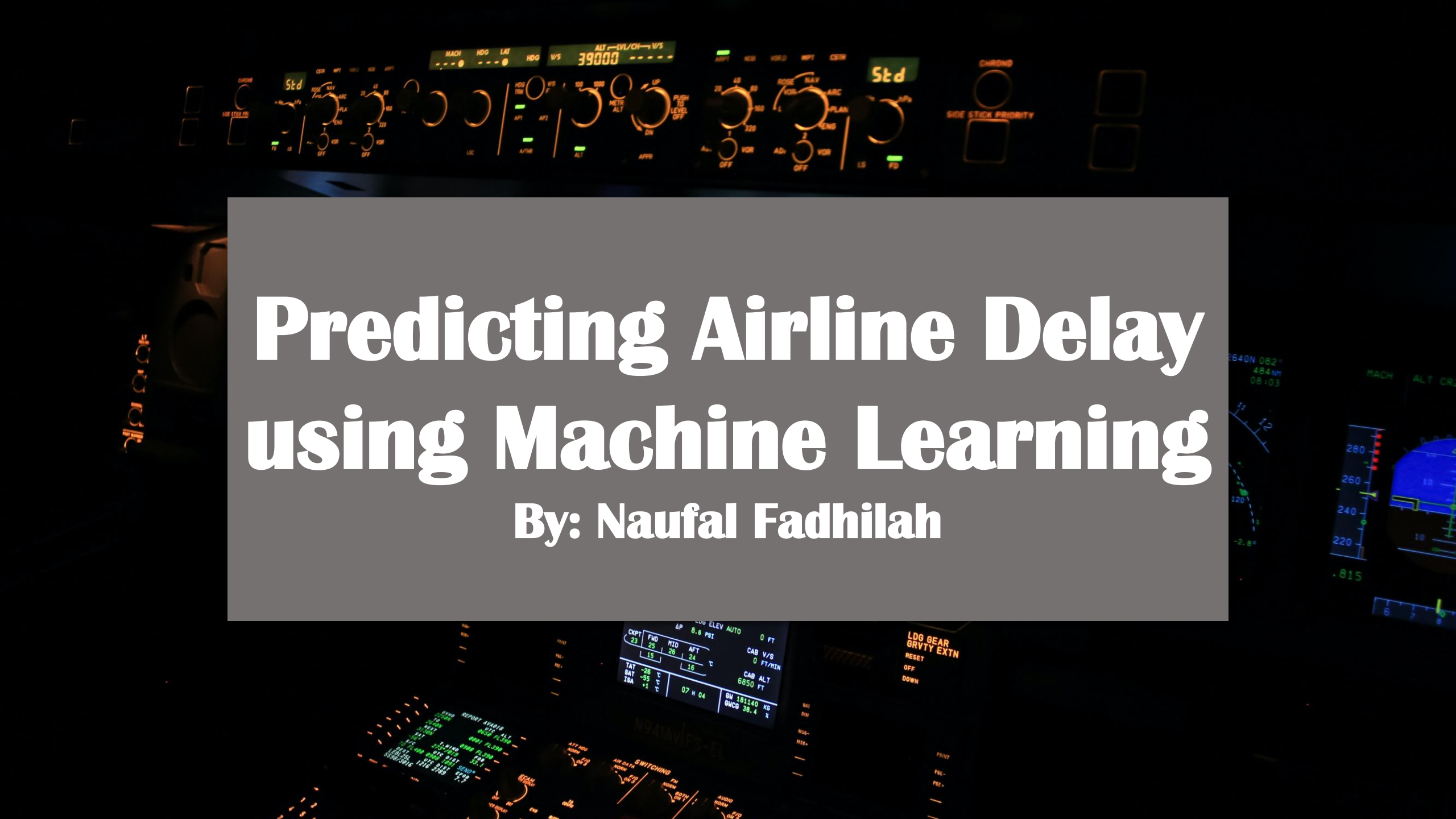

Predicting Airline Delay using Machine Learning

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1

Data Understanding

Data Understanding

Obtained through Kaggle, this dataset is about predicting whether the airline will be delayed or not. Where it contains 539.382 data with 8 columns

- Flight = Flight number
- Time = Departure time (in minutes from 00:00)
- Length = Total flight time (in minutes)
- Airline = Name of the airlines
- AirportFrom = The departing airport
- AirportTo = The destination airport
- DayOfWeek = Day of departure
- Class = Whether they are delayed or not

	Flight	Time	Length	Airline	AirportFrom	AirportTo	DayOfWeek	Class
0	2313.0	1296.0	141.0	DL	ATL	HOU	1	0
1	6948.0	360.0	146.0	OO	COS	ORD	4	0
2	1247.0	1170.0	143.0	B6	BOS	CLT	3	0
3	31.0	1410.0	344.0	US	OGG	PHX	6	0
4	563.0	692.0	98.0	FL	BMI	ATL	4	0
...	...	...	...	...	...	...	...	...
539377	6973.0	530.0	72.0	OO	GEG	SEA	5	1
539378	1264.0	560.0	115.0	WN	LAS	DEN	4	1
539379	5209.0	827.0	74.0	EV	CAE	ATL	2	1
539380	607.0	715.0	65.0	WN	BWI	BUF	4	1
539381	6377.0	770.0	55.0	OO	CPR	DEN	2	1

539382 rows × 8 columns

2

Exploratory Data Analysis & Data Pre processing

Exploratory Data Analysis & Data Pre Processing

```
Flight          0
Time            0
Length          0
Airline         0
AirportFrom     0
AirportTo       0
DayOfWeek       0
Class           0
dtype: int64
```

There are no missing values!

```
16.0      420
5.0       407
9.0       401
8.0       396
62.0      364
          ...
7814.0      1
4544.0      1
5131.0      1
6969.0      1
3518.0      1
Name: Flight, Length: 6585, dtype: int64
```

It is found that there are 216618 duplicated data, they all are coming from the Flight column.

