Tool and Techniques Name

1) Python Libraries :-
    - Numpy
    - Pandas
    - Matplotlib
    - Seaborn
    - Sklearn
    - Imblearn
    - Tensorflow
    - Skfeature
    - Sklearn.metrics
    - Sklearn.preprocessing
2) Dataset Link :-
    - ✓ Lithuanian airports flight dataset | Kaggle
    - ✓ Here we have used 2 dataset i.e, Arrival and Departure Dataset.
3) Preprocessing Techniques : -
    - Label encoding to encode the categorical data
    - filled the missing values by using mode of that column.
    - Used SMOTE Technique for oversampling the training data.
4) Feature Extraction / Selection Techniques
    - ✓ CMIM Technique for feature selection so that we could enhance the model training and Testing accuracy.
5) Classification Technique

    We have 6 classes in our base3 paper to classify the time deviation i.e,

    - ➢ Delay(15,30] min

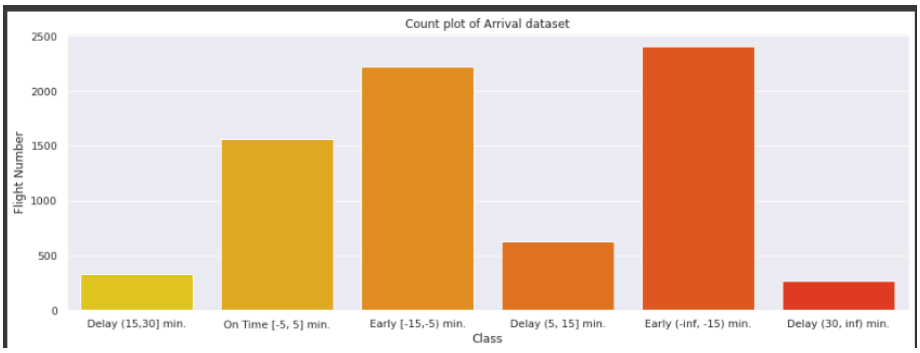
- ➢ On Time [-5,5] min
- ➢ Early [-15,5} min
- ➢ Delay (5,15] min
- ➢ Early (-inf,-15) min
- ➢ Delay (30,inf) min

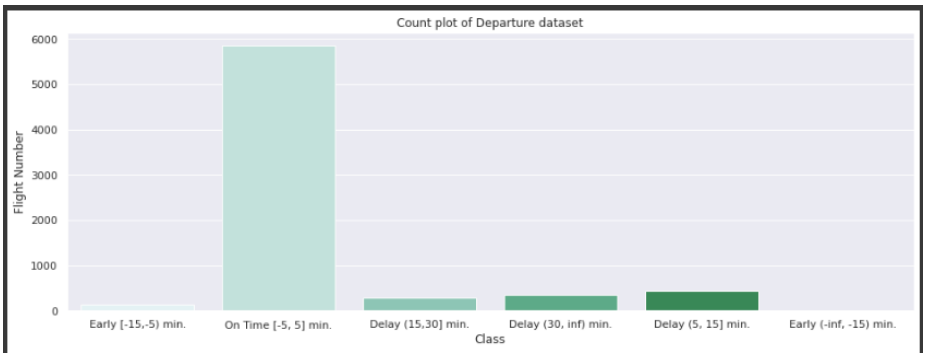
6) Data Split Ratio
   - ✓ Splitted the data into 80:20
7) Base Model
   - ▪ XGB classifier
   - ▪ LGBM classifier
   - ▪ ADABOOST Classifier

if any another tool and technique used so pls include it and remove it to above points

