

Artificial Intelligence in Aviation

Anirban Gupta¹, Aditya Kumar^{*2}

¹Department of Hotel Management, Punjab College of Technical Education, Punjab, India, ²Department of Travel and Tourism Management, Punjab College of Technical Education, Punjab, India

ABSTRACT

This paper focuses on the technological perspective of the aviation industry, its uses and potential market demand. This study will give the reader better perspective of the usage and handling of artificial intelligence in the aviation industry along with the analysis of the growth achieved by the sector before and after the technological advancement. The proper analysis of present past and future data will give the reader complete knowledge about the technological sector of aviation. As the coming future will be machine dominated most probably, so a hint of machine learning along with the artificial intelligence will be provided in the study just to enhance the understanding perspective. Artificial Intelligence is itself a vast subject to be studied and it's a multidisciplinary approach makes it even complex to understand and interpret. Before explaining the uses of Artificial intelligence in the aviation sector it becomes very much to understand the basic and visualize that how AI works and How it could be beneficial for the upcoming trends?

Impacts of Machine learning in the aviation sector especially on the manufacturing section as machine learning deals with the learning process of the machine and mines the required data in order to ensure the work done in effective and efficient manner. Also, there is an issue of AI i.e. though it is being made and developed by human but the future demand of it is frightening the aviation professionals and the potential ones. The critical analysis on this matter will also be done. Then finally the current situation of the globe will also be discussed along with its impact and effect on the aviation sector and the role of artificial intelligence in it to facilitate the situation.

Keywords: Computing power; Quantum Computing; Machine Learning; Deep learning; Algorithm

INTRODUCTION

Artificial intelligence (AI) is an extensive computing component responsible for the creation of intelligent machines capable of performing tasks that require human ingenuity. AI is a multi-disciplinary science with many approaches, but advances in machine learning and in-depth learning create great demand in the current and current technology industry. AI is a branch of computer science the act of duplicating or mimicking human intelligence in machines [1].

Machine learning feeds computer data and statistical techniques are used to help you determine how to continuously appeal to a task, unless specifically designed for that task, eliminating the need for multiple lines of written code. In-depth learning can be

a form of machine learning that uses inputs using health-inspired neural specifications. Neural networks consist of various layers in which information is processed, allowing the machine to go deeper into its learning, making connections and adding weight to positive results [2].

Literature Review

The artificial intelligence review reveals all the dimensions used in the research that is being used in the aviation sector and other factors such as safety, production and operation of the aviation industry. Proper study of the textbooks confirms the success of the study and keeps in mind the textbooks and research paper used in the text are-

*Correspondence to: Aditya Kumar, Department of Travel and Tourism Management, Punjab College of Technical Education, Punjab, India, Tel no: 8318596454; Email: adityakushwaha.gk@gmail.com

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- Exploring the fundamentals threats and opportunities of artificial intelligence (AI) in the aviation industry- white paper IATA, June 2018.
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Relevance of Research

As the upcoming trend is highly dependent on the machines and technology also the aviation sector is the most vast and growing sector if we observe the stats from past few decades also due to the pandemic the disturbed scenario of the aviation is more than mandatory to be repaired and boosted with necessary elements in order to bring back to track. As transportation is the backbone of any major business and aviation is the most important factor in that aspect. Artificial intelligence has played a major role in developing the aerospace industry by providing valuable information that might otherwise be difficult to be obtained via conventional methods [3].

Research Objectives

Within this framework, there were four specific research objectives which will be the base of the study and the research paper:

- Use of artificial intelligence in the aviation industry
- Impact of Machine Learning in Aviation
- Impact of AI-Human Collaboration
- Future Aspects of Aviation by AI

Research Methodology

This research is based upon the secondary data and hypothesis formulation on some major issues. The research uses a potential future scenario development methodology to conceptualize the abilities of AI and machine learning as they apply to aviation industry, including emerging and currently fielded technologies that include the detailed design and development in aircraft. The study examines the capabilities and limitations of the dynamics between humans and computers regarding decision-making and execution of tactical aviation operations. These dynamics include pilots making decisions for computers as demonstrated in current unmanned systems, computers making decisions for pilots as demonstrated in decision-aiding AI, and computers making decisions for computers as demonstrated in fully autonomous systems. These varying degrees of aircraft autonomy possess unique possibilities to expand the capabilities of aviation concerning risk, tactical employment, and survivability [4].

