# Machine Learning-Based Predictive Analytics For Aircraft Engine

## INTRODUCTION:

Engine failure is highly risky and needs a lot of time for repair. Unexpected failure leads to loss of money and time. Predicting the failure prior will save time, effort, money and sometimes even lives. The failure can be detected by installing the sensors and keeping a track of the values. The failure detection and predictive maintenance can be for any device, out of which we will be dealing with the engine failure for a threshold number of days. The project aims to predict the failure of an engine by using Machine Learning to save loss of time & money thus improving productivity.

## LITERACY SURVEY:

### [1] Aircraft Engine Remaining Useful Life Prediction Framework for Industry

The proposed model considers continuous learning and improvement to account for any further operational changes that affect the model prediction ability. This is reached by ingesting the model with the actual RUL during the maintenance of the engine unit, and by comparing it to the predicted one

**Advantages:**

Accuracy - 94%
Comparing multiple algorithms.

**Disadvantages:**

Need more Down Time.

### [2] 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.

**Advantages:**

Using Deep learning Increases the Accuracy and computing time.

**Disadvantages:**

Didn’t compare many algorithm to get the best.

**[3] A rare failure detection model for aircraft predictive maintenance using a deep hybrid learning approach.**

The use of aircraft operation logs to develop a data-driven model to predict probable failures that could cause interruption poses many challenges and has yet to be fully explored. Given that aircraft is high-integrity assets, failures are exceedingly rare. Hence, the distribution of relevant log data containing prior signs will be heavily skewed towards the typical (healthy) scenario. Thus, this study presents a novel deep learning technique based on the auto-encoder and bidirectional gated recurrent unit networks to handle extremely rare failure predictions in aircraft predictive maintenance modelling. The auto-encoder is modified and trained to detect rare failures, and the result from the auto-encoder is fed into the convolutional bidirectional gated recurrent unit network to predict the next occurrence of failure.

**Advantages:**

High Accuracy, good recall and G-means

**Disadvantages:**

Didn’t compare many algorithm to get the best.

**[4] Predictive Maintenance of the Aircraft Engine Bleed Air System Component**

This paper presents a predictive maintenance solution of an aircraft engine bleed air system component using machine learning approaches on aircraft Quick Access Recorder

(QAR) data. However, when the QAR parameters are not sufficiently representative of the component health, it has been highlighted that there is a need to leverage on more data sources such as Smart Access Recorder (SAR) data.

**Advantages:**

Good Accuracy in both training and Validating dataset.

**Disadvantages:**

Using only one algorithm.

**[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. )e 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.

**Advantages:**
Accuracy - 0.9316 while using LR and SVR,

Comparing multiple models to select the best.

**Disadvantages:**

Consume more time using Relief and K - means in data preparation.

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