Screenshots of base and proposed results

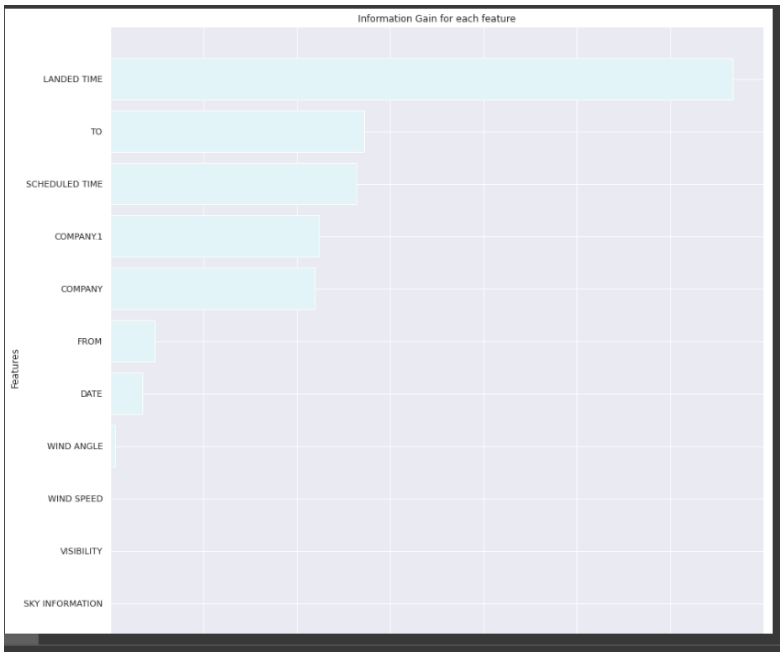
1) Dataset visualization screenshots



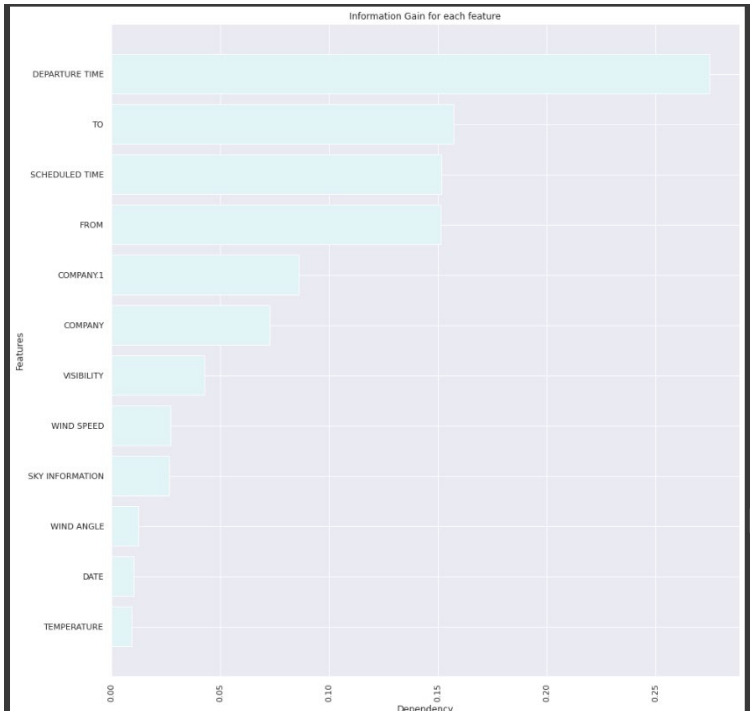


2) Preprocessing results
3) Feature extraction/selection results

- Arrival Dataset



- Departure Dataset:-



4) Classification Results

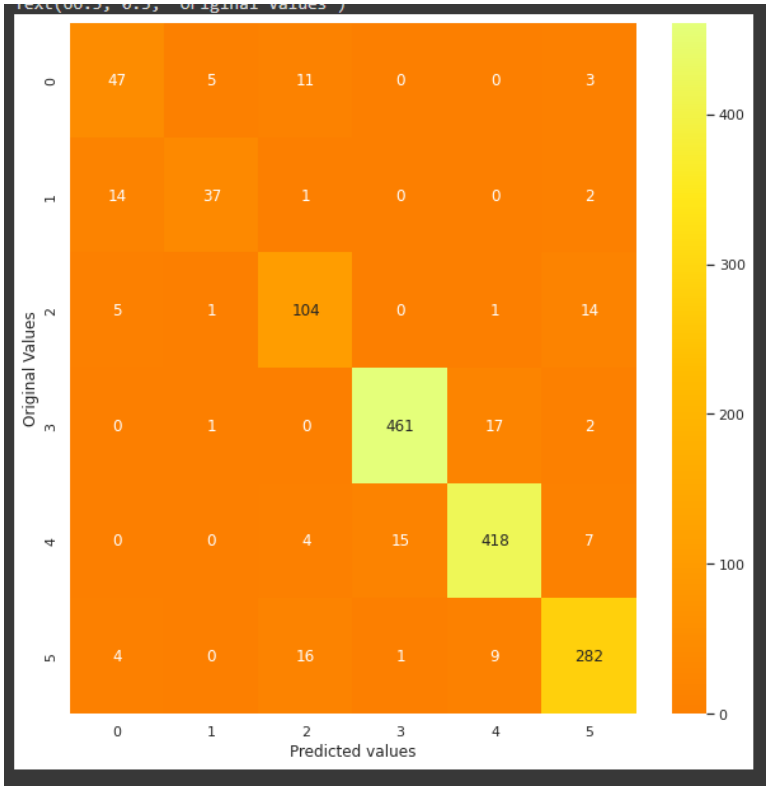
5) Proposed model results:-

- Arrival Dataset
  - XG Boosting:-

	precision	recall	f1-score	support
0	0.67	0.71	0.69	66
1	0.84	0.69	0.76	54
2	0.76	0.83	0.80	125
3	0.97	0.96	0.96	481
4	0.94	0.94	0.94	444
5	0.91	0.90	0.91	312
accuracy			0.91	1482
macro avg	0.85	0.84	0.84	1482
weighted avg	0.91	0.91	0.91	1482