Research Detail

This research gives the fair idea to the reader about the complex field of artificial intelligence along with its components which functions to foster any industry but we are particularly discussing about aviation industry. So, considering the world aviation from 1950 to 2012 which also include the problems and crisis taken place in the world. Meanwhile, the chart shows the global aviation industry growth along with the revenue being generated by the passengers in the world economy [5].

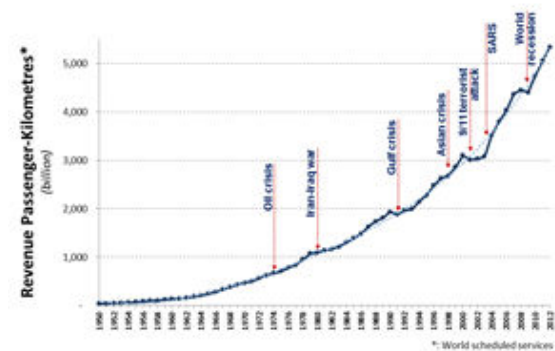


Figure1: The World Aviation 1950-2012

The second graph will give the information about the world economic growth and adjacent to that is air traffic growth along with the consequences being faced by the world. These data will give the reader an idea about the situation of aviation industry since the 20th century to the present [6].

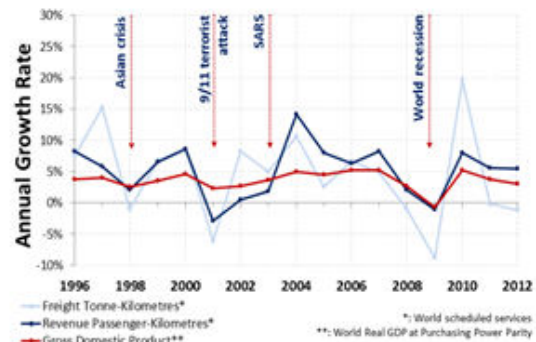


Figure2: World economic growth vs. Air Traffic Growth (passenger and freight)

Research Findings

AI is an ancient field of computer science that combines many techniques and integrates many types of applications. AI is a broad term and its meaning has changed as technology has evolved. AI applications can be divided into model-driven AI (also known as symbolic AI) and data-driven AI (also known as mathematical AI). Modeled AI applications include for example known 'professional programs' that are still being developed in the traditional way [7].

Current success is linked to machine learning (ML), which is the use of data to train algorithms to improve their performance. Deep learning (DL) is an ML piece that emerges through the use of deep neural networks (NNs) that bring the ability to read closely to the work of the human brain. It enables applications such as computer vision and native language processing (NLP) that were not accessible before the in-depth learning. Data-driven learning strategies are actually disruptive and, in contrast to software development strategies, cannot be tested in traditional ways [8].

Uses of AI in the aviation industry

AI has the ability to help people with aircraft operations. Artificial Intelligence (AI) technology improves aviation performance and has a significant impact on the commercial aviation industry. Leading airlines around the world use AI and other emerging technologies to provide customized services and improve customer experience. Automatic kiosks perform automated functions and check safety at the airport. Going forward, AI will play a very important role in the aviation industry.

The aviation industry introduces AI through Machine Learning, Computer Vision, Robotic, and Natural Language Processing. Key benefits include - Predictive Adjustment, Pattern Recognition, Automatic Editing, Targeted Advertising, and Customer Feedback Analysis to improve overall customer experience [9].