Exploratory Data Analysis & Data Pre Processing

```
<class 'pandas.core.frame.DataFrame'>
Int64Index: 322764 entries, 0 to 539379
Data columns (total 8 columns):
 #   Column       Non-Null Count   Dtype
---  ------       --------------   -----
 0   Flight       322764 non-null  float64
 1   Time         322764 non-null  float64
 2   Length       322764 non-null  float64
 3   Airline      322764 non-null  object
 4   AirportFrom  322764 non-null  object
 5   AirportTo    322764 non-null  object
 6   DayOfWeek    322764 non-null  int64
 7   Class        322764 non-null  int64
dtypes: float64(3), int64(2), object(3)
memory usage: 22.2+ MB
```

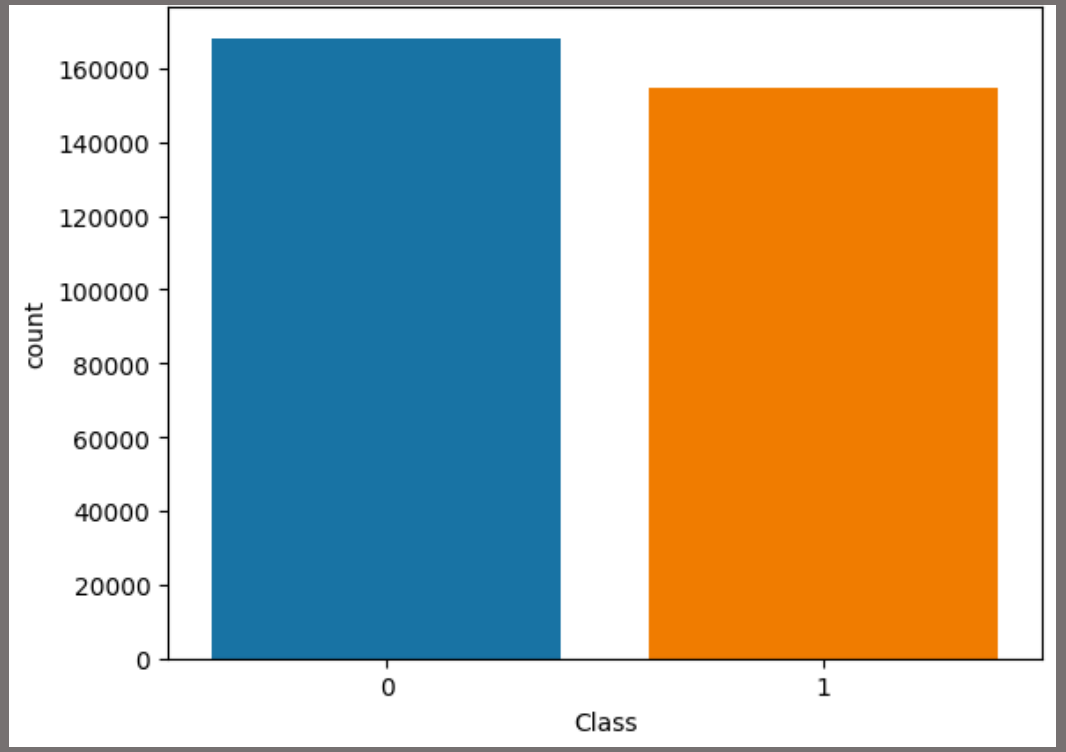
After cleaning the data from duplicates and missing values, we are left with 322764 datas.

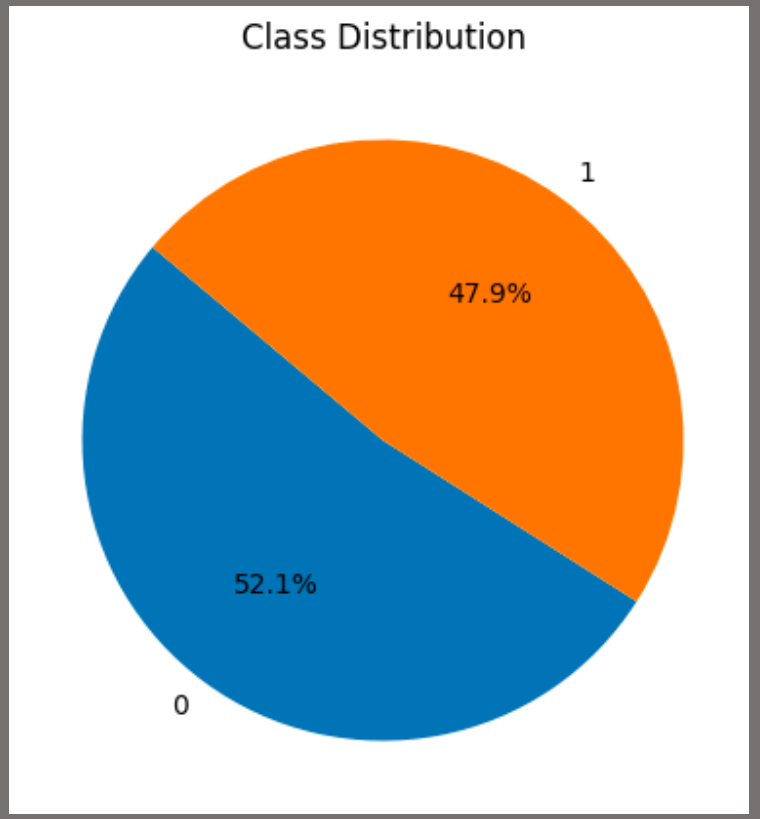
Exploratory Data Analysis & Data Pre Processing

