Flight Delay Forecast

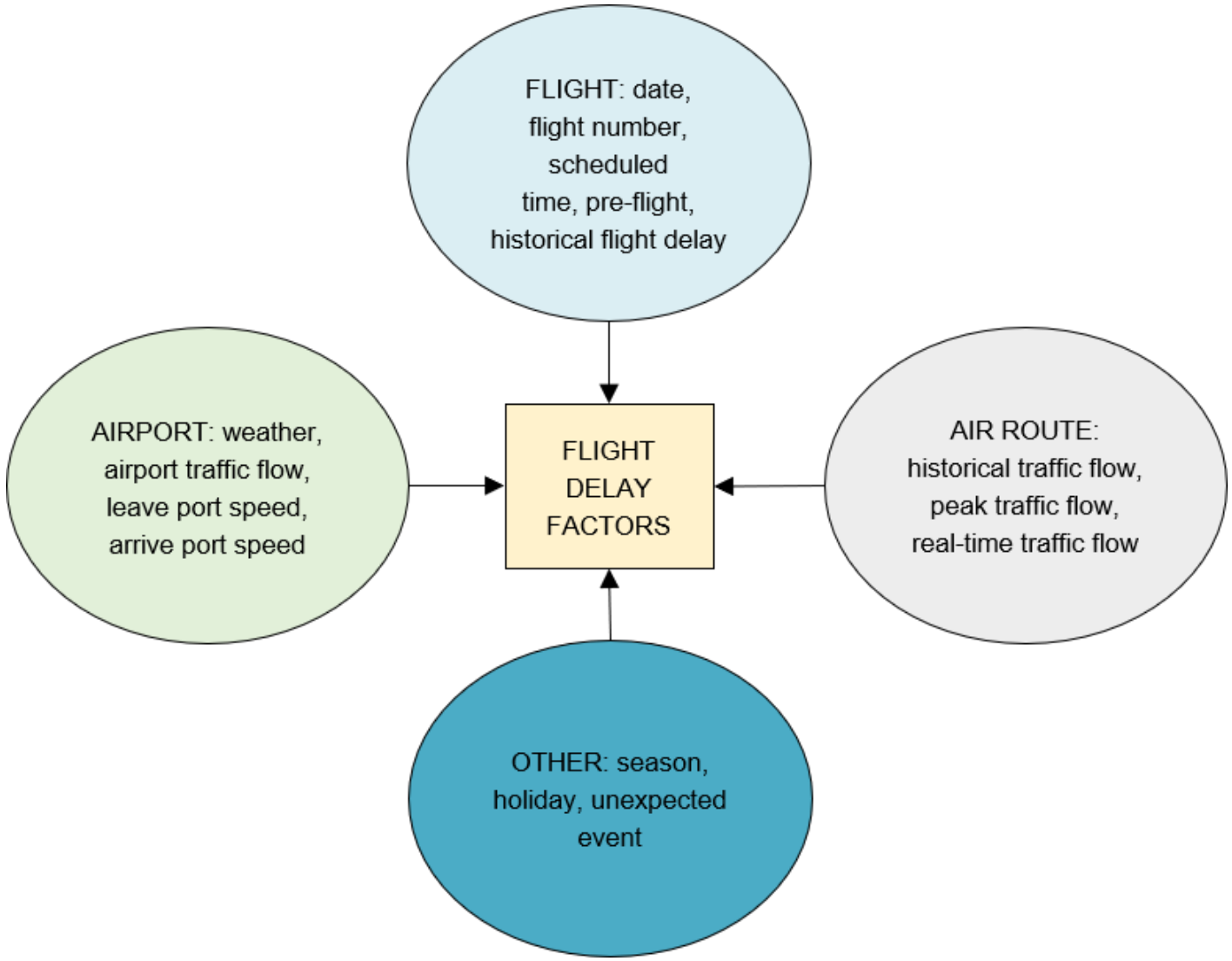
Soul software

Goal

Predict aircraft delays in airport terminal area using machine learning techniques on historical data.

