LITERATURE SURVEY

PROBLEM STATEMENT:

Airline Data Analytics for Aviation Industry

DOMAIN:
Data Analytics

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S.NO	TITLE	AUTHOR	ABSTRACT
1.	Applications of Big Data in Airline Industry (Publication: JAAUTH, Vol. 21 No 4, pp.73-108, 2021)	Dou Lee Nikolopoulos and Petropoulos Izzo Larsen Sternberg	With the advent of big data era, modern aviation industry can find solutions for their major challenges of safety and performance improvement because big data can provide multidimensional, adequate, and real-time information and improve the predictive and preventive capabilities of aviation flight risks. Big data will effectively improve the technical performance and operating conditions of aircraft, avoid various adverse external environmental conditions, and reduce manual errors, to enhance aviation safety. By adopting big data technology, fuel consumption, crew deployment, and flight operations could be optimized; maintenance could anticipate when parts need replacing; air congestion could be reduced; flight routes could be altered well in advance of takeoff to avoid storms and passengers could be kept informed about schedules from the minute they leave their home for the airport. The airline industry makes use of primary data sets that come from many different parameters such as flight tracking data, airport operations data, weather conditions, airline information, market information, passenger information, aircraft data and air safety reports.
2.	A Machine Learning Approach to Predict Aircraft Landing Times using Mediated Predictions from Existing Systems (Publications: AIAA AVIATION FORUM, 2024, 2021)	Daniel Wesely Andrew Churchill John Slough William J Coupe	Developed a novel approach for predicting the landing time of airborne flights in realtime operations. The first step predicts a landing time by using mediation rules to select from among physics-based predictions (relying on the expected flight trajectory) already available in real time in the Federal Aviation Administration System Wide Information Management system data feeds. The second step uses a machine learning model built upon the mediated predictions. The model is trained to predict the error in the mediated prediction, using features describing the current state of an airborne flight. These features are calculated in real time from a relatively small number of data

			elements that are readily available for airborne flights. Initial results based on five months of data at six large airports demonstrate that incorporating a machine learning model on top of the mediated physics-based prediction can lead to substantial additional improvements in prediction quality.
3.	Predictive analytics with aviation Big Data (Publicatins: Intergrated Communicatins, Navigation and Surveillance Conference, 2013)	Samet Ayhan Johnathan Pesce Paul H Comitz Gary Gerberick	In this paper, we describe a novel analytics system that enables query processing and predictive analytics over streams of big aviation data. As part of an Internal Research and Development project, Boeing Research and Technology (BR&T) Advanced Air Traffic Management (AATM) built a system that makes predictions based upon descriptive patterns of massive aviation data. Boeing AATM has been receiving live Aircraft Situation Display to Industry (ASDI) data and archiving it for over two years. At the present time, there is not an easy mechanism to perform analytics on the data. The incoming ASDI data is large, compressed, and requires correlation with other flight data before it can be analyzed. The service exposes this data once it has been uncompressed, correlated, and stored in a data warehouse for further analysis using a variety of descriptive, predictive, and possibly prescriptive analytics tools. The service is being built partially in response to requests from Boeing Commercial Aviation (BCA) for analysis of capacity and flow in the US National Airspace System (NAS). The service utilizes a custom tool developed by Embry Riddle Aeronautical University (ERAU) that correlates the raw ASDI feed, IBM Warehouse with DB2 for data management, WebSphere Message Broker for real-time message brokering, SPSS Modeler for statistical analysis, and Cognos BI for front-end business intelligence (BI) visualization tools. This paper describes a scalable service architecture, implementation and value it adds to the aviation domain

4.	Prediction of runway configurations and airport acceptance rates for multi-airport system using gridded weather forecast (Publication: Transportation Research Part C-Emerging Technologies 125, 103049, 2021)	Yuan Wang Yu Zhang	Accurate prediction of real-time airport capacity, a.k.a. airport acceptance rates (AARs), is key to enabling efficient air traffic flow management. AARs are dependent on selected runway configurations and both are affected by weather conditions. Although there have been studies tackling on the prediction of AARs or runway configurations or both, the prediction accuracy is relatively low and only single airport is considered. This study presents a data-driven deep-learning framework for predicting both runway configurations and AARs to support efficient air traffic management for complex multi-airport systems. The two major contributions from this work are 1) the proposed model uses assembled gridded weather forecast for the terminal airspace instead of an isolated station-based terminal weather forecast, and 2) the model captures the operational interdependency aspects inherent in the parameter learning process so that proposed modeling framework can predict both runway configuration and AARs simultaneously with higher accuracy. The proposed method is demonstrated with a numerical experiment taking three major airports in New York Metroplex as the case study. The prediction accuracy of the proposed method is compared with methods in current literature and the analysis results show that the proposed method outperforms all existing methods.
5.	Data Science And Analytics In Aviation(2020)	Sai-Ho-Chung Hoi-Lam-ma	The researcher in this article cited that,Due to the rapid development of advanced technologies nowadays, a massive amount of real time data regarding flight information, flight performance, airport conditions, air traffic conditions, weather, ticket prices, passengers comments, crew comments, etc., are all available from a diverse set of sources, including flight performance monitoring systems, operational systems of airlines and airports, and social media platforms. Development of data analytics in aviation and related applications is

