, a process called positioning. Positioning involves the accurate dedication of certain commodities or services to a specific group of individuals. In order to know the specific requirements of the pleasure target group for effective positioning, a company should have an extensive market research in such group(s). More importantly, companies should have enough market information about the industrial trends to facilitate targeting and positioning of diverse customers. According to Kotler & Armstrong (2010), all the diverse customer needs ought to be well established for effective positioning in a marketing context, which would be facilitated by cordial marketing information system. Wende Roth (2009) considers a well-established marketing information system as an effective strategy to ensure keep the companies informed about the market situation through marketing research. As it has been observed in the hospitality and tourism industry, consumers' purchasing patterns are influenced by various factors. One of the most influential factors is the corporate image of the business organization. Being part of the society, consumers expect business corporations to be actively involved in societal development projects like sporting or other development projects. Brands have also been revealed to impact a lot on the purchasing patterns of consumers. In this case, business organizations in the hospitality and tourism industry should form strategic alliances with potential brands to enhance their reputation (Arian, 2008). More so, business-customer interactions play a very important role in determining the purchasing patterns of consumers. Business language used between customers and business organizations should promote courtesy largely. More so, pricing strategy of the business organizations is quite influential in determining their popularity among the consumers. Further, integrated marketing communications has been revealed to relate to corporate responsibility to a great extent (Lens cold, 2003).

Target Specifecification and Characterization:

- AI tools are used to analyser and understand consumer behaviour and trends from travel data to deliver personalized services. Hotels use artificial intelligence to better know their customers, anticipate their demands, and meet their needs. New developments show that the future is all about smart hotels. From check-in through facial recognition and rooms that complement the guests' habits to doors that open through WhatsApp and speech-recognition technology, artificial intelligence will reinvent the way hotels do customer service.
- Chatbots to play an important part in the process of reinventing the travel industry. They allow for real-time answers and solutions and contribute massively to solving online queries. Moreover, they help travel organizations save a lot of money by offering 24/7 online assistance without any demands. Conversational AI contributes to increased customer satisfaction due to its promptness, accuracy, and availability.
- Chatbots have simplified the way we travel, especially at airports. They have reduced the number of identification procedures and have allowed for faster airport transit. Chatbots are there for us when we plan our trips and answer any query instantaneously. They can offer real-time recommendations and help us locate our favourite destinations.
- Artificial intelligence can also contribute to better online reputation management. AI tools allow travel organizations to monitor customer reviews and keep track of what customers have to say about them. We all know that reviews can make or break a business. Travel companies that rely on AI to get access to social media comments or any other mentions about their brand have the opportunity to manage negative reviews. They can intervene and offer prompt answers proving a high level of engagement.
- Tourism is no longer about all-inclusive packages and luxury hotels. It's about experiences! Travelers are no longer motivated by the best price or cheapest deal. They are looking for

personalization, excellence, and engagement. Everything is personal and interactive now. And travel organizations need to make the necessary adjustments to keep up with the trend. They need to invest in artificial intelligence technology to stay relevant and meet their customers' needs.

Bench Marking Alternate Products:



- ## Online Customer Service and Chatbots:

The most visible manifestation of AI are undoubtedly chatbots that are basically virtual assistants with the ability to hold a natural language conversation with a human. How do AI chatbots work in travel?

The Dutch airline **KLM** was among the first to embrace bots and chat apps, sending their passenger boarding passes and flight information via Viber, Facebook Messenger, WeChat, and other chat apps.

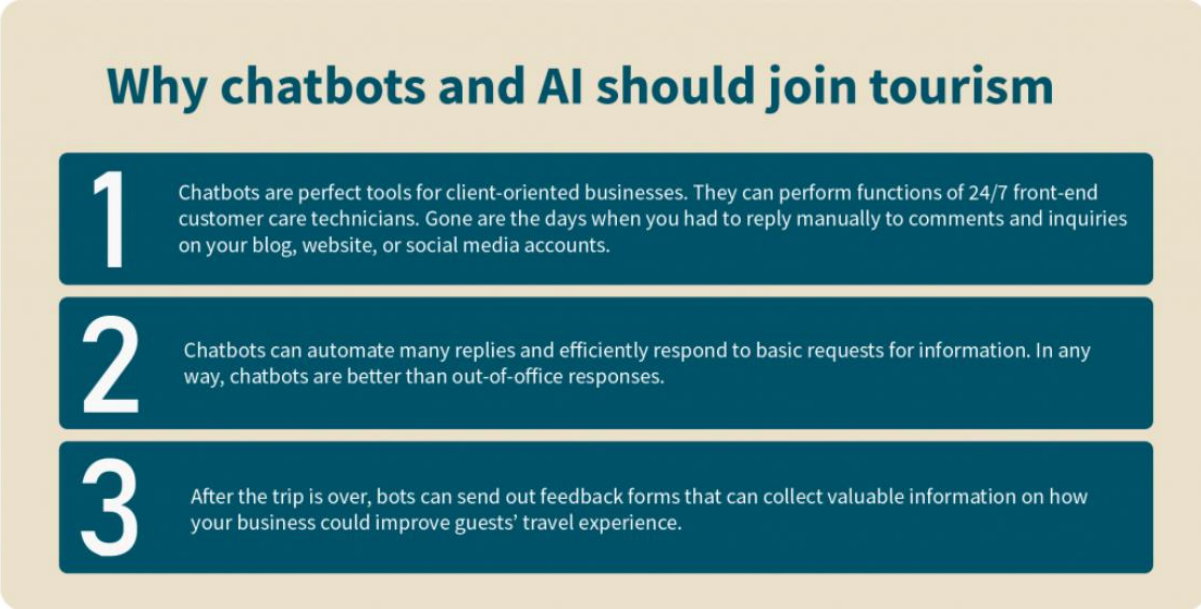
Companies like **Hipmunk, Expedia, Skyscanner and Cheapflights** have also something to say in the sphere of using AI for customer service. "We see AI as an evolutionary part of travel," notes a Skyscanner spokesperson. "We've always believed that people would go from click-type-tap style searching to a conversational format. Interestingly, those using our bots treat them in a very 'human' way – ask for the bot's name, send an emoji or sticker of appreciation."

Hilton hotels went even further. Their chatbot is a physical robot named Connie who helps guests at check-in and advises them on local attractions and things to do.

- ## Chatbots:

AI is closely related to chatbots, the virtual assistants that respond to users through instant messaging. Chatbots can carry on a coherent, functional conversation with a user in real-time, adapting to users' answers. They let you provide high-quality customer service, sending useful information in real-time, all while using fewer resources. "Chatbot is a piece of software that conducts a conversation via auditory or textual methods." There are mainly two types of Chatbots, namely Text message-based chatbots & Voice based chatbots. Text message-based chatbots provide message services to the queries of customers

in the form of text messages. Voice-based chatbots provide message services to the queries of the customers in the form of voice-based messages (Kumar et al., 2018; Kumar et al., 2016). Chatbots are typically computer software machines, which are pre-programmed to answer the simple questions raised by the customers (Oh et al., 2017). Chatbots has inbuilt programs that identify the keywords within the questions that trigger the number of responses in response to a single question. This key feature of sending out multiple responses to a single question immediately has been a notable aspect of chatbots (Makar and Tindall, 2014). Moreover, **chatbots can be accessed 24/7 for all the 365 days in a year.** These key features made chatbots to replace the employees. Some companies offer a unique experience using travel chatbots. The traveller's can ride the car on their own without any guide & the travel chatbot installed in the car keeps on describing each place. This technology is named as an Audio tour, which is preferred by the traveller's who wish to have privacy & travel alone with their families. Every hotel wants to have your guests a great experience. Inevitably, the guests need some or the other information about the hotel facilities. That's where the Chatbots come into play. Personalization is a key component that marketers need to integrate with their services. Especially, Voice-based chatbots provide a high-profile personalized service to its customers. It serves the customers by offering a wide range of services like ordering food services, cab services, reading out the messages, scheduling the tasks & appointments, setting up alarms, room services, house-keeping services, informing the hotel facilities, etc. All in all, it acts as an assistant to the guest. Chatbots can even store the previous data of the guests by which they can suggest recommendations based on past purchases & activities. These voice-based chatbots are specially meant to improve hospitality, which further improves customer engagement & experience (Nagaraj and Singh, 2018, 2019). Delivering a great guest experience can be possible with chatbots for hospitality. Few hotels use the chatbots namely, Marriott hotels, Hyatt hotels, GRT hotels



- **Smart forecasting: flight and hotel rates:** Flight and hotel rates are dynamic and vary in real-time, depending on the provider. No one has the time to manually track all these changes. That's why smart algorithms that monitor and send timely alerts on the most attractive deals are currently in high demand in the travel industry.

Trivago and Make my trip sift through a multitude of data points, variables, and supply and demand models to recommend optimized travel and hotel prices. AltexSoft's scientific team designed a

similarly innovative fare prediction tool for one of its clients, an international online travel agency, Fareboom.com. Working on its core product, a digital travel booking website, they were able to access and collect historical data on millions of fare searches going back several years. Mining this dataset, they were able to create a self-learning algorithm, capable of forecasting future price movements based on a number of factors, such as seasonal trends, demand growth, airline specials, and deals.

Applicable Patents:

1. Cloud Platform:

A cloud platform refers to the operating system and hardware of a server in an Internet-based data centre. It allows software and hardware products to co-exist remotely and at scale. Enterprises rent

access to compute services, such as servers, databases, storage, analytics, networking, software, and intelligence.

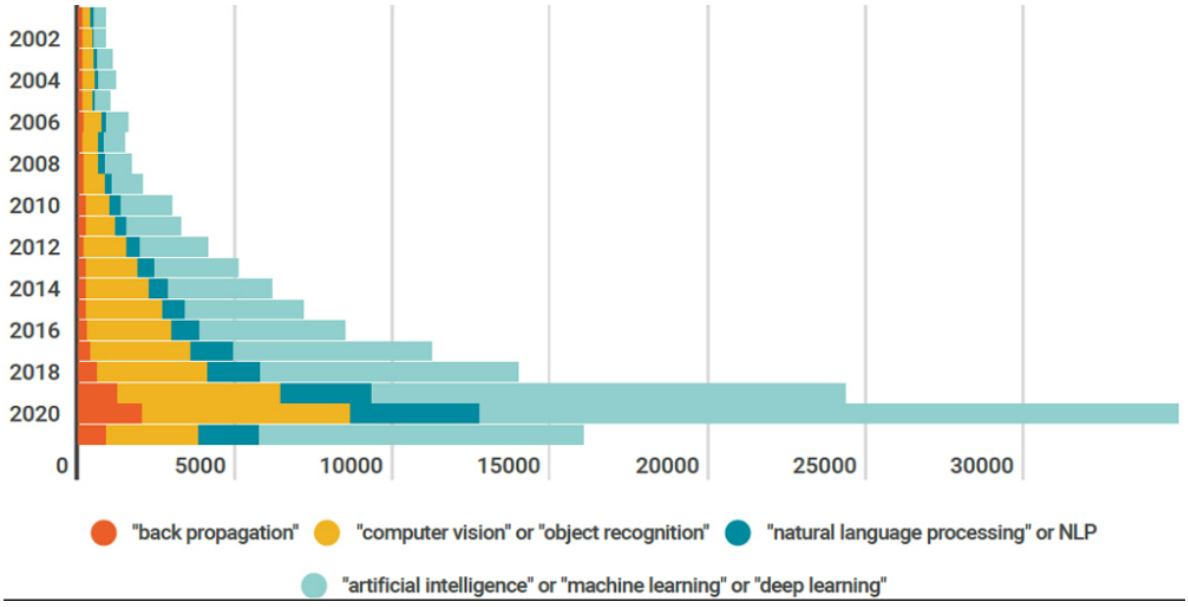
Types of Cloud Platforms:

There are several types of cloud platforms. Not a single one works for everyone. There are several models, types, and services available to help meet the varying needs of users. They include:

1. **Public Cloud**:
    a. Public cloud platforms are third-party providers that deliver computing resources over the Internet. **Examples include Amazon Web Services (AWS), Google Cloud Platform, Alibaba, Microsoft Azure, and IBM Bluemix.**
2. **Private Cloud**:
    a. A private cloud platform is exclusive to a single organization. It's usually in an on-site data centre or hosted by a third-party service provider.
3. **Hybrid Cloud**:
    a. This is a combination of public and private cloud platforms. Data and applications move seamlessly between the two. This gives the organization greater flexibility and helps optimize infrastructure, security, and compliance.

A cloud platform allows organizations to create cloud-native applications, test and build applications, and store, back up, and recover data. It also allows organizations to analysed data. Organizations can also stream video and audio, embed intelligence into their operations, and deliver software on-demand on a global scale.

2. DEEP LEARNING:



The pipeline: three categories of AI invention:

Many aspects of AI may provide patentable value. However, it is important to note that the term 'artificial intelligence' is an umbrella term. AI covers many different technologies, including:

1. **fuzzy logic** – decision-making processes that use 'fuzzy' values as inputs, rather than only '0' (false) and '1' (true);
2. **expert systems** – human experts provide simple logic rules to a computer system;
3. **genetic algorithms** – decision-making processes 'evolve' to adapt to new information;

supervised learning – humans 'train' algorithmic models to categorise new data and perform tasks, based on previous instructions for similar data; and

unsupervised learning – systems develop algorithms for categorising data or performing tasks, without being given explicit rules to follow.

Systems built around ML – that is, more autonomous and fewer rules-based forms of AI – have been the primary focus of interest in recent years. In general, ML allows computers to make decisions and perform tasks using statistical models and algorithms, without requiring explicitly programmed instructions for every case, and relies on artificial neural networks (ANNs). In particular, deep learning (a type of ML that uses ANNs with multiple internal layers) has driven significant developments in many subfields of AI, ranging from computer vision to automatic speech recognition to pharmaceutical drug design.

Just as AI itself is a wide-ranging term, 'AI-based invention' also has a broad scope. The AI pipeline refers to a wide swath of technologies related to different aspects of AI, from the input stage to the end use. In general, AI-based inventions can be split into three basic categories, each of which has a place in a well-thought-out patenting strategy:

- applications of AI to specific use cases and systems;
- improvements in fundamental AI technologies; and
- AI-supportive technologies, including technologies for managing and storing the data that powers AI systems.