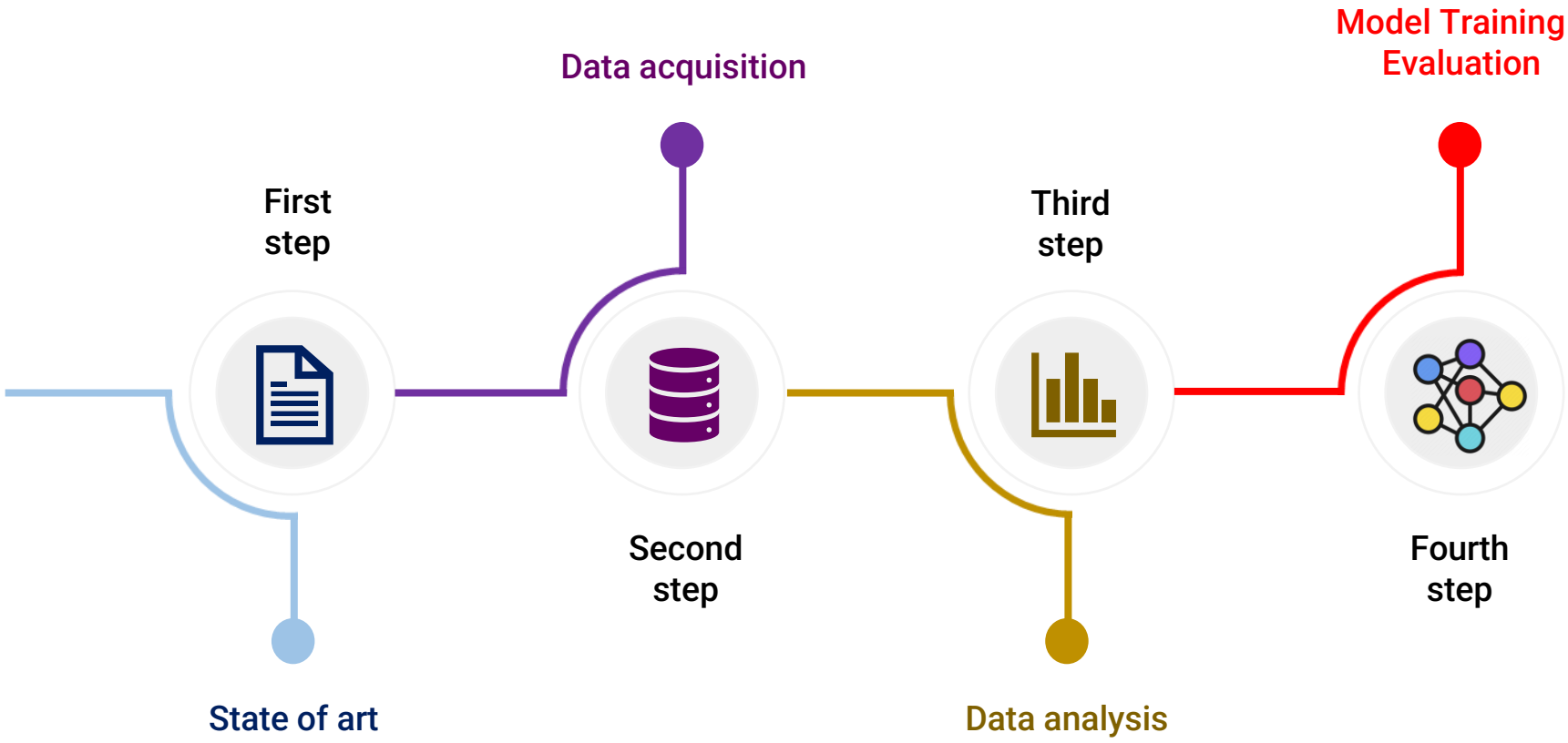
Focus

- On departure and arrival delays of flights for 227 European airports.
- Airlines: Charter, Low-cost, Traditional Scheduled, All-Cargo, Business Aviation