Accuracy: 0.9102564102564102

```
Precision by XGB of testing data is: 0.910
Recall by XGB of testing data is: 0.910
F1 score by XGB of testing data is: 0.910
```

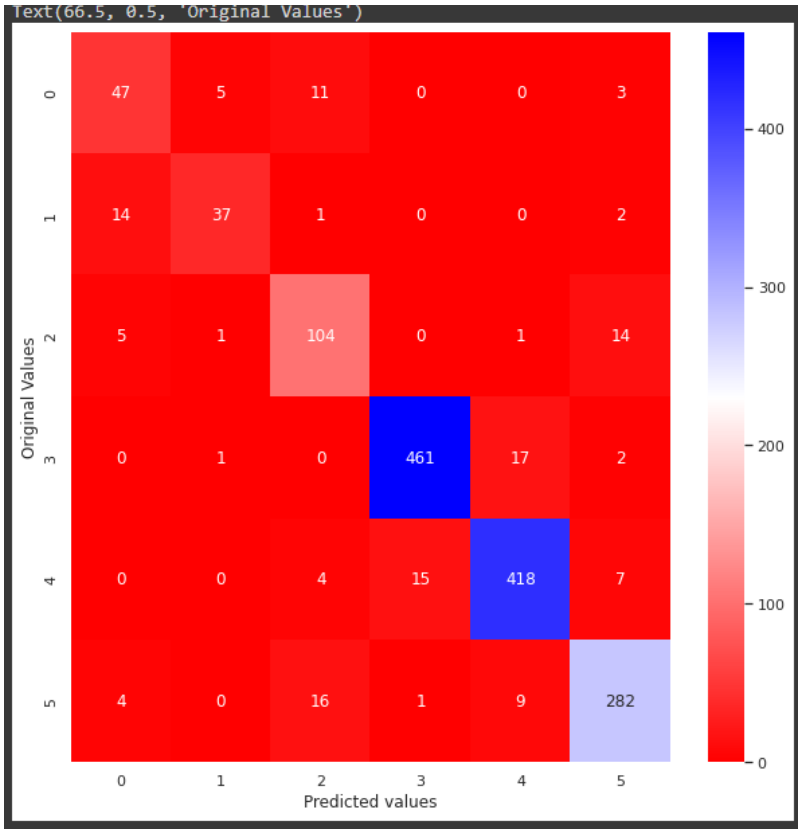


- LGBM Classifier:-

	precision	recall	f1-score	support
0	0.67	0.71	0.69	66
1	0.84	0.69	0.76	54
2	0.76	0.83	0.80	125
3	0.97	0.96	0.96	481
4	0.94	0.94	0.94	444
5	0.91	0.90	0.91	312
accuracy			0.91	1482
macro avg	0.85	0.84	0.84	1482
weighted avg	0.91	0.91	0.91	1482

```
Accuracy:  0.9102564102564102
```

```
Precision by LGBMClassifier of testing data is: 0.910
Recall by LGBMClassifier of testing data is: 0.910
F1 score by LGBMClassifier of testing data is: 0.910
```