Applicable Regulations:

The **regulation of artificial intelligence** is the development of public sector policies and laws for promoting and regulating artificial intelligence (AI); it is therefore related to the broader regulation of algorithms. The regulatory and policy landscape for AI is an emerging issue in jurisdictions globally, including in the European Union and in supra-national bodies like the IEEE, OECD and others. Since 2016, a wave of AI ethics guidelines have been published in order to maintain social control over the technology.[1] Regulation is considered necessary to both encourage AI and manage associated risks. In addition to regulation, AI-deploying organizations need to play a central role in creating and deploying trustworthy AI in line with the principles of trustworthy AI,[2] and take accountability to mitigate the risks.[3] Regulation of AI through mechanisms such as review boards can also be seen as social means to approach the AI control problem.

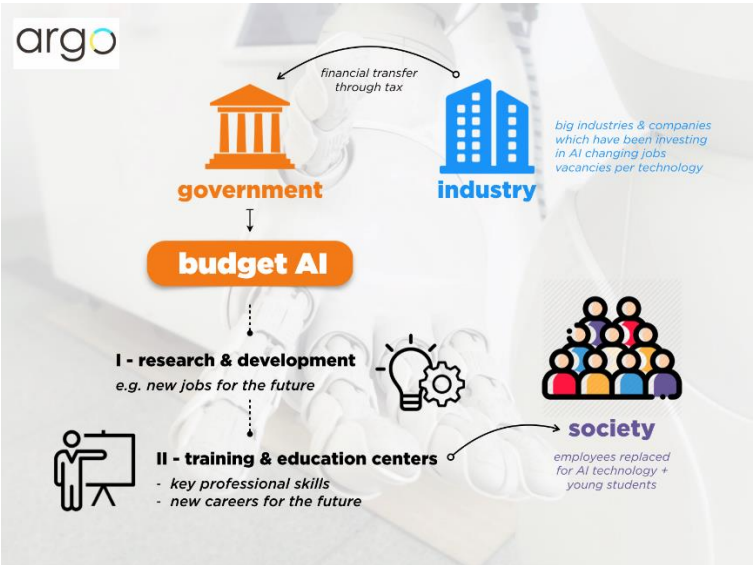
1. **Canada:**
   The *Pan-Canadian Artificial Intelligence Strategy* (2017) is supported by federal funding of Can $125 million with the objectives of increasing the number of outstanding AI

researchers and skilled graduates in Canada, establishing nodes of scientific excellence at the three major AI centres, developing 'global thought leadership' on the economic, ethical, policy and legal implications of AI advances and supporting a national research community working on AI.[42] The Canada CIFAR AI Chairs Program is the cornerstone of the strategy. It benefits from funding of Can$86.5 million over five years to attract and retain world-renowned AI researchers.[42] The federal government appointed an Advisory Council on AI in May 2019 with a focus on examining how to build on Canada's strengths to ensure that AI advancements reflect Canadian values, such as human rights, transparency and openness. The Advisory Council on AI has established a working group on extracting commercial value from Canadian-owned AI and data analytics.[42] In 2020, the federal government and Government of Quebec announced the opening of the International Centre of Expertise in Montréal for the Advancement of Artificial Intelligence, which will advance the cause of responsible development of AI.[42] In 2022, the Canadian Federal Government tabled a bill for the Artificial Intelligence and Data Act.

2. **USA:**
   AI in the United States have included topics such as the timeliness of regulating AI, the nature of the federal regulatory framework to govern and promote AI, including what agency should lead, the regulatory and governing powers of that agency, and how to update regulations in the face of rapidly changing technology, as well as the roles of state governments and courts. In January 7, 2019, following an Executive Order on Maintaining American Leadership in Artificial Intelligence, the White House's Office of Science and Technology Policy released a draft *Guidance for Regulation of Artificial Intelligence Applications*, which includes ten principles for United States agencies when deciding whether and how to regulate AI.[92] In response, the National Institute of Standards and Technology has released a position paper,[93] the National Security Commission on Artificial Intelligence has published a report,[94] and the Defence Innovation Board has issued recommendations on the ethical use of AI.[95] A year later, the administration called for comments on regulation in another draft of its Guidance for Regulation of Artificial Intelligence Applications
3. **CHINA**
   The regulation of AI in China is mainly governed by the State Council of the People's Republic of China's July 8, 2017 "A Next Generation Artificial Intelligence Development Plan" (State Council Document No. 35), in which the Central Committee of the Communist Party of China and the State Council of the PRC urged the governing bodies of China to promote the development of AI up to 2030. Regulation of the issues of ethical and legal support for the development of AI is accelerating, and policy ensures state control of Chinese companies and over valuable data, including storage of data on Chinese users within the country and the mandatory use of People's Republic of China's national standards for AI, including over big data, cloud computing, and industrial software.[59][60][61] In 2021, China published ethical guidelines for the use of AI in China which state that researchers must ensure that AI abides by shared human values, is always under human control, and is not endangering public safety
4. **United Kingdom:**
   The UK supported the application and development of AI in business via the *Digital Economy Strategy 2015-2018,* introduced at the beginning of 2015 by Innovate UK as part of the UK Digital Strategy.[80] In the public sector, guidance has been provided by the Department for Digital, Culture, Media and Sport, on data ethics[81] and the Alan Turing Institute, on responsible design and implementation of AI systems.[82] In terms of cyber security, in 2020 the National Cyber Security Centre has issued guidance on 'Intelligent Security Tools'.[32][83] The following year, the UK published its 10-year National AI Strategy,[84] which describes actions to assess long-term AI risks, including AGI-related catastrophic risks

Applicable Constraints:

1. **BUDGET:**



Advancing technology, all kinds of industries are turning towards Artificial Intelligence and Machine Learning for their efficient services enabling businesses to achieve key goals, objectives, insights, and help in decision-making processes. And this is the reason many governments across the globe are funding AI and ML for better services. The government's attempts include unleashing Federal AI computing, increasing AI research investment, and data resources, building an AI workforce, setting AI technical standards, and engaging with international allies. It can assist members of the public to interact with the government and its services. Let's see a few of the governments that have allocated budgets for AI and ML.

- The Government of China is determined to become the world's primary AI innovation centre with an increase in R&D expenditure by 10.6% in 2021 and over 7% each ear over the next five years.
- The Government of the USA is set to pass a bill to increase DARPA's annual budget by US$3.5 billion with total authorized funding to US$7 billion over the next five years. The bill provides US$29 billion over 2022-2026 for emerging tech research and innovation and to be allocated for existing initiatives at US$52 billion for AI and machine learning along with US$1.5 billion for 5G R&D.
- The Government of South Korea has allocated 11.6 trillion won for 2021 and a total of 68.7 trillion won by 2025. It has mentioned these allocations for 2021— Data dam with 2.8 trillion won, AI government with 0.8 trillion won, a smart healthcare facility with 60 billion won, smart schools with 0.1 trillion won, and digital twin with 0.3 trillion won.
- The Government of India announced that US$477 million would be required for Digital India for more innovations and R&D on Artificial Intelligence and the completion of the MCA 21 project with Rs.357.81 crore.
- The Government of Russia allocated US$5.3 million to complete a project on an experimental model of neural network development known as Kashtan and has a plan to spend 244 billion rubels for AI by 2024. 120 billion rubels will be spent on AI Federal Project.
- The Government of Germany will spend 230 million euros on AI funding for more R&D. Over 190 million euros are allocated to young scientists

- The Government of France has dedicated EUR 1.5 billion for the development of AI including EUR 700 million for research by 2022

Prototype:

- **Flight Price Prediction:**

GitHub: https://github.com/sumeet0701/Flight-Price-prediction

INTRODUCTION

The objective of the study is to analyse the flight booking dataset obtained from “Ease My Trip” website and to conduct various statistical hypothesis tests in order to get meaningful information from it. The 'Linear Regression' statistical algorithm would be used to train the dataset and predict a continuous target variable. 'MakeMyTrip' is an internet platform for booking flight tickets, and hence a platform that potential passengers use to buy tickets. A thorough study of the data will aid in the discovery of valuable insights that will be of enormous value to passengers.