	Flight	Time	Length	Airline	AirportFrom	AirportTo	DayOfWeek	Class	TimeCategory
0	2313.0	21:36	141.0	DL	ATL	HOU	1	0	Evening
1	6948.0	06:00	146.0	OO	COS	ORD	4	0	Morning
2	1247.0	19:30	143.0	B6	BOS	CLT	3	0	Evening
3	31.0	23:30	344.0	US	OGG	PHX	6	0	Evening
4	563.0	11:32	98.0	FL	BMI	ATL	4	0	Morning

Here Time format from minutes have been turned into HH:MM format. Also a new column called “TimeCategory” has been added.

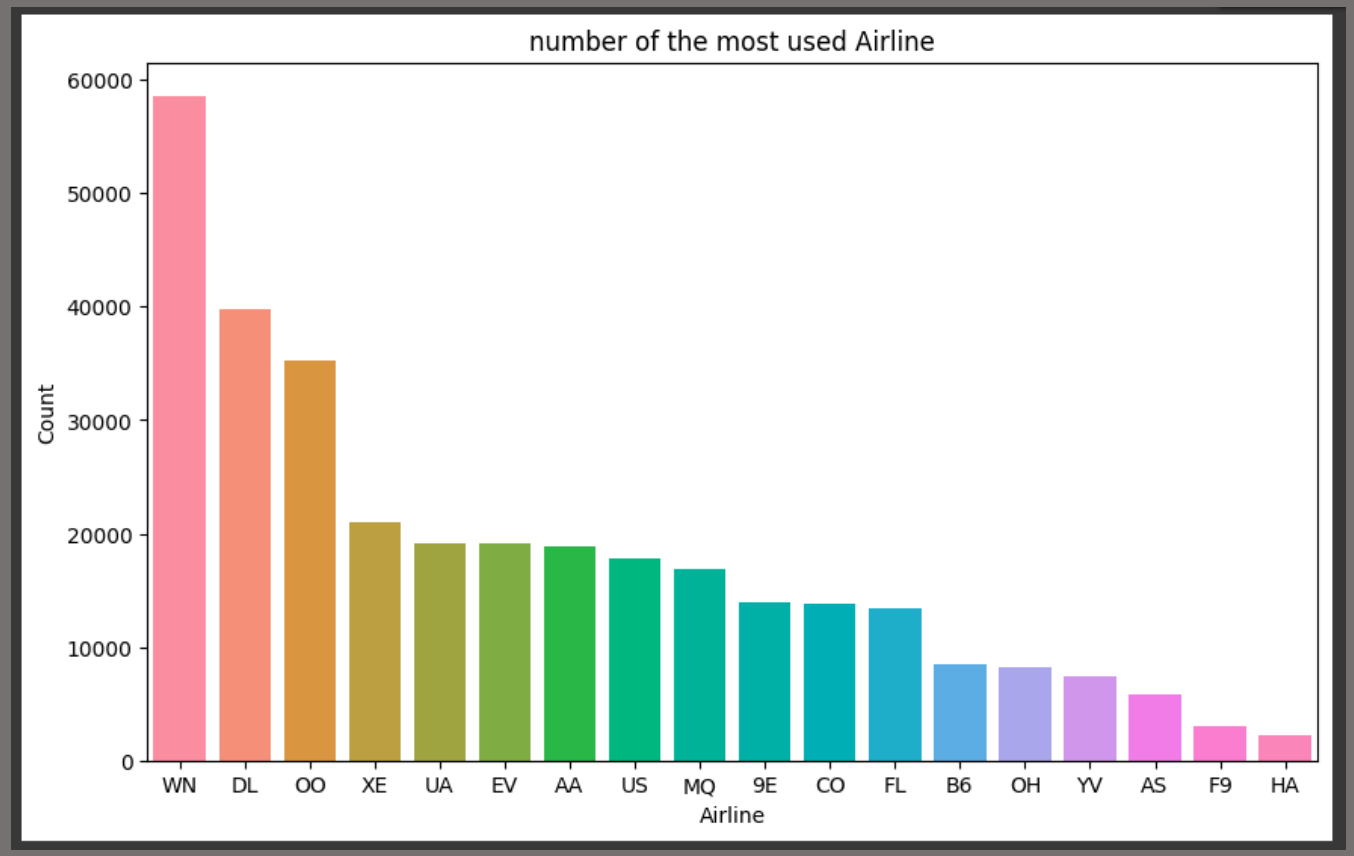
Exploratory Data Analysis & Data Pre Processing





