Ideation Phase

Literature survey

Date	10 september
Team Id	PNT2022TMID06086
Project Name	Project - Machine Learning-Based Predictive Analytics for Aircraft Engine
Maximum marks	-

1) Predictive Maintenance and Performance Optimisation in Aircrafts using Data Analytics:

Authors: Shakthi Weerasinghe, Supunmali Ahangama.

Published: IEEE 2018

Description: Airline industry has provided a significantly conventional, faster and reliable mode of transportation for passengers and freight over the decades in which the industry has been in service despite the pressure being applied especially in maintaining operational affordability. The study critically reviews the techniques and tools, infrastructure and general application architecture for discussing the applicability of data analytics based on both batch processing and real time stream data in general aviation for health monitoring and predictive analysis in order to predict maintenance and optimize the performance of aircrafts. In this respect, the study further evaluates the significant capability in addressing contemporary problems which are uniquely addressed by data analytics system.

2)Applications of deep learning in big data analytics for aircraft complex system anomaly detection:

Authors: Shungang Ning, Jianzhong Sun , Cui Liu and Yang Yi

Published: SAGE 2021

Description: Big data analytics with deep learning approach have attracted increasing attention in transportation engineering, involving operations, maintenance, and safety. In commercial aviation sectors, operational, and maintenance data produced on modern aircraft is increasing exponentially, and predictive analysis of these data is an exciting and promising field in aviation maintenance, which has a potential to revolutionize aerospace maintenance industry. This study illustrates the stateof-the-art applications of deep learning in big data analytics for predictive maintenance and a real-world case study for commercial aircraft. A Long Short-Term Memory network based Auto-Encoders (LSTM-AE) is proposed for complex aircraft system fault detection and classification, which makes use of the raw time-series data from heterogeneous sensors.

The proposed method uses nominal time-series samples corresponding to healthy behavior of the system to learn a reconstruction model based on LSTM-AE framework. Then the system health index (HI) and fault feature vectors are derived from the reconstruction error matrix for fault detection and classification. The proposed method is demonstrated on a real-world data set from a commercial aircraft fleet. The typical PCV faults as well as the 390 F sensor and 450 F sensor faults due to sense line air leakage are successfully detected and distinguished based on the extracted features. The case study results show that the computed HI can effectively characterize the health state of the aircraft system and different fault types can be identified with high confidence, which is helpful for line fault troubleshooting.

3) Predictive Aircraft Engine Maintenance:

Authors: Vikas Chhikara

Published: 2020

Description: For maintenance decisions and selecting a suitable operation for a machine, it's necessary to analyze the remaining useful life of the machine accurately. Machine learning techniques for RUL are usually focused as they are faster and easy to use. The existing models for RUL prediction are a single path or based on a top down approach. For increasing the accuracy and to achieve promising results this report proposes a methodology that combines the Convolutional neural networks (CNN) and Long short-term memory in order to predict the useful life of the machine. A different approach than existing models for this report CNN and LSTM model is actually combined rather than just using CNN for extracting features. But as for input single timestamp is used that can further lead to the same batch padding which could affect the model's prediction. The proposed methodology is used to overcome these issues by sliding the time one step size. For this report turbofan engine degradation data by NASA is used for training, testing, and validation of the RUL Model. By comparing the model using different Models like simple LSTM and transfer learning using the same dataset. With comparison, it will be easy to examine the performance of the proposed approach.

4) Predictive Maintenance of Aircraft Engine using Deep Learning Technique.

In this paper, an accurate algorithm to estimate remaining useful life of aircraft engine is proposed. Since the aircraft engine has a low fault tolerant, meaning that a little faulty in the system can lead to catastrophic conditions, an accurate and real-time information about the engine condition is required. This paper utilizes the combination of CNN and LSTM algorithms in learning the behavior of the historical data and providing the accurate information about the time to failure of the system. The simulation results demonstrate that the proposed system is able to achieve improved performance in terms of accuracy rate and computing time compared to the previous works.

5) Failure Prediction of Aircraft Equipment Using Machine Learning with a Hybrid Data Preparation Method.

Reliability and availability of aircraft components have always been an important consideration in aviation. Accurate prediction of possible failures will increase the reliability of aircraft components and systems. Scheduling of maintenance operations help determine the overall maintenance and overhaul costs of aircraft components. Maintenance costs constitute a significant portion of the total operating expenditure of aircraft systems.