Flight delay factors

Process steps



Flight Model Implementation

Data sources

Traffic, time, and waiting times from 2015 to mid-2018

EUROCONTROL

Weather from 2015 to mid-2018

WEATHER UNDERGROUND

Tools

Python

Keras

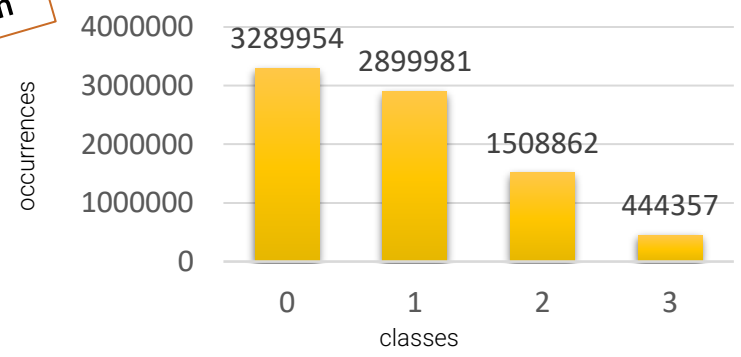
Scikit Learn

Departure dataset

Version 1

ADEP	Departure airport
ICAO Flight type	Scheduled or non scheduled flight
Date FIELD	Day of week and season
Time FIELD	Time of day
STATFOR Market Segment	Low-Cost or traditional flight or others
Weather	Weather condition, wind direction and wind speed