Passenger Identification

AI-enabled tools will speed up the process of identifying passengers. Safety scanners, machine learning tools, and Biometric Identification will reduce performance at the global workforce level. With proper identification of a Biometric Face Recognition rider based on transparent visual images, infrared images captured using cameras, transparent visual images and infrared images can be captured. Prediction statistics enable Digital Twin airport to improve management team performance. A text-reading bag from luggage labels to improve reading levels during filtering and acting as a failure when barcode reading systems fail. The detection of a threat on photographs using x-rays or minimal extraction. Face image quality checking and automatic line monitoring are used.

Baggage Screening

The luggage test feature is designed to protect the X-ray equipment from dangerous objects and other threats scanned in the X-ray system during the luggage test. In the event of threats or dangerous objects, the system will automatically notify security personnel at the airport. This will, in a sense, reduce the entry time of passengers and compliance with the security check-in process. This feature is being continuously developed by many companies to provide effective services and includes a potentially dangerous threat that will alert security personnel even if there is a 1% chance of an accident.

Customer Support

Customer service is the most important phase in the aviation industry as it is the forefront and builder of thought in the

minds of customers. Also, industry experts believe that in the next five years more than 52% of aviation service providers will use AI-enabled tools to improve customer experience. Customer support offers a wide range of Artificial Intelligence capabilities. Its benefits include - reducing operating and personnel costs and efficient use of resources. Airlines can use AI programs to find a quick solution to customer problems by providing accurate information about upcoming flights to Wi-Fi enabled devices.

Predictive Maintenance

Estimation correction uses data from various sources such as record history records, sensor data from machines, and weather data to determine when the machine will need to be operational. Using real-time data and historical data, operators can make more informed decisions about when the machine will need to be repaired. Guessing correction takes big data and uses AI and speculation software, translating that data into logical understanding and data points that help avoid data loading. Airbus, a leading airline manufacturer, uses AI systems to improve the reliability of their aircraft maintenance process. Also, there are many cloud-based applications that help with efficient data storage. Vessels collect and record large amounts of data in real time, process it and store it on a cloud server. Predictive Analytics and AI develops an airline's strategic approach to determining an effective aircraft maintenance process

Journey Management System

The Journey Management System is an automated pricing engine. However, there are a few rules governing this automated pricing system. Using machine learning capabilities, the algorithm detects irregularities during high inflation and analyzes various factors that have caused price differences at that time. Travel agents recommend a good time to buy cheap tickets or book a hotel using this algorithm. Also, human capital is being invested to develop this program which could be a major turning point in the tourism and aviation industry. Several travel agencies and airline flights can simplify their tickets, coupons and even special offers.

Impact of AI in Travel and Aviation Industry

A study by Statista estimates an increase in AI funding from \$ 3221.8 million in 2016 to \$ 89847.26 million by 2025. Clearly, this will accelerate growth in the use of AI applications in various fields. Automatic speculation on the aeronautics show has taken USD 112.3 Million out of 2017 and is likely to achieve USD 2,222.5 Million by 2025, at the CAGR of 46.65% over the course of the period. The great controversy surrounding the development of AI in the aircraft encourages the inclusion of big data in aviation exchanges, significant additions to the thinking of aviation organizations, and a growing collection of cloud-based applications and organizations in the aviation business. When it comes to the tourism and aviation industry, AI assists tourism managers / promoters in analyzing customer preferences, location, budget, cuisine, preferences, etc. to deliver personalized content. This understanding also helps with recommendations made specifically to improve general

knowledge. Automatic, personalized and discreet travel options are now possible.