Research Questions

The aim of our study is to answer the below research questions.

a. Does price vary with Airlines?

b. How is the price affected when tickets are bought in just 1 or 2 days before departure?

c. Does ticket price change base on the departure time and arrival time?

d. How the price changes with change in Source and Destination?

e. How does the ticket price vary between Economy and Business class?

DATA COLLECTION AND METHODOLOGY:

Octoparse scraping tool was used to extract data from the website. Data was collected in two parts: one for economy class tickets and another for business class tickets. A total of 300261 distinct flight booking options was extracted from the site. Data was collected for 50 days, from February 11th to March 31st, 2022.
Data source was secondary data and was collected from Ease my trip website.

DATASET

Dataset contains information about flight booking options from the website Easemytrip for flight travel between India's top 6 metro cities. There are 300261 datapoints and 11 features in the cleaned dataset.

FEATURES

The various features of the cleaned dataset are explained below:

1. **Airline:** The name of the airline company is stored in the airline column. It is a categorical feature having 6 different airlines.

2. **Flight:** Flight stores information regarding the plane's flight code. It is a categorical feature.
3. **Source City**: City from which the flight takes off. It is a categorical feature having 6 unique cities.
4. **Departure Time:** This is a derived categorical feature obtained created by grouping time periods into bins. It stores information about the departure time and have 6 unique time labels.
5. **Stops**: A categorical feature with 3 distinct values that stores the number of stops between the source and destination cities.
6. **Arrival Time**: This is a derived categorical feature created by grouping time intervals into bins. It has six distinct time labels and keeps information about the arrival time.
7. **Destination City**: City where the flight will land. It is a categorical feature having 6 unique cities.
8. **Class**: A categorical feature that contains information on seat class; it has two distinct values: Business and Economy.
9. **Duration**: A continuous feature that displays the overall amount of time it takes to travel between cities in hours.
10. **Days Left**: This is a derived characteristic that is calculated by subtracting the trip date by the booking date.
11. **Price:** Target variable stores information of the ticket price

Does price vary with Airlines?

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- As we can see Vistara has Maximum Price range
- Vistara and Air India Airlines Have Maximum Price when compared to Others
- SpiceJet , AirAsia , GO_First and Indigo has some what equal prices

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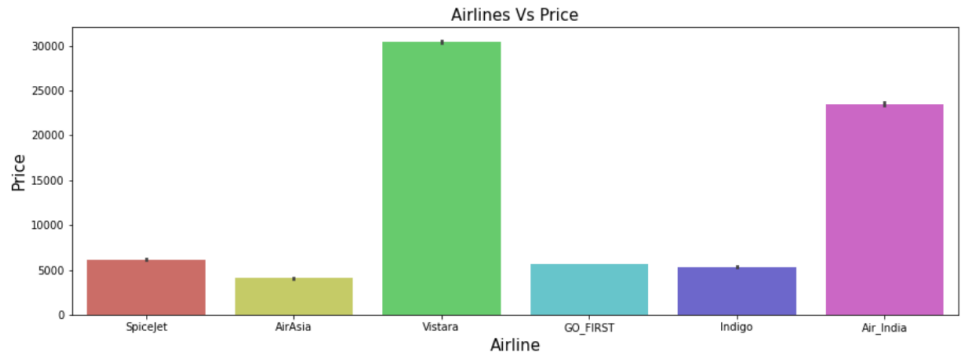
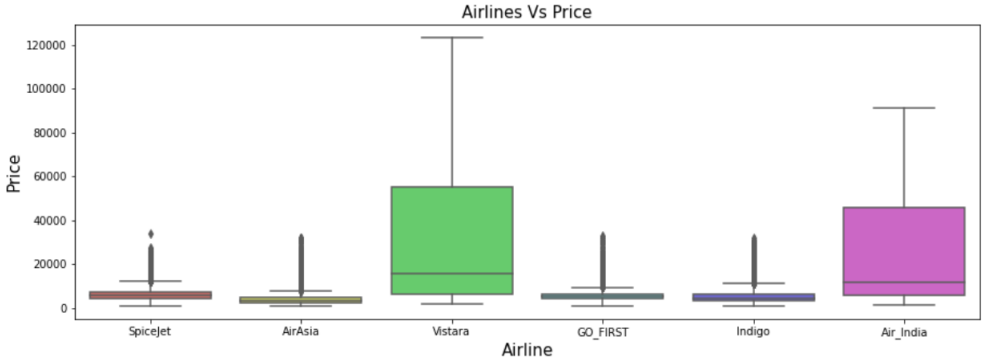
- SpiceJet , AirAsia , GO_First and Indigo has some what equal prices

In [13]:
```
plt.figure(figsize=(15,5))
sns.barplot(x=df['airline'],y=df['price'],palette='hls')
plt.title('Airlines Vs Price',fontsize=15)
plt.xlabel('Airline',fontsize=15)
plt.ylabel('Price',fontsize=15)
plt.show()
```



In [12]:
```
plt.figure(figsize=(15,5))
sns.boxplot(x=df['airline'],y=df['price'],palette='hls')
plt.title('Airlines Vs Price',fontsize=15)
plt.xlabel('Airline',fontsize=15)
plt.ylabel('Price',fontsize=15)
plt.show()
```



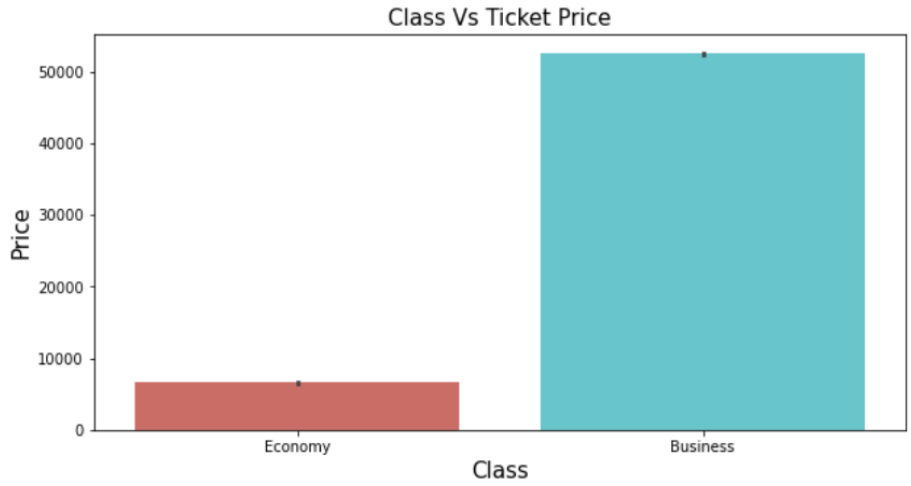
How Does the Ticket Price vary between Economy and Business Class?