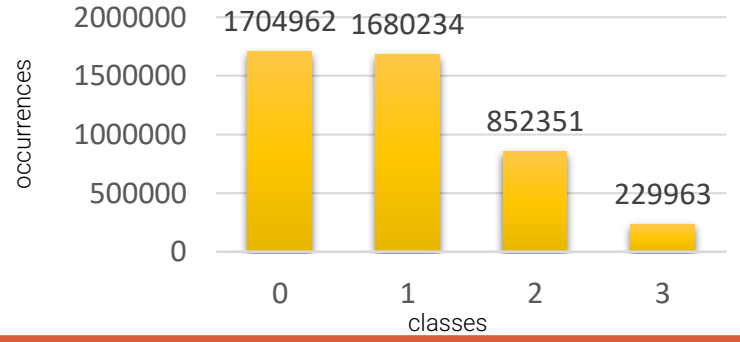
Classes distribution



Classes:
0 -> 0 min;
1 -> 1 to10 min;
2 -> 11 to 25min
3 -> over 30 min

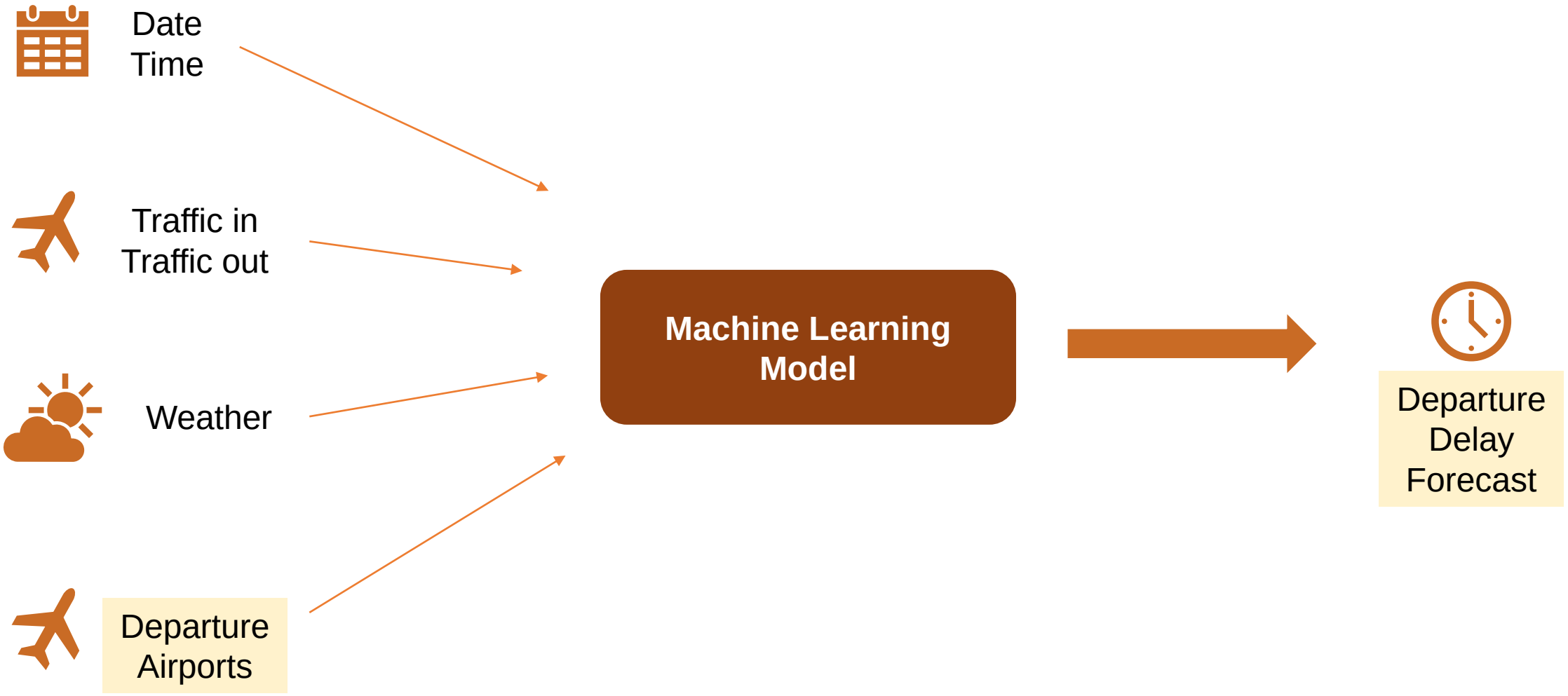
Version 2

ADEP	Departure airport
ICAO Flight type	Scheduled or non scheduled flight
Date FIELD	Day of week and season
Time FIELD	Time of day
STATFOR Market Segment	Low-Cost or traditional flight or others
Weather	Weather condition, wind direction and wind speed
Capacity of airport	Number of runway
Traffic	Traffic in and out of the airport



Classes distribution

Departure model

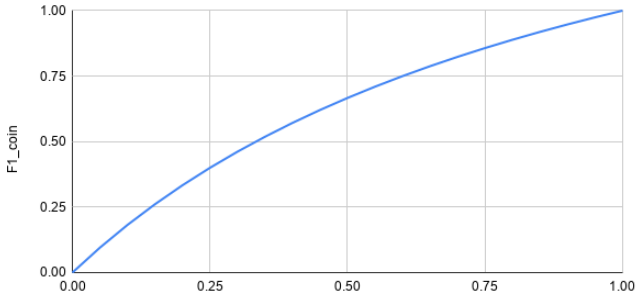


F1-score

It is a measure of accuracy on the test and it varies in a range between 0 and 1 where

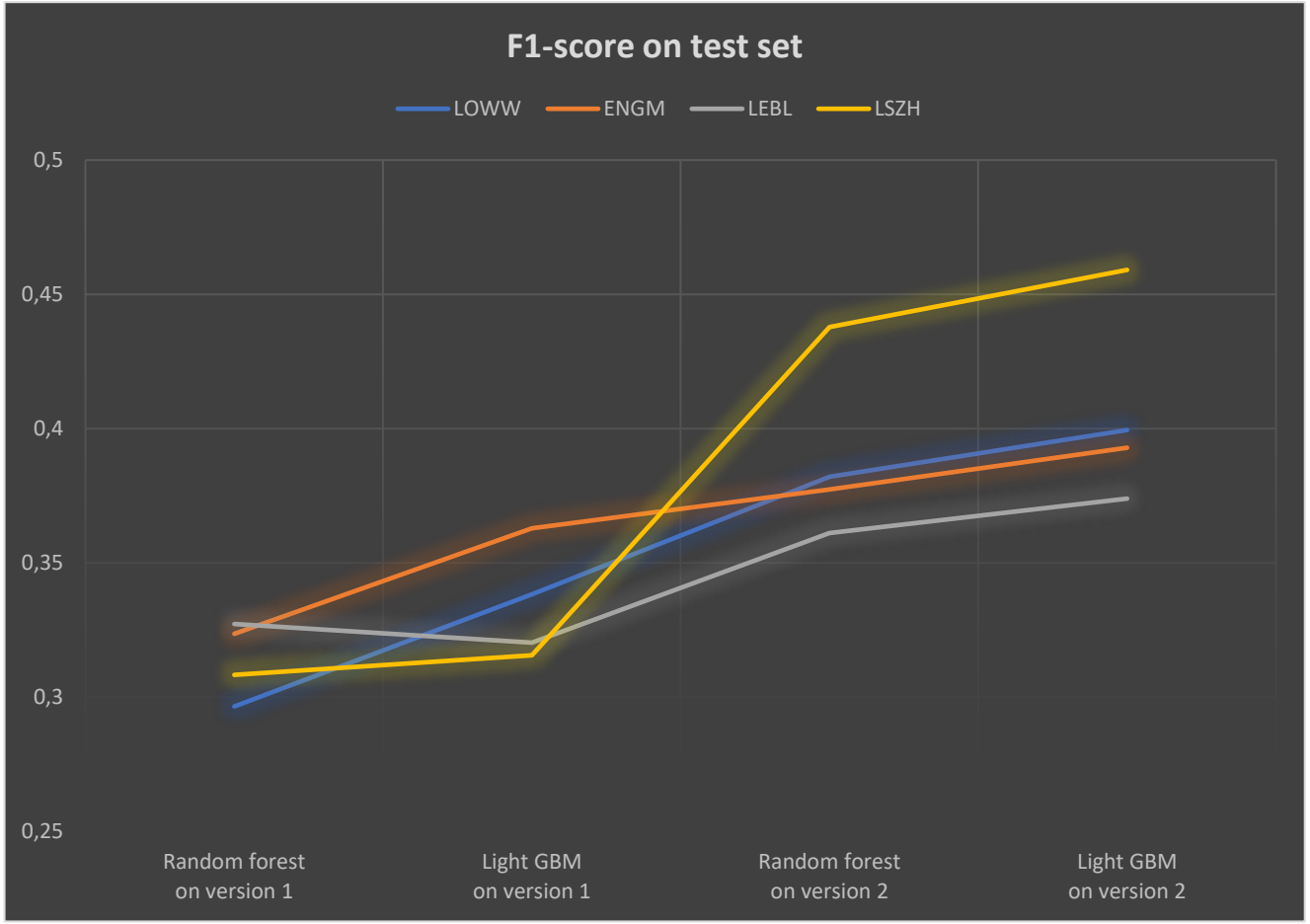
- 1 represents the highest accuracy

- 0 represents the lowest, there is no accuracy on the test



Departure

Trained on 227 ICAOS
Plotted 4 ICAOs



Legend:

LOWW: Vienna International Airport

ENGM: Oslo Airport

LEBL: Barcelona–El Prat Airport

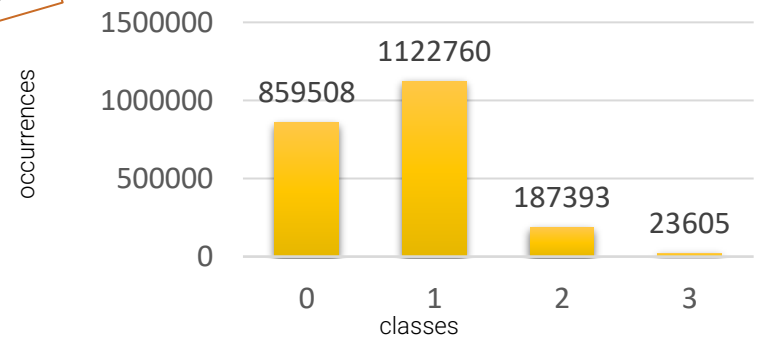
LSZH: Zürich Airport

Arrival dataset

Version 1

ADEP, ADES	Departure and arrival airports
ICAO Flight type	Scheduled or non scheduled flight
Date FIELD	Day of week and season
Time FIELD	Time of day
STATFOR Market Segment	Low-Cost or traditional flight or others
Weather	Weather condition, wind direction and wind speed

Classes distribution



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Version 2

ADEP, ADES	Departure and arrival airports
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Date FIELD	Day of week and season
Time FIELD	Time of day
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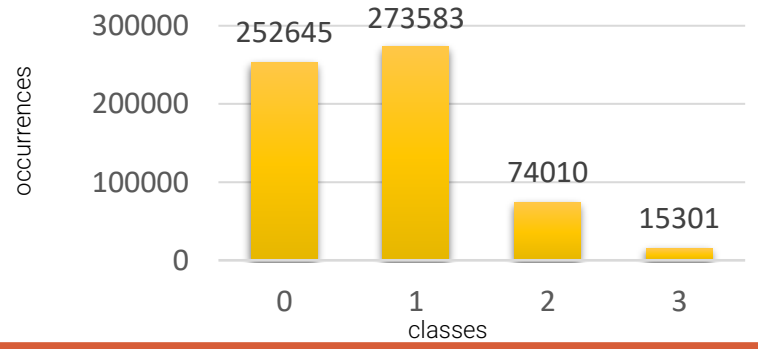