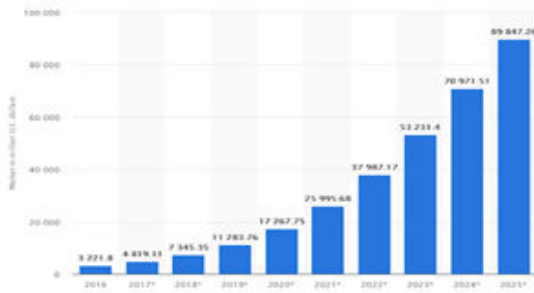


Figure 3: impact of AI

Role of AI in the Aviation Industry

In the public aviation sector, as in other industrial sectors, paper-based processes have been increasingly replaced by digital systems. Books are now available on computers and electronic aircraft, the control towers have become significantly smaller, and much of the airline information is discarded with digital data. These changes are all part of the global digital aviation industry. A lot of information is generated and exchanged by air systems, surveillance systems, air traffic control systems, but also between these and airport applications and other stakeholders. This information is the basis for building new services, and their integration and collaboration can bring additional value to the entire aviation environment.

Impact of Machine Learning in Aviation

Many aviation industry domains will be affected by this emerging technology. The air transport system is facing new challenges: increasing air volume, heavy environmental standards, growing systems complexity, greater focus on competition, AI can provide opportunities for it. This section provides an overview of the expected impact of each domain.

Aircraft Design and Operation

AI, and especially the ML AI field, brings a tremendous amount of power to create applications that would not have been possible with the development techniques used so far. The current emergence of deep learning (DL) brings a wide range of applications that can help aviation; in particular, computer vision and natural language process (NLP). For aircraft, these types of systems can open the door to solutions such as high-resolution traffic detection or practical assistance to the pilot. Ensuring safe flight and airflow or managing distances between air traffic with reduced distances compared to current ATM systems. This is where AI will work: to enable full autonomy, more powerful algorithms will be required to deal with the large amount of data generated by the sensors installed and machine-to-machine communication. There were a few ways to pave the way for the construction of new systems that would change the relationship between the driver and the systems:

- Reducing the use of human resources in non-mechanized activities, thus allowing them to focus more effectively

- In activities of higher value, especially flight safety;
- Placing people at the center of complex decision-making processes, aided by the machine; and
- Addressing the impact of human performance limitations.

Aircraft Production and Maintenance

Production and care (including consumer goods) are the areas where digital production is most likely to have the most impact on business processes and models. In terms of digitalization, the amount of data held by manufacturing and processing organizations is slowly increasing and with this, the need for reliance on AI to handle this data is also growing. Among the trends that will be mentioned is the development of digital twins in the manufacturing industry, the introduction of Internet of Things (IoT) into production chains and the creation of predictable feeds where a large amount of data and the need for very low signals require the use of AI.

Optimized flight

Fuel efficiency is one of the highest limits on aerospace production and this can be done with the help of artificial intelligence. Any small improvements in fuel efficiency can have a significant impact on aircraft crashes and this is achieved by the production of lightweight aircraft parts. AI assists pilots during flight by analyzing sensitive data such as fuel system, system condition, weather conditions and other major parameters that can be tested in real time to improve flight performance. In addition, AI helps to increase time-consuming tasks in the aerospace industry and paves the way for better human machine performance.

Generative Design

Artificial intelligence is used continuously to create efficient, fast and bright components in the aerospace industry and is used to discover new ways to design them. Depending on the needs, new product designs are developed using machine learning methods. Many options are available in a short period of time to get the best design, making it easy for engineers and builders.

Efficient Supply Chain

Implementing AI in commerce makes working in the aviation industry much easier. The rise in consumer goods makes maintaining equipment and repairs always easier than hand-making and saves money and reduces the downtime as is known before knowing exactly when repair work should be done. Automated data collection makes it easy to improve the efficiency of asset sales management.

Impact of Human- AI Collaboration

As I had already mentioned about AI as well as ML which might have gave you an overview of the technology and the potential growth which it can cause to the industry. There are several statistics and research which shows that the future will be of robots, machines and similar technology which is creating a sense of fear in our working generation that will they be getting enough jobs in future? Or the machines will be overpowering them in this aspect? Well this is a never-ending debatable issue and opinion may differ from person to person. But my analysis

on this issue reflects that machines are made by human so increased machine will lead to more machine manufacturing and development and as we know that machines do not have brain to improvise, they only perform the work which they are assigned to do. Also, replacing human with machines is certainly not a right choice as the installation and maintenance cost of these machines are way too high. Also, the ethics and norms which is yet being followed by the human mind is stupidity if one expects that from a machine.