- Ticket Price is Maximum for business Class When compared to Economy Class

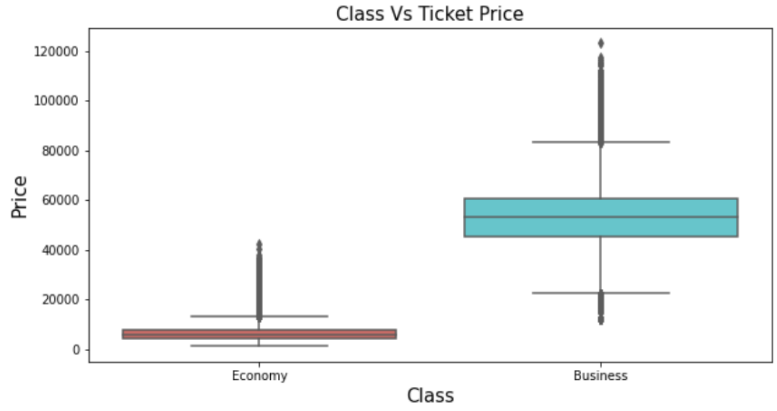
How Does the Ticket Price vary between Economy and Business Class?

- Ticket Price is Maximum for Bussiness Class When compared to Economy Class

In [14]:
```
plt.figure(figsize=(10,5))
sns.barplot(x='class',y='price',data=df,palette='hls')
plt.title('Class Vs Ticket Price',fontsize=15)
plt.xlabel('Class',fontsize=15)
plt.ylabel('Price',fontsize=15)
plt.show()
```



In [13]:
```
plt.figure(figsize=(10,5))
sns.boxplot(x='class',y='price',data=df,palette='hls')
plt.title('Class Vs Ticket Price',fontsize=15)
plt.xlabel('Class',fontsize=15)
plt.ylabel('Price',fontsize=15)
plt.show()
```

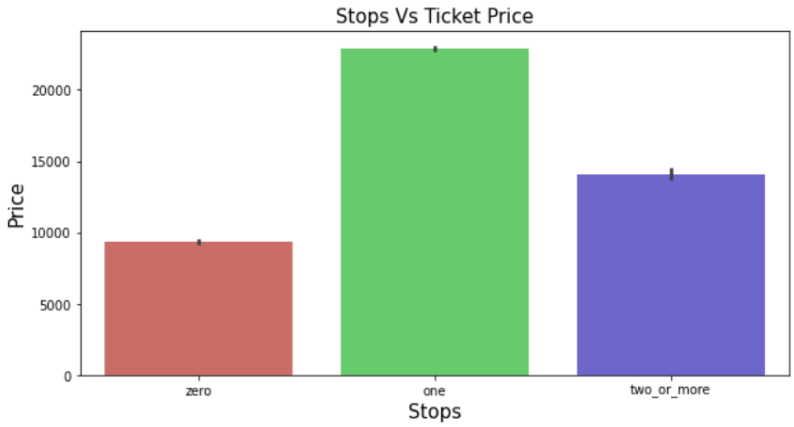


How Does the Ticket Price vary with the number of stops of a Flight?

- Flights having one stop has maximum ticket price

- Flights having one stop has maximum ticket price

In [15]:
```
plt.figure(figsize=(10,5))
sns.barplot(x='stops',y='price',data=df,palette='hls')
plt.title('Stops Vs Ticket Price',fontsize=15)
plt.xlabel('Stops',fontsize=15)
plt.ylabel('Price',fontsize=15)
plt.show()
```



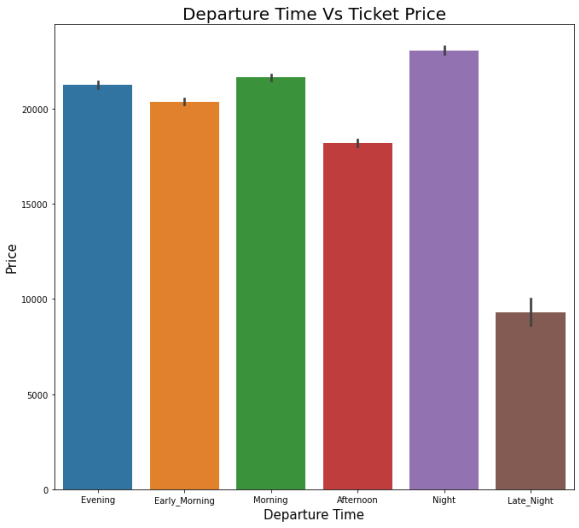
How the Ticket Price change based on the Departure Time and Arrival Time?

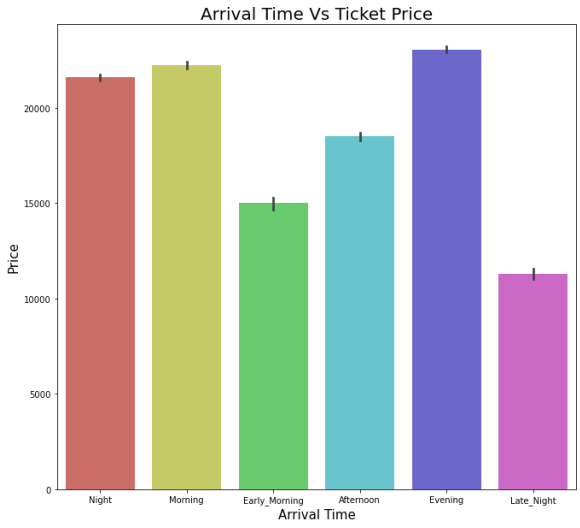
1. Departure Time Vs Ticket Price

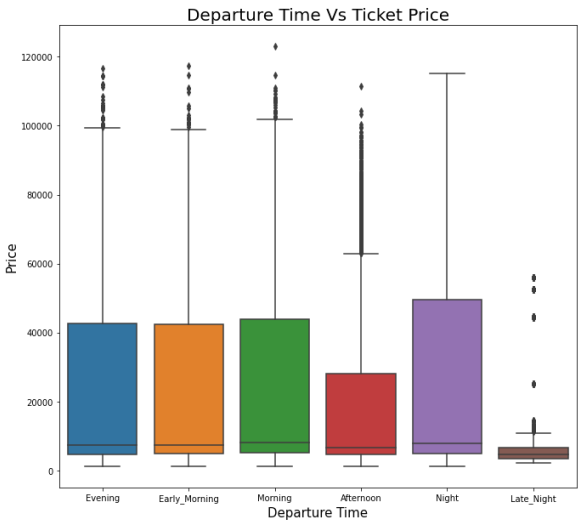
- Ticket Price is More for the Flights when the Departure Time is at Night
- Ticket Price is almost equal for flights Having Departure time at Early_morning , Morning and Evening
- Ticket Price is Low for the Flights Having Departure Time at Late_night

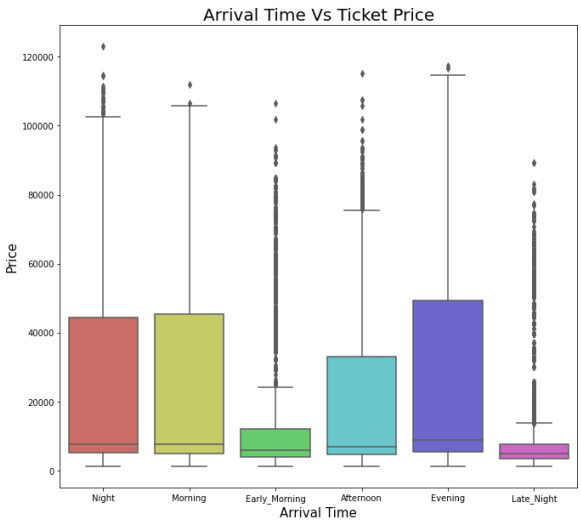
2. Arrival Time Vs Ticket Price

- Ticket Price is More for the Flights when the Arrival Time is at Evening
- Ticket Price is almost equal for flights Having Arrival time is at Morning and Night
- Ticket Price is Low for the Flights Having Arrival Time at Late_night as same as Departure Time