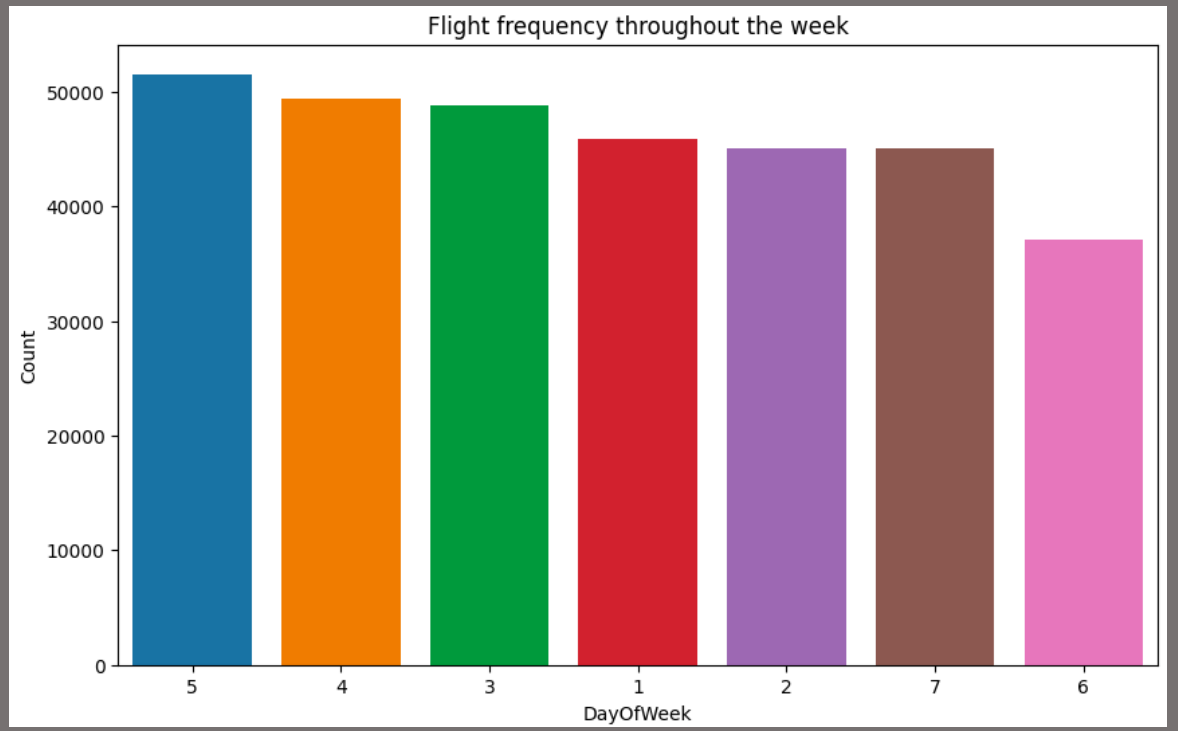

```
0    168162
1    154602
Name: Class, dtype: int64
```

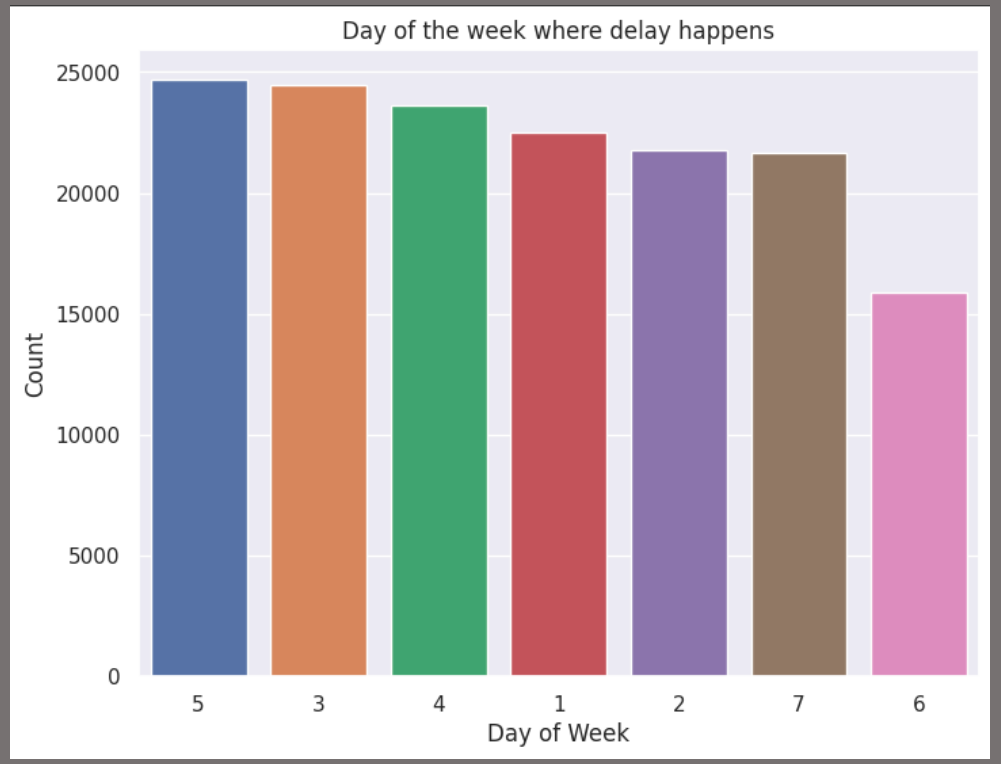
Exploratory Data Analysis & Data Pre Processing