Some of the most important things in any organization can be certification, rules and standards development, the accreditation of organizations will be affected by the introduction of AI, it is very important to ensure that employees get the right level of AI technology to carry out their duties. In contrast to industry employees, Agency employees are not directly identified or involved in AI construction. This puts the risk of having an information gap between the technical and the industry experts, which could lead to disruption in the organization's work environment. To overcome this danger, you will not only need to train staff in AI but also expose them to AI / ML processes as soon as possible. A comprehensive training package should be designed to ensure peer-to-peer dialogue with our industry and regulatory authorities.

Based on the above information it would be wise to work together and create a successful environment as it is very important to understand that skipping any aspect of the other leads to destruction. Therefore, it would be better if both parties work together and focus on the goal of uplifting and developing the organization so that it can do better than before.

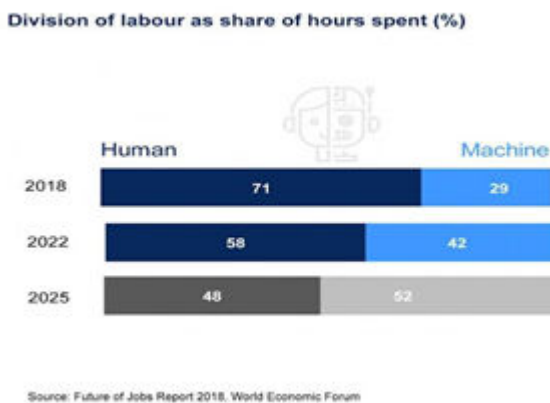


Figure4: Rate of Automation

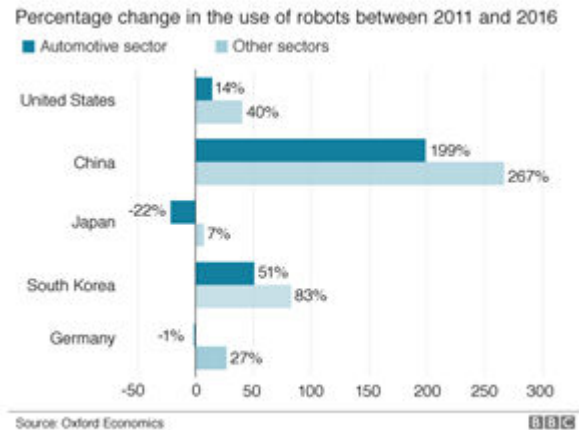


Figure5: The rise of the robot

Future Aspects of AI in Aviation Industry

Artificial intelligence or AI is now used in various industries around the world. It makes mark in the aviation industry as airlines continue to experiment with how AI can make flying faster, safer, and easier to use. While these tests are in the early stages right now, they show a promise that could allow AI to have a strong future in the aviation industry tomorrow.

Compliance with Growing Industries Required by all accounts, the global aviation industry is growing at an unprecedented rate. Over the next few years, passenger numbers are expected to double. This increased demand could put a strain on the systems used today at airports around the world. With AI, however, the need can be easily met without adding further difficulties to aircraft operations or budgeting. It can also maintain and effectively manage key aspects of the industry including keeping track of security records, keeping costs, increasing customer satisfaction, and making more money.

AI incorporates engineering and computer programming to perform tasks that would require human ingenuity. While AI systems vary in technology and impact, the machines have gone beyond automation to actually learn from the models without being explicitly programmed with their intended output. The first wave of Assisted Intelligence: equipment has already taken the place of many jobs and has also benefited from automation, with the increase in passenger entry systems, budget cuts and border controls, eliminating the need for more large airlines, airports and cultural personnel.