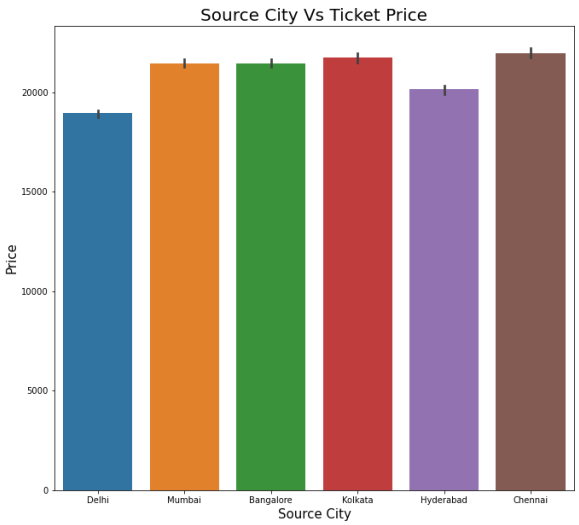
How the price changes with change in Source city and Destination city?

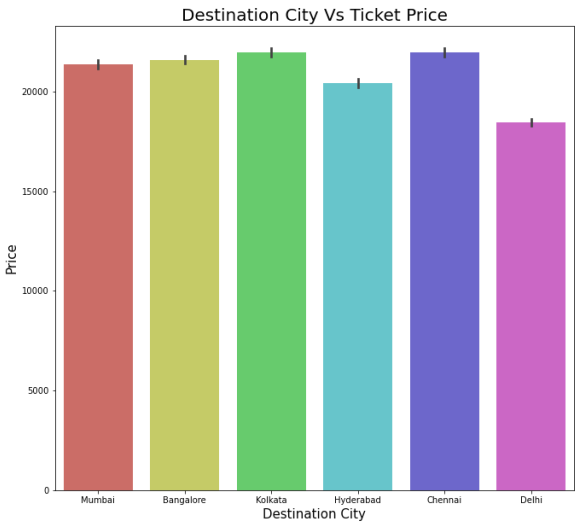
1. Source City Vs Ticket Price

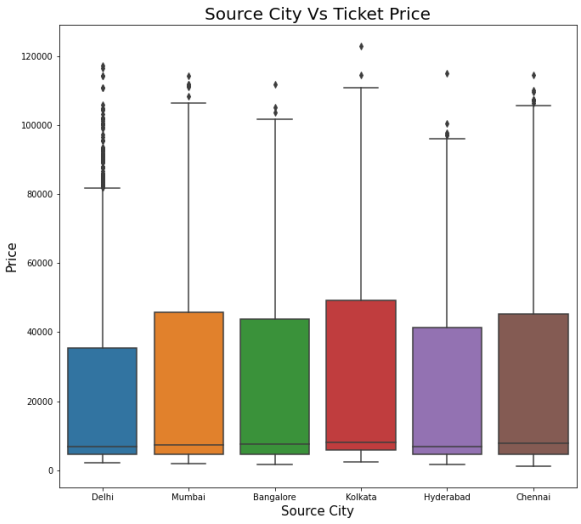
- Ticket Price is More for the Flights whose Source City is Kolkata
- Ticket Price is almost equal for flights Having Source Cities as Mumbai and chennai , Hyderabad and Bangalore
- Ticket Price is Low for the Flights Having Source City as Delhi

2. Destination City Vs Ticket Price

- Ticket Price is More for the Flights whose Destination City is kolkata and Chennai
- Ticket Price is almost equal for flights Having Destination Cities as Mumbai and Bangalore
- Ticket Price is Low for the Flights Having Destination City as Delhi



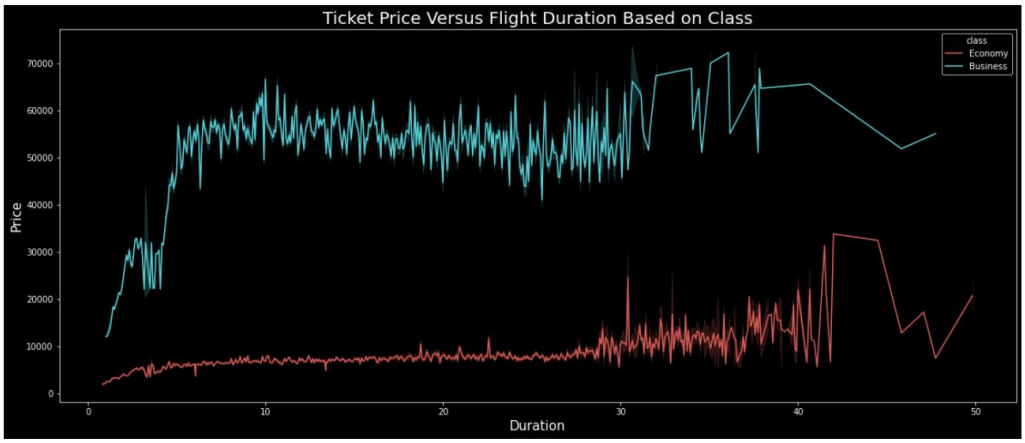


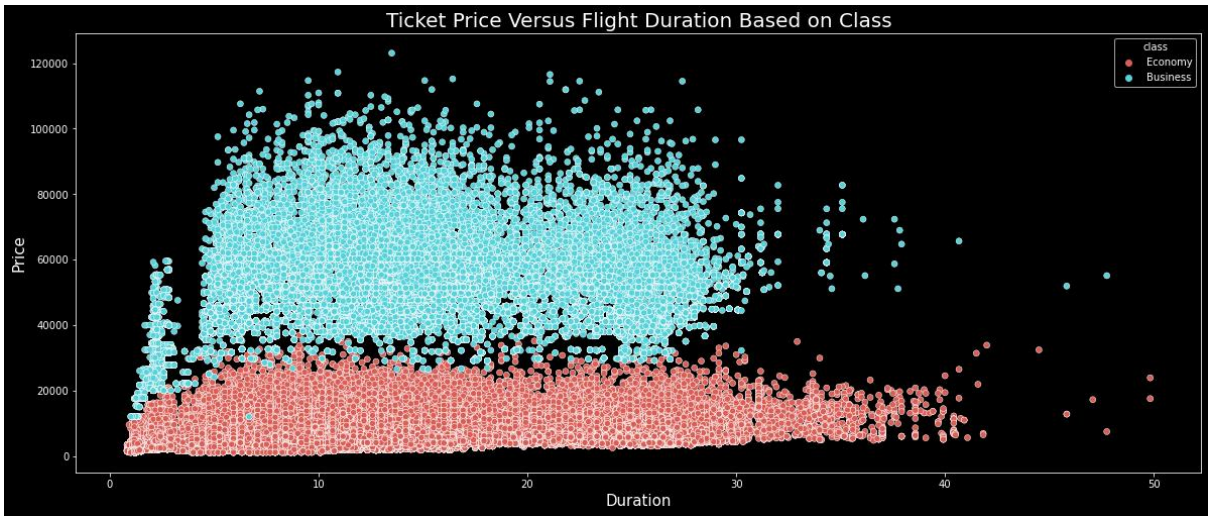


How Price Varies with the Flight Duration Based on Class?