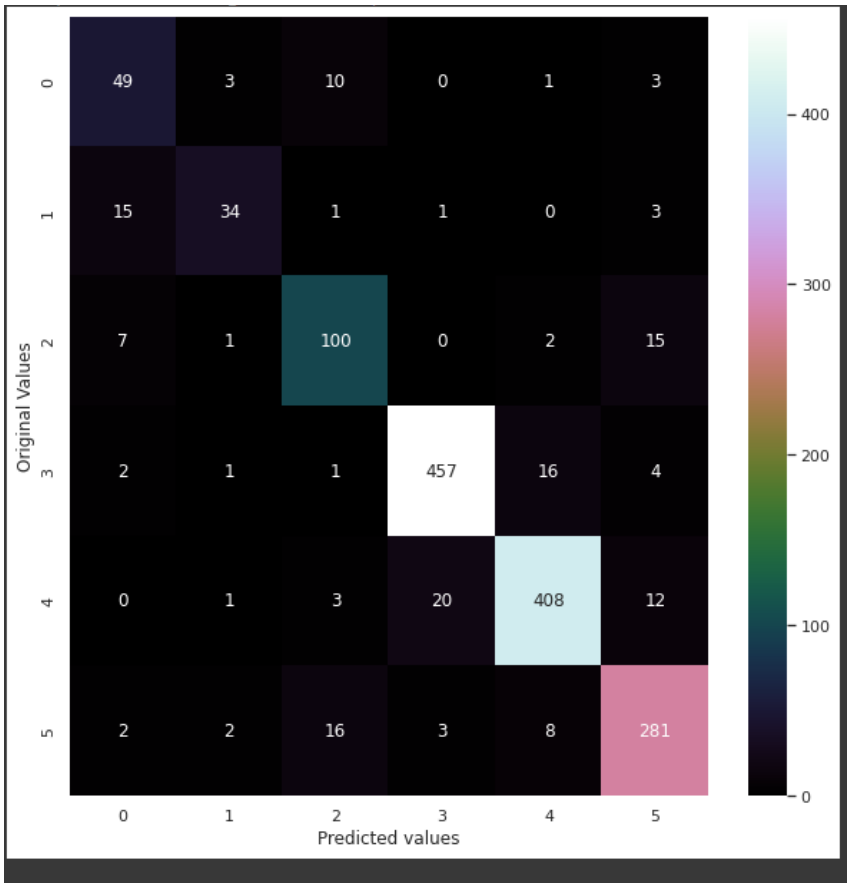


- AdaBoost Classifier: -

	precision	recall	f1-score	support
0	0.65	0.74	0.70	66
1	0.81	0.63	0.71	54
2	0.76	0.80	0.78	125
3	0.95	0.95	0.95	481
4	0.94	0.92	0.93	444
5	0.88	0.90	0.89	312
accuracy			0.90	1482
macro avg	0.83	0.82	0.83	1482
weighted avg	0.90	0.90	0.90	1482

Accuracy: 0.8967611336032388

```
Precision by AdaBoost of testing data is: 0.897
Recall by AdaBoost of testing data is: 0.897
F1 score by AdaBoost of testing data is: 0.897
```

