

## Abstract

Covid-19 almost shut down the operations for the transport sector as a whole, while the aviation industry took the biggest hit.

With the restriction on the International and Domestic flights, the airline industry is struggling to survive, with mounting debt and all the major airlines in India reporting huge losses in the Q1 and Q2 of this fiscal year. The pandemic is also expected to decrease the number of passengers that travel on airlines in 20-21 to about 25% to the number that travelled in 19-20, a number that has scared of any possible ways of getting help from the capital markets for these companies.

Hence, I've decided to Analyze The Impact Of Covid-19 On The Aviation Industry in detail, comparing data from 2019 - 2020 to other major events of downfall and comment on it's recovery.

## Introduction

- This project aims at shining light on the various implications of the pandemic on the airline industry.
- In depth analysis of changes in passenger volumes, air traffic volumes, and airfare in 2019 and 2020.
- Understand the financial impact of the pandemic on airlines.
- Forecast stock prices to understand path to recovery using the best possible model.

The problem statement can therefore be broken down to 5 main questions:

1. How has Covid-19 affected the volume of passengers between 2019 and 2020?
2. How has Covid-19 affected the number of domestic flights between 2019 and 2020?
3. What was the impact on airline fares?
4. What was the financial impact on the airline industry in terms of revenue?
5. What are the forecasted stock prices of the top airlines?

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## Tools and Algorithms

**Tools:**

Programming - Python

Libraries - Numpy, Matplotlib, Scipy, Keras, Fbprophet, Sklearn

**Methodology:**

Use Pandas to clean data, perform calculations and visualise the impact of covid - 19 on the airline industry.

Test time series models and choose the best fit to forecast the stock prices of popular airlines.

**Algorithms Tested -**

1. Facebook's Prophet Model:

The most commonly used models for forecasting predictions are the autoregressive models. Briefly, the autoregressive model specifies that the output variable depends linearly on its own previous values and on a stochastic term (an imperfectly predictable term).

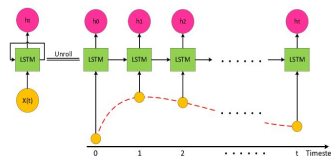
Prophet is a procedure for forecasting time series data based on an additive model where non-linear trends are fit with yearly, weekly, and daily seasonality, plus holiday effects. It works best with time series that have strong seasonal effects and several seasons of historical data. Prophet is robust to missing data and shifts in the trend, and typically handles outliers well.

Prophet is able to capture daily, weekly and yearly seasonality along with holiday effects, by implementing additive regression models.

2. Long Short-Term Memory:

Long short-term memory (LSTM) is an artificial recurrent neural network (RNN) architecture used in the field of deep learning. Unlike standard feedforward neural networks, LSTM has feedback connections.

This characteristic is extremely useful when we deal with Time-Series or Sequential Data. When using an LSTM model we are free and able to decide what information will be stored and what discarded.



## Implementation and Results

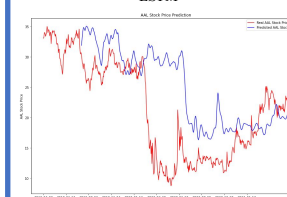
To understand how covid-19 has affected the volume of passengers, we calculate the percentage change in the number of passengers before and after the 2 busiest days for airlines in the year - christmas and independence day. We then plot the passenger volumes monthwise for both years side by side to understand the drop in numbers.

We use a similar, percentage change mechanism to analyze the changes in the number of flight, revenue and air fares.

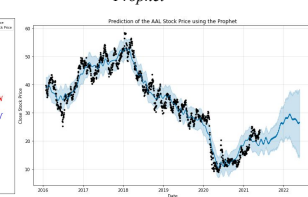
For the time series model, we forecasted the closing price of the American Airline stock, in order to predict the recovery of the airline industry as a whole.

LSTM vs Prophet: The LSTM model was able to accurately follow most of the unexpected jumps/drops however, for the most recent date stamps, we can see that the model expected (predicted) lower values compared to the real values of the stock price. Hence, this model was discarded for the other choice.

*LSTM*



*Prophet*



TSA Passenger Volume from March to December between 2019 and 2020