- With increase in Duration, the Ticket Price is also Increases In both the Economy and Business classes

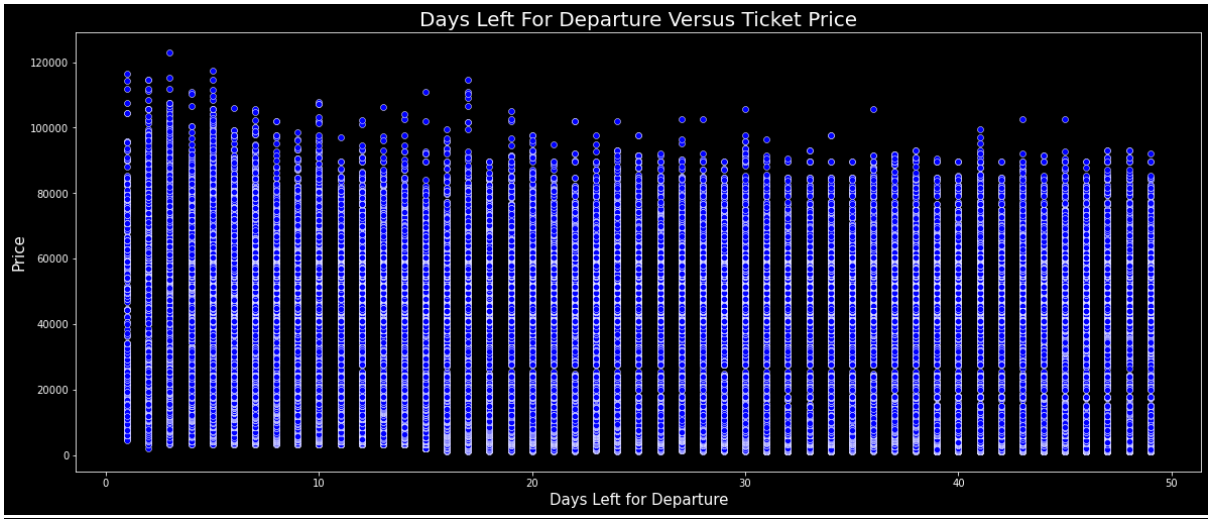
```
In [17]:
plt.style.use('dark_background')
plt.figure(figsize=(20,8))
sns.lineplot(data=df,x='duration',y='price',hue='class',palette='hls')
plt.title('Ticket Price Versus Flight Duration Based on Class',fontsize=20)
plt.xlabel('Duration',fontsize=15)
plt.ylabel('Price',fontsize=15)
plt.show()
```

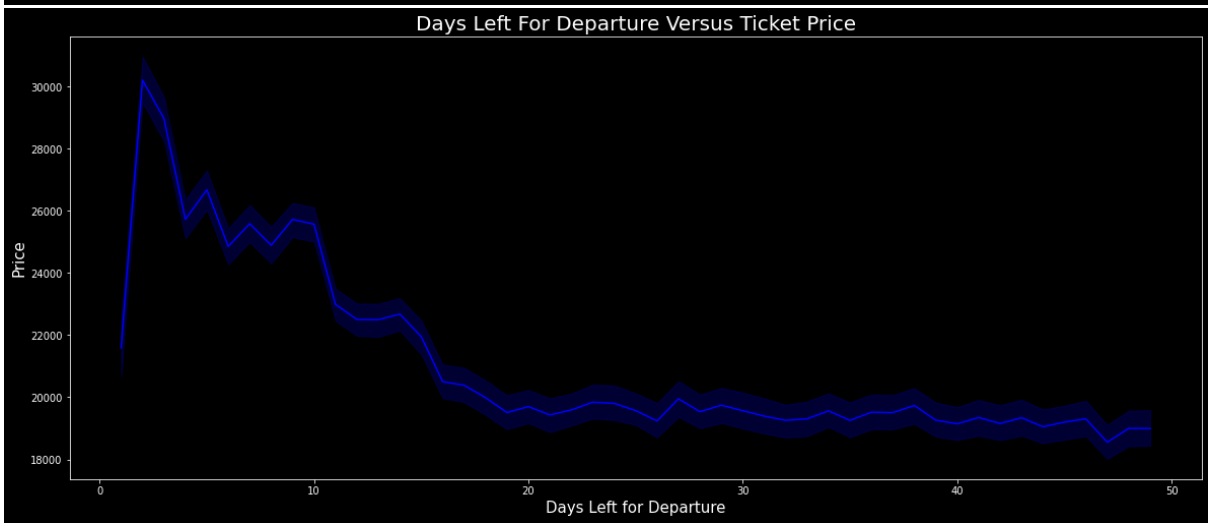




How does the price affected on the days left for Departure?

- As we can see when compared to others when there are two days remaining for departure then the Ticket Price is very High for all airlines