	Airline	Count
0	WN	58593
1	DL	39806
2	OO	35207
3	XE	20961
4	UA	19155
5	EV	19135
6	AA	18896
7	US	17868
8	MQ	16825
9	9E	13944
10	CO	13845
11	FL	13419
12	B6	8468
13	OH	8174
14	YV	7424
15	AS	5849
16	F9	2981
17	HA	2214

Exploratory Data Analysis & Data Pre Processing

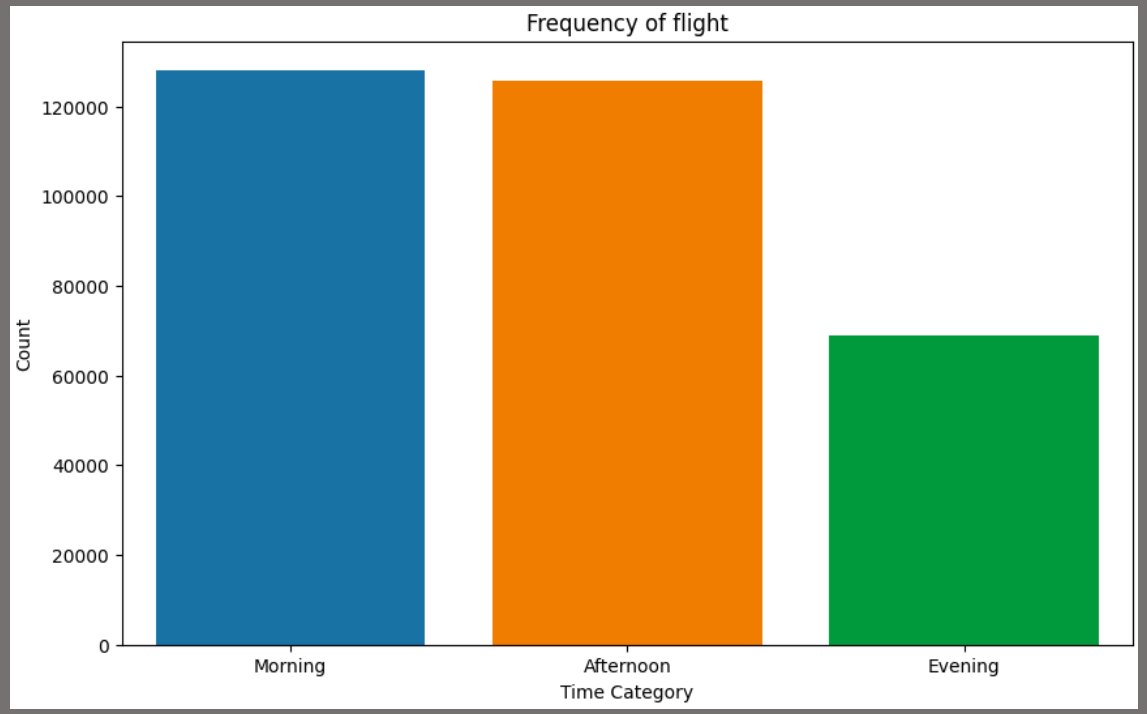


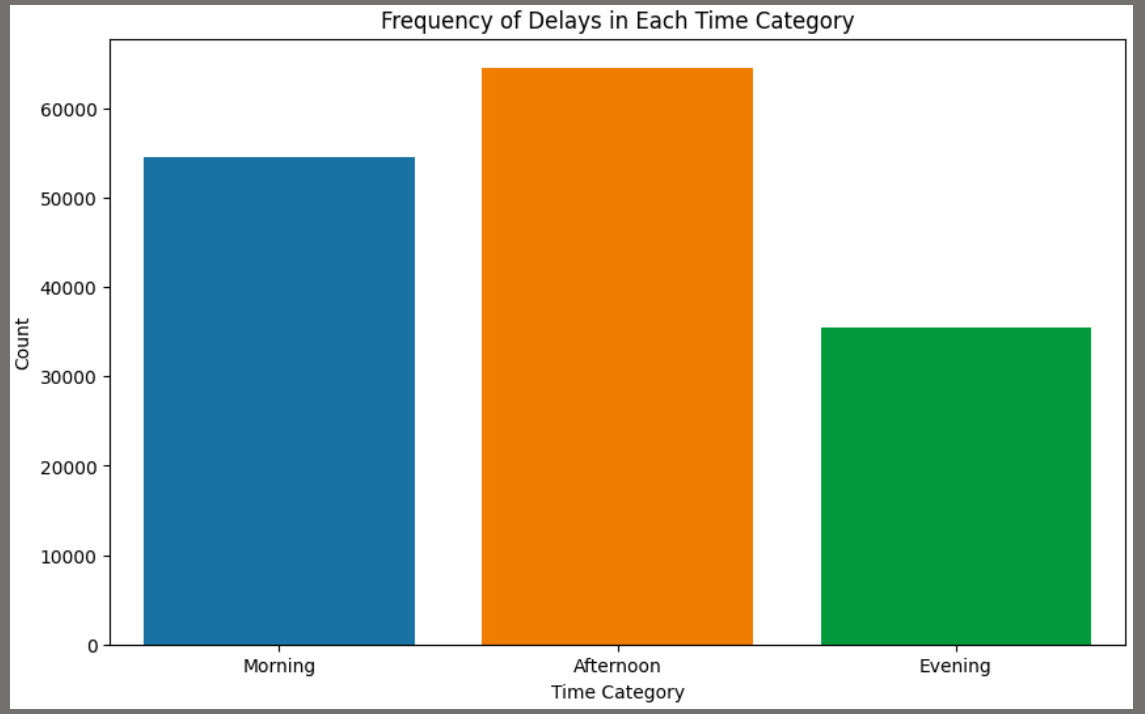



```
5    7847
3    5957
4    5870
2    5768
1    5424
7    4998
6    2966
Name: DayOfWeek, dtype: int64
```