Safety and Real-Time Monitoring

AI can make it possible to have an Aircraft Real-time Health Monitoring System (ARHMS), driven by atom-level sensors in all parts of the aircraft, its contents and the environment. Any differences for example pressure, pressure, magnetic force, temperature, humidity fluctuations can be measured and processed. Upon arrival, the AI can physically test, scan the entire aircraft via ARHMS and use an independent multi-drone system. This will be an important factor in aviation safety as also many aviation accidents occur due to lack of communication and technological advances, which means that receivers and

emitters are out of date. Although airport agencies are also active in the construction of these facilities to increase the quality of the frequency of appropriate communication.

Baggage Delivery

AI can deliver bags in conjunction with a Drone Service Provider that delivers bags from the aircraft directly to the designated area for passengers. This means that freight delivery is much safer and empowers airports and airports to deliver appropriate cargo services to their passengers. AI can be used to provide a deeper understanding of cargo, which allows airports and airports to determine which routes are causing the most stress in their systems, what causes problems and how to ship bags effectively. AI can also be used to enable autonomous equipment to transport cargo between terminal and aircraft and to improve communication services so that cargo information can be shared more efficiently between airport and airport staff and passengers.

Commercial Decision Making

AI can also perform intermediate functions for example assisting commercial decision-making, revenue management, monitoring of the Service Level Agreement, managing all Smart contracts with payment partners, invoices and payments. Many airlines have become accustomed to data-driven decision-making processes. Data can improve decisions, but it requires the right processor to get the most out of it. Many people think the processor is human. A data driven word means data is selected and summarized for people to process. But to make full use of the amount contained in the data, companies need to bring artificial intelligence to their operations and, in some cases, get people out of the way. We need to transition from data processing to AI-driven workflows.

Pilotless flights

Flights Airlines today do not have pilots in almost anything except travel and landing are controlled by available PCs, so it is a small moderate obstacle to overcome. There are many other reasons why airplanes are not fully self-sufficient today, much like digital hacking power. But replacing pilots with AI is a complex task, and it can involve technical, legal, and political aspects. The auto-driving feature to some extent can fly a plane but usually involves some human contact. Completely automatic without human intervention is not an easy task. In addition, getting an auto-pilot certified by a controlling body is a daunting task. Independent commercial airlines will also need to upgrade all ATC systems. If the ATC needs to redirect the aircraft, or issue a change, it is currently handled in person-to-person communication. A certain type of command on the plane with a data link will be required to do it by default. Therefore, the default will be required for both aircraft and the ATC system.

More Comfortable flight experience

While many aircraft agencies are already operating in a real-time database of unrest, AI can improve this, for example a real-time air pressure data supply within a certain area, which can be used for efficient purposes such as avoiding chaos.

Well, AI can contribute in measuring and analyzing all the previous flight and then suggesting accordingly the best suited flight which can save time and money of the traveler and can also serve more comfortable flight experience. Also, airports are coming up with easy to use AI based machines which can facilitate works like enquiry services, issuing boarding pass and also checking and security.

CONCLUSION

Artificial intelligence plays a major role in reducing costs, reducing design cycle time, copying, prototyping, optimization, storage, production and renewal of products and all are planned to drive more progress in the aerospace industry over the next 15 years. Advances in AI can help aerospace companies implement their own production process. However, the adoption of machine learning strategies in the aviation industry has been reduced and the main reason for this is the lack of high-quality data, increased reliance on simpler models compared to more complex models and a lack of skilled staff and partners?

The Aviation industry has also noticed good news during this pandemic which was the comeback of Jet Airways in the Indian Aviation market. So, it also brings the employment opportunity and also a sigh of relief for the hospitality graduates who were worried about the post COVID situations. The highest bid made by the Karlock Capital and Murari Lal Jalan during the auction of the Jet Airways stakes, revived the airlines and made bliss of hope to India and its civilians.

Finally, we can assume that the coming generation or the time period after pandemic will have a great hunger and chase for development and making a comeback in the industry as most of them are facing a setback at the earliest. Many researchers have assumed that human's dependency on machine will increase in a crazy manner and the continuous growth of which can also have some disruptive effect on the mankind.

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