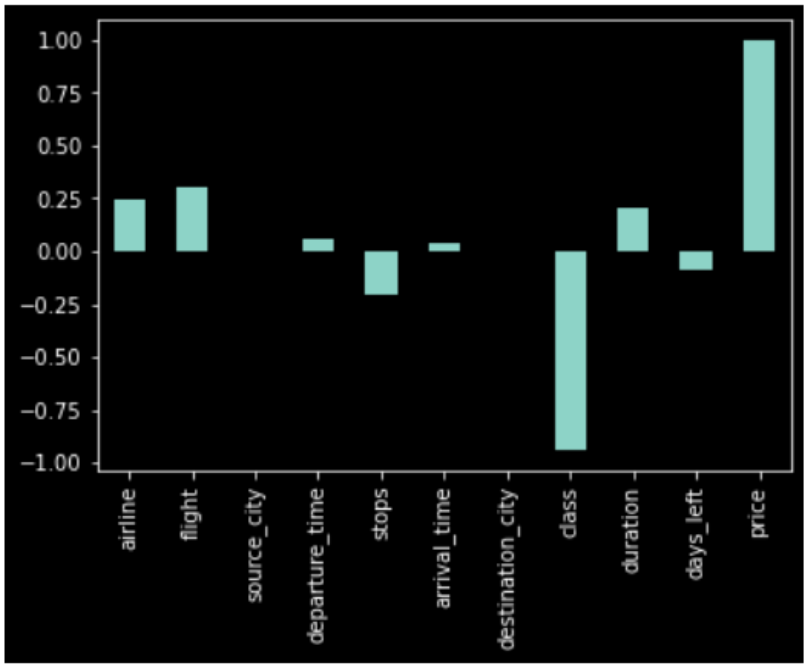




CORRELATION:

```
In [48]: df.corr()['price'].plot(kind ='bar')
```

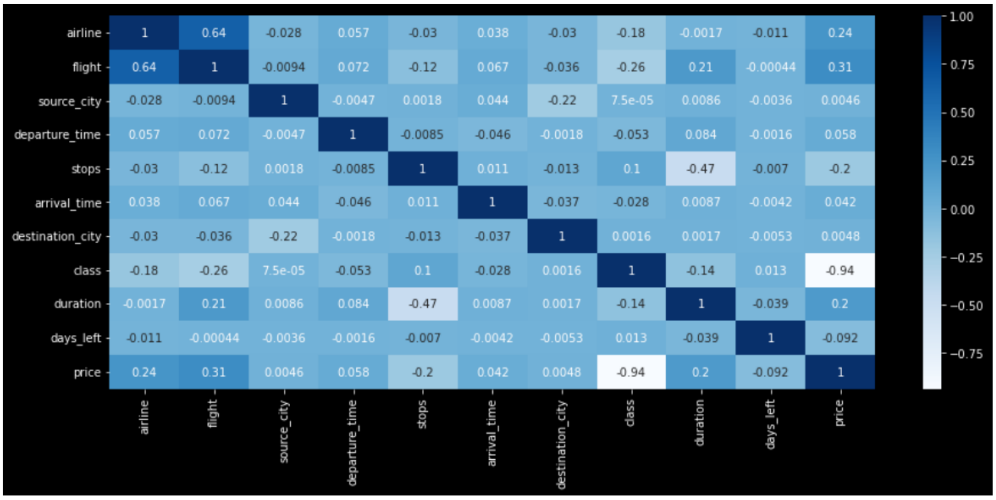
Out[48]: <AxesSubplot:>



HEATMAP:

```
In [50]: plt.figure(figsize=(15,6))
         sns.heatmap(df.corr(),annot=True,cmap="Blues")
```

Out[50]: <AxesSubplot:>



Applying ML Algorithm of Dataset:

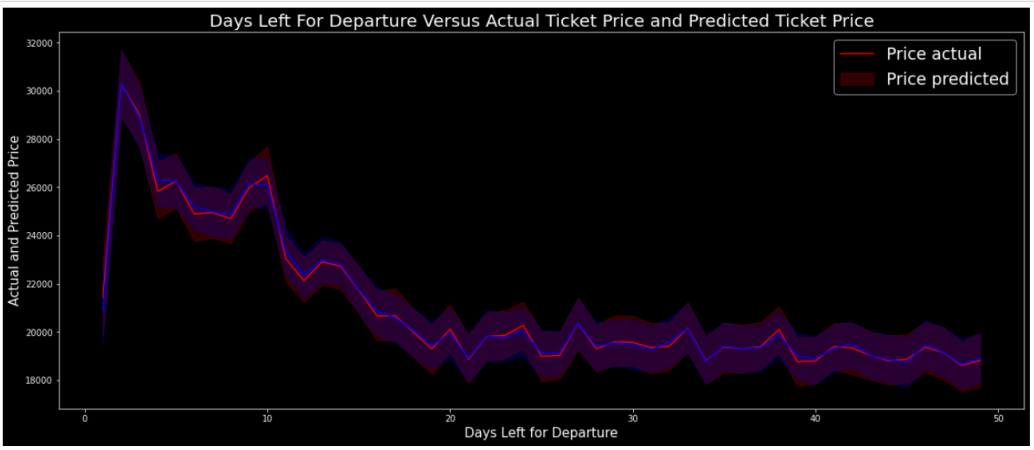
	Model_Name	R2_score	A
0	ExtraTreesRegressor	0.984763	
1	RandomForestRegressor	0.984067	
2	BaggingRegressor	0.982118	
3	XGBRegressor	0.977948	
4	DecisionTreeRegressor	0.973380	
5	KNeighborsRegressor	0.971646	
6	GradientBoostingRegressor	0.956824	
7	Lasso Regression	0.904656	
8	Ridge Regression	0.904656	
9	LinearRegression	0.904656	

From the Above Results, The Top 3 Models by comparing Errors, R2_Score values are

1. **ExtraTreesRegressor**
2. **RandomForestRegressor**
3. **Bagging Regressor**

Training the Data with **ExtraTreesRegressor**

In [44]:
```
plt.figure(figsize=(20,8))
sns.lineplot(data=result,x='days_left',y='Price_actual',color='red')
sns.lineplot(data=result,x='days_left',y='Price_pred',color='blue')
plt.title('Days Left For Departure Versus Actual Ticket Price and Predicted Ticket Price',fontsize=20)
plt.legend(labels=['Price actual','Price predicted'],fontsize=19)
plt.xlabel('Days Left for Departure',fontsize=15)
plt.ylabel('Actual and Predicted Price',fontsize=15)
plt.show()
```



In [45]:
```
plt.figure(figsize=(10,5))
sns.regplot(x='Price_actual',y='Price_pred',data=result,color='cyan')
plt.title('Actual Price  Vs  Predicted Price ',fontsize=20)
plt.xlabel('Actual Price',fontsize=15)
plt.ylabel('Predicted Price',fontsize=15)
plt.show()
```

Conclusion:

With every passing day, the presence of Artificial intelligence in the tourism scene is increasing. Due to the widening application of innovative technology, it is expected that the tourism industry will reach unimaginable heights in the future. As per a recent research study, the global travel technology market, which encompasses Artificial Intelligence, is expected to grow by more than 9 per cent during the period 2010 and 2023. One of the main factors for the expected growth is the prosperous performance of the travel and tourism industry. But the application of innovative and novel technologies such as Artificial Intelligence, and Machine Learning will bring about significant changes at the industrial level. The technological factors can mold the industry landscape and the processes that are conducted by tourism businesses. According to an article by Forbes, due to the rise in the overall application of AI in the travel and tourism industry, many new jobs will be created. It is believed that between 2018 and 2022, the aviation industry and the tourism industry will see a high level of retraining so that human factors can adapt to the evolving technological infrastructure. It is expected that almost 58 million new jobs will be created by the year 2022. Such a scheduled change could help to deal with the existing unemployment problem.

In the technology-driven times, the rise in the AI footprint in the tourism industry is a good sign. This is because it indicates that the industry can make the optimum use of the latest technology to improve efficiency and productivity. The customers of the tourism industry will benefit due to the improved level of satisfaction. At the same time, the tourism business undertakings will be able to have better control over the processes. The business processes will be automated to a great extent, and the business operations and protocols will be streamlined in nature.

Even though the application of Artificial Intelligence technology will give rise to many benefits at the industry level, the organizational level as well as the customer level, it can also give rise to numerous

challenges and complexities. For instance, introducing different types of AI in the business context of the tourism industry would not be an easy job. Business undertakings would need adequate financial resources to build a secure and robust technical infrastructure. The increase in the use of robots, chatbots, and other AI technologies would mean that the actual human interaction would be restricted in the tourism industry. This could have an adverse implication on the traveling and tourism experience of the end-users. The technology-driven approach could give rise to new, complex, and challenging technical issues that are not yet known. The marketers operating in the tourism industry would have to integrate technology seamlessly so that the technology would be easy to use, and at the same time, it would be beneficial for all the stakeholders. Such a process could be quite lengthy as the Artificial Intelligence technology is still in an early stage.

The Artificial Intelligence concept is quite new and very powerful. There is a need to carry out more research studies on the AI concept as well as its application in the industrial tourism setting. Additional studies will shed light on the complexities that might arise before business undertakings in the tourism industry due to the application of AI technology (Dirican, 2015). Many technical experts have been sceptical of AI such as Stephen Hawking. So it is necessary to carry out a holistic assessment if the new and unique form of technology as its implications would be severe. The concept of robotics and Artificial Intelligence could have a direct impact on the human factors that are currently functioning in the industry. Thus there is a need to conduct comprehensive research studies on AI in tourism so that the overall implication of the technology can be critically assessed. It will help to capture the positive as well as the negative impact on the technology on the industry, the businesses, and the customers