- Flight happens mostly during day 5 and least at day 3
- Delay also happens the most at day 5

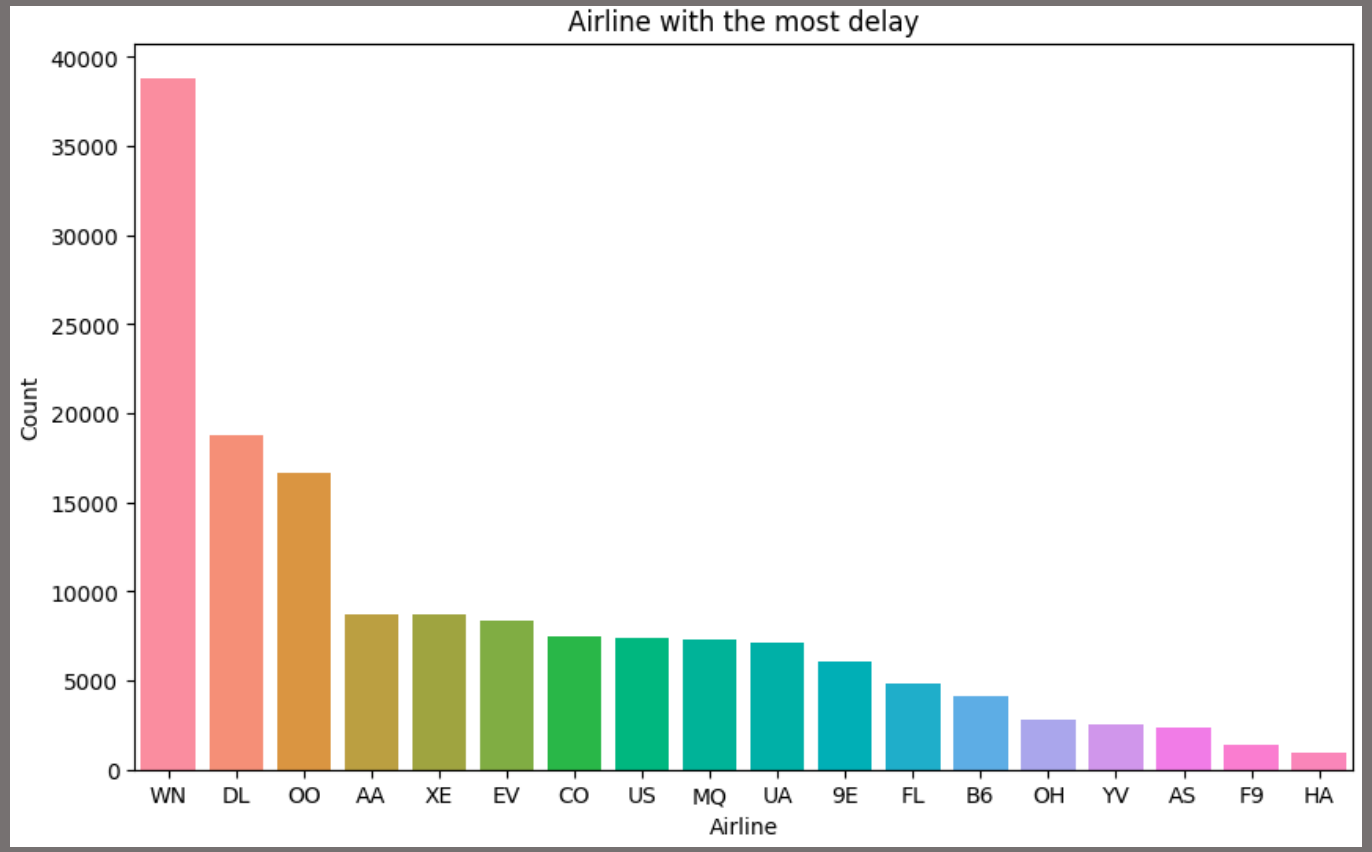
Exploratory Data Analysis & Data Pre Processing