			also growing rapidly. This paper concisely examines data science and analytics in aviation studies in several critical areas, namely big data analysis, air transport network management, forecasting, and machine learning. The papers featured in this special issue are also introduced and reviewed, and future directions for data science and analytics in aviation are discussed.
6.	Topologic Data Analysis For Aviation Applications(2018)	Max Z. Li Megan S. Ryerson and Hamsa Balakrishnan	Aviation data sets are increasingly high-dimensional and sparse. Consequently, the underlying features and interactions are not easily uncovered by traditional data analysis methods. Recent advancements in applied mathematics introduce topological methods, offering a new approach to obtain these features. This paper applies the fundamental notions underlying topological data analysis and persistent homology (TDA/PH) to aviation data analytics. We review past aviation research that leverage topological methods, and present a new computational case study exploring the topology of airport surface connectivity. In each case, we connect abstract topological features with real-world processes in aviation, and highlight potential operational and managerial insights.

7.	Airline Route Profitability Analysis And Optimization Using Big Data Analytics On Aviation Data Sets Under Heuristic Techniques(2016)	Kasturi E Prasanna Devi Sb Vinu Kiran Sb Manivannan Sc	Researchers in this article cited that ,applying vital decisions for new airline routes and aircraft utilization are important factors for airline decision making.For data driven analysis key points such as airliners route distance, availability on seats/freight/mails and fuel are considered. The airline route profitability optimization model is proposed based on performing Bigdata analytics over large scale aviation data under multiple heuristic methods, based on which practical problems are analysed. Analysis should be done based on key criteria, identified by operational needs and load revenues from operational systems e.g. passenger, cargo, freights, airport, country, aircraft, seat class etc. The result shows that the analysis is simple and convenient with concrete decision.
8.	Analysis Of Flight Data Using Clustering Techniques For Detecting Abnormal Operations(2015)	Lishaui Li Santanu Das	The researcher in this article cited that,the airline industry is moving toward proactive risk management, which aims to identify and mitigate risks before accidents occur. However, existing methods for such efforts are limited. They rely on predefined criteria to identify risks, leaving emergent issues undetected. This paper presents a new method, cluster-based anomaly detection to detect abnormal flights, which can support domain experts in detecting anomalies and associated risks from routine airline operations. The new method, enabled by data from the flight data recorder, applies clustering techniques to detect abnormal flights of unique data patterns. Compared with existing methods, the new method no longer requires predefined criteria or domain knowledge. Tests were conducted using two sets of operational data consisting of 365 B777 flights and 25,519 A320 flights. The performance of cluster-based anomaly detection to

			detect abnormal flights was compared with those of multiple kernel anomaly detection, which is another data-driven anomaly detection algorithm in recent years, as well as with exceedance detection, which is the current method employed by the airline industry. Results showed that both cluster-based anomaly detection to detect abnormal flights and multiple kernel anomaly detection were able to identify operationally significant anomalies, surpassing the capability of exceedance detection. Cluster-based anomaly detection to detect abnormal flights performed better with continuous parameters,whereas multiple kernel anomaly detection was more sensitive toward discrete parameters.
9.	Assessing Quality Of Air Transport Service: A Comparative Analysis Of Two Evaluation Models(2021)	Denise Dumiko De Medeiros	The researcher in this article cited that,this paper aims to analyze the opinion of tourists about airlines' service in a developing country. For this, the study proposes to make a comparative analysis of two evaluation models (SERVQUAL and SERVPERF) to investigate the factors that influence the formation of perceived quality in airline services, using statistical techniques such as Cluster Analysis and Structural Equation Modeling. Although the results were not the same, the result of both analyzes indicated two common dimensions (tangibles and empathy) that influence the customer's perception of the airline service quality. The main conclusion of this study is that the two analyzes are convergent for the study sample. The SERVQUAL and cluster analysis allow airline managers to identify and prioritize gaps in service delivery according to criticality, aiming at the allocation of efficient resources by the airline. The SERVPERF and SEM provide statistical evidence of the impact of different

			dimensions of service quality on customer satisfaction, highlighting the direct relationship between satisfaction and dimensions. Considering how customers evaluate the service provided by airlines, particularly regarding the service they receive from airport employees, this study has relevance for decisions taken by airline managers to develop quality services, and provide guidelines for improvements in airline services.
10.	Data Analytics for Air Travel Data(2021)	Haiman Tian Yudong Tao	The researcher in this article cited that,From the start, the airline industry has remarkably connected countries all over the world through rapid long-distance transportation, helping people overcome geographic barriers. Consequently, this has ushered in substantial economic growth, both nationally and internationally. The airline industry produces vast amounts of data, capturing a diverse set of information about their operations, including data related to passengers, freight, flights, and much more. Analyzing air travel data can advance the understanding of airline market dynamics, allowing companies to provide customized, efficient, and safe transportation services. Due to big data challenges in such a complex environment, the benefits of drawing insights from the air travel data in the airline industry have not yet been fully explored. They introduce existing data sources commonly used in the papers surveyed and summarize their availability. Finally, we discuss several potential research directions to better harness airline data in the future. They anticipate this study to be used as a comprehensive reference for both members

			of the airline industry and academic scholars with an interest in airline research.