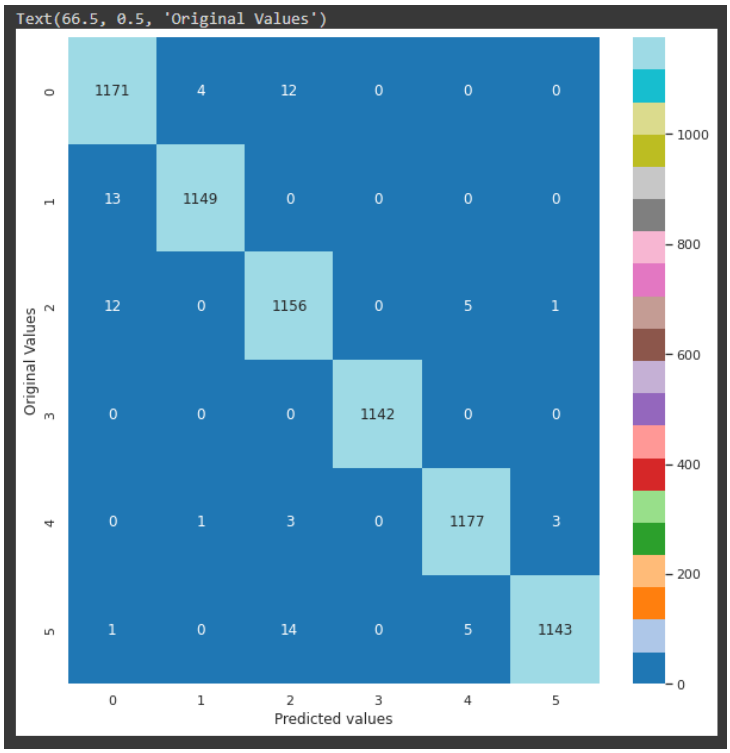


- Departure Dataset
  - XG Boosting:-

	precision	recall	f1-score	support
0	0.98	0.99	0.98	1187
1	1.00	0.99	0.99	1162
2	0.98	0.98	0.98	1174
3	1.00	1.00	1.00	1142
4	0.99	0.99	0.99	1184
5	1.00	0.98	0.99	1163
accuracy			0.99	7012
macro avg	0.99	0.99	0.99	7012
weighted avg	0.99	0.99	0.99	7012

```
Accuracy:  0.9894466628636623
```

```
Precision by XGB of testing data is: 0.989
Recall by XGB of testing data is: 0.989
F1 score by XGB of testing data is: 0.989
```

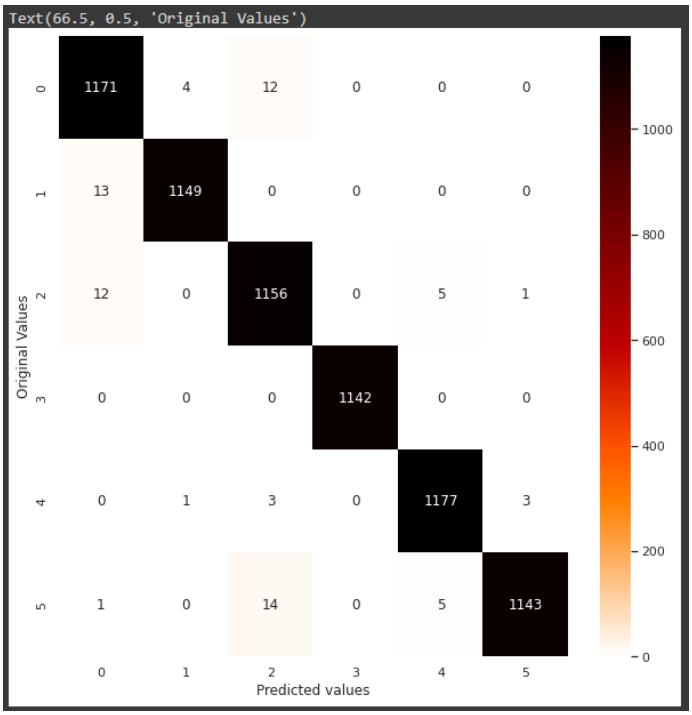


- LGBM Classifier:-

	precision	recall	f1-score	support
0	0.98	0.99	0.98	1187
1	1.00	0.99	0.99	1162
2	0.98	0.98	0.98	1174
3	1.00	1.00	1.00	1142
4	0.99	0.99	0.99	1184
5	1.00	0.98	0.99	1163
accuracy			0.99	7012
macro avg	0.99	0.99	0.99	7012
weighted avg	0.99	0.99	0.99	7012