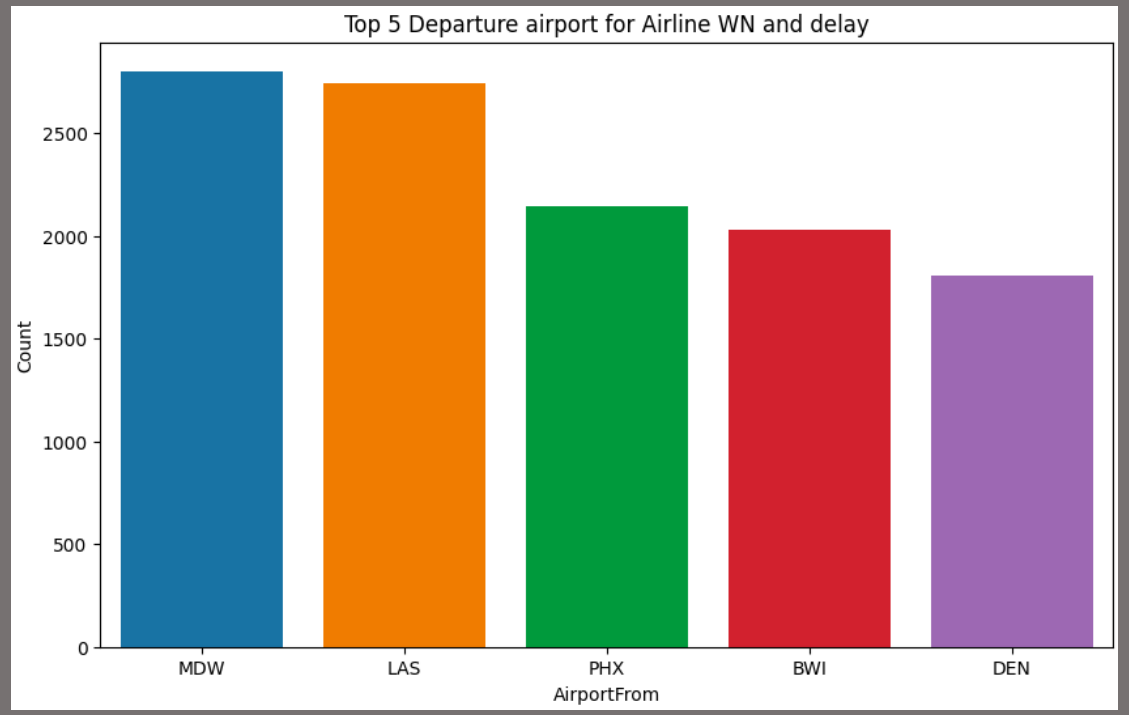
Most flights happens during morning time, however, the most delayed are in the Afternoon.

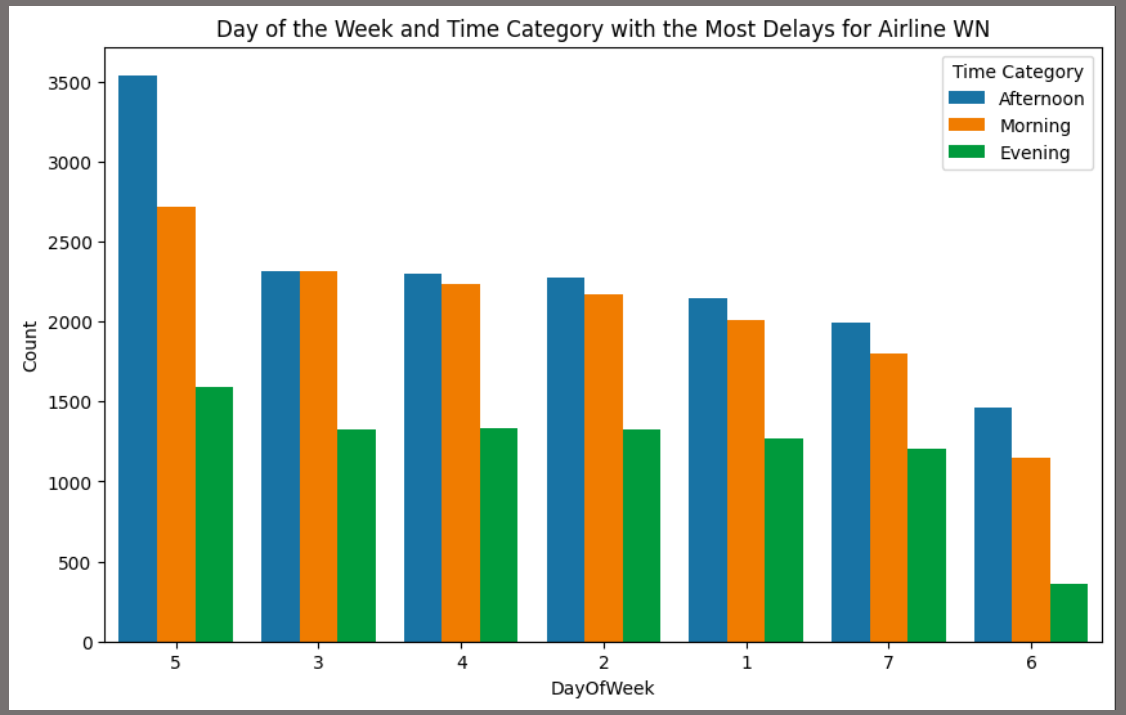
Exploratory Data Analysis & Data Pre Processing



WN is the airline with the most delay, coming in second is DL and the least delay airline being HA.

Exploratory Data Analysis & Data Pre Processing





- WN mostly delayed from MDW airport
- Delay occurs mainly on day 5 in the Afternoon while the least being in the Evening.

Exploratory Data Analysis & Data Pre Processing

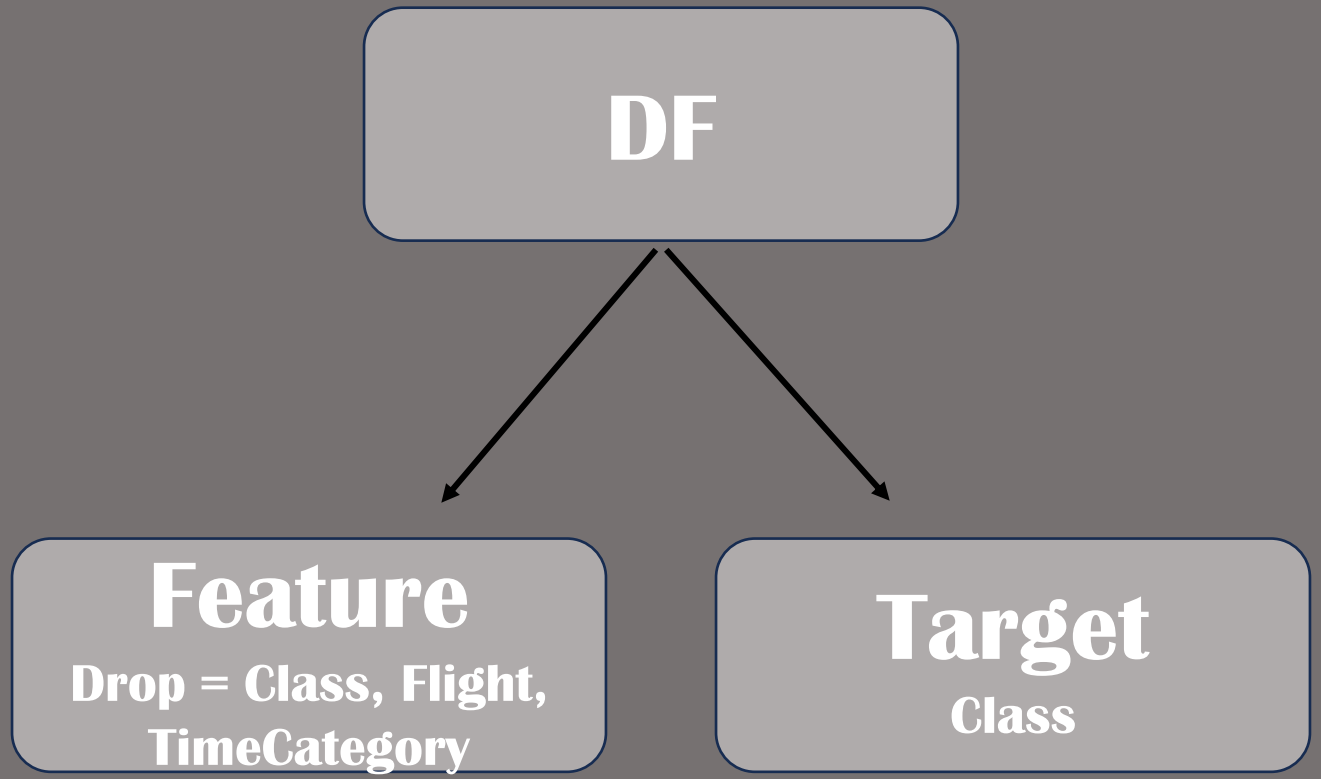
	Flight	Length	DayOfWeek	Class	TimeCategory	Airline_encoded	AirportFrom_encoded	AirportTo_encoded	Time_encoded
0	2313.0	141.0	1	0	Evening	5	16	129	1006
1	6948.0	146.0	4	0	Morning	12	65	208	70
2	1247.0	143.0	3	0	Evening	3	35	60	880
3	31.0	344.0	6	0	Evening	14	203	217	1112
4	563.0	98.0	4	0	Morning	8	32	16	402

Encoding the classification column (Airline, AirportFrom, AirportTo and Time

3

Machine Learning Model

Machine Learning Modelling



Machine Learning Modelling

	Model	Train	Test
0	KNN	67.22%	46.85%
1	Logistic Regression	54.98%	55.16%
2	Decision Tree	75.80%	32.85%
3	Random Forest	75.80%	35.34%
4	Naive Bayes	55.13%	55.45%
5	Gradient Boosted Tree	59.57%	59.54%
6	XGBoost	61.84%	58.79%

- Random Forest and Decision Tree is overfitted
- Knn appears to be underfitted
- The best model to be used is the Gradient Boosted Tree with 59.54% accuracy and appears to be well fitted.

4

Conclusion and Recommendation

Conclusion and Recommendations

With this dataset, I ran through numerous different model, thus the results are in. Gradient Boosted Tree has the highest accuracy score of 59.54% to predict delay, while the lowest being Decision Tree with only 32.85% accuracy. However, the recall for 1 is only 39.97% is is very low, this suggests that the model struggles to correctly identify the positive cases. For example in 100 delay it will only identify as 39 delays.

- It is highly recommended for WN airline to increase their aircraft
- WN needs to add its flights on the evening more
- Airline need to prepare and compensate the delayed passenger in advance to keep customer satisfaction


Thank You
Merci
Obrigado
Dyakuyu
Arigato
Salamat
Spasibo
Dank Je
Kiitos
Grazie
Asante
Vinaka
Mamana
Maake
Multumesc
Juspaxar
Kiitos
Mochchakkeram
Cam on ban
Raibh Maith Agat
Matur Nuwun
Chokrane
Kia Ora
Terma Kasih
Welalin
Matondo
Dankon
Salamat
Kirtingrazzjak
Ua Tsaug Rau Koj