Accuracy: 0.9894466628636623

```
Precision by LGBMClassifier of testing data is: 0.989
Recall by LGBMClassifier of testing data is: 0.989
F1 score by LGBMClassifier of testing data is: 0.989
```

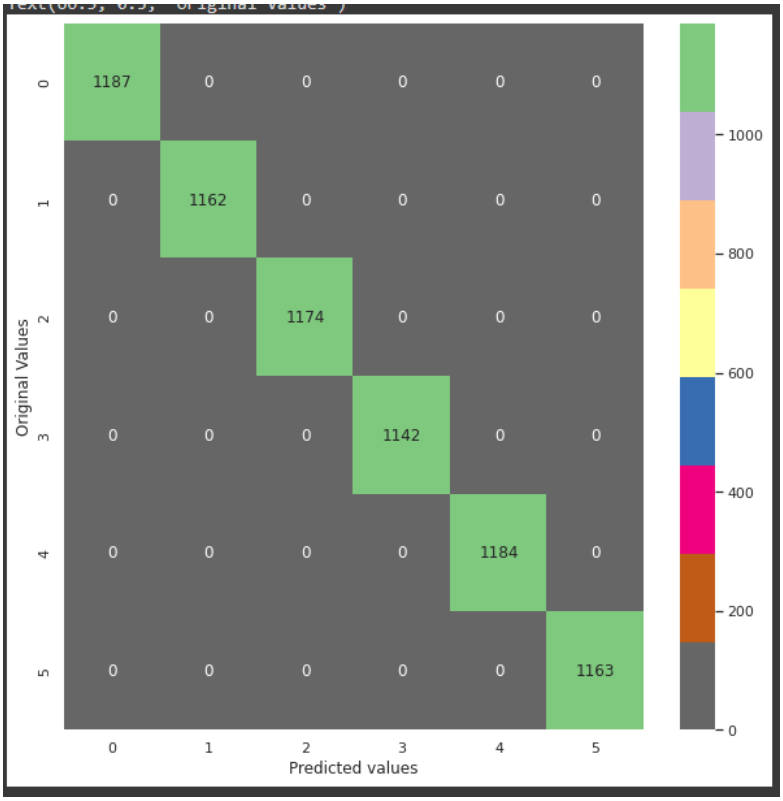


- Ada Boosting :-

	precision	recall	f1-score	support
0	1.00	1.00	1.00	1187
1	1.00	1.00	1.00	1162
2	1.00	1.00	1.00	1174
3	1.00	1.00	1.00	1142
4	1.00	1.00	1.00	1184
5	1.00	1.00	1.00	1163
accuracy			1.00	7012
macro avg	1.00	1.00	1.00	7012
weighted avg	1.00	1.00	1.00	7012

Accuracy: 1.0

```
Precision by AdaBoost of testing data is: 1.000
Recall by AdaBoost of testing data is: 1.000
F1 score by AdaBoost of testing data is: 1.000
```



Propose Result table

ARRIVAL DATASET

MODEL	Accuracy	Precision	Recall	F1 Score
XGB	91.02%	0.91	0.91	0.91
LGBM	91.02%	0.91	0.91	0.91
ADABOOST	89.67%	0.89	0.89	0.89

DEPARTURE DATASET

MODEL	Accuracy	Precision	Recall	F1 Score
XGB	98.94%	0.98	0.98	0.98

LGBM	98.94%	0.98	0.98	0.98
ADABOOST	100%	100	100	100

Base and proposed results comparison table

ARRIVAL DATASET

MODEL	Accuracy	Precision	Recall	F1 Score
Proposed	91.02	0.91	0.91	0.91
Base	83.33%	0.83	0.83	0.83

DEPARTURE DATASET

MODEL	Accuracy	Precision	Recall	F1 Score
Proposed	98.94	0.98	0.98	0.98
Base	92.13%	0.92	0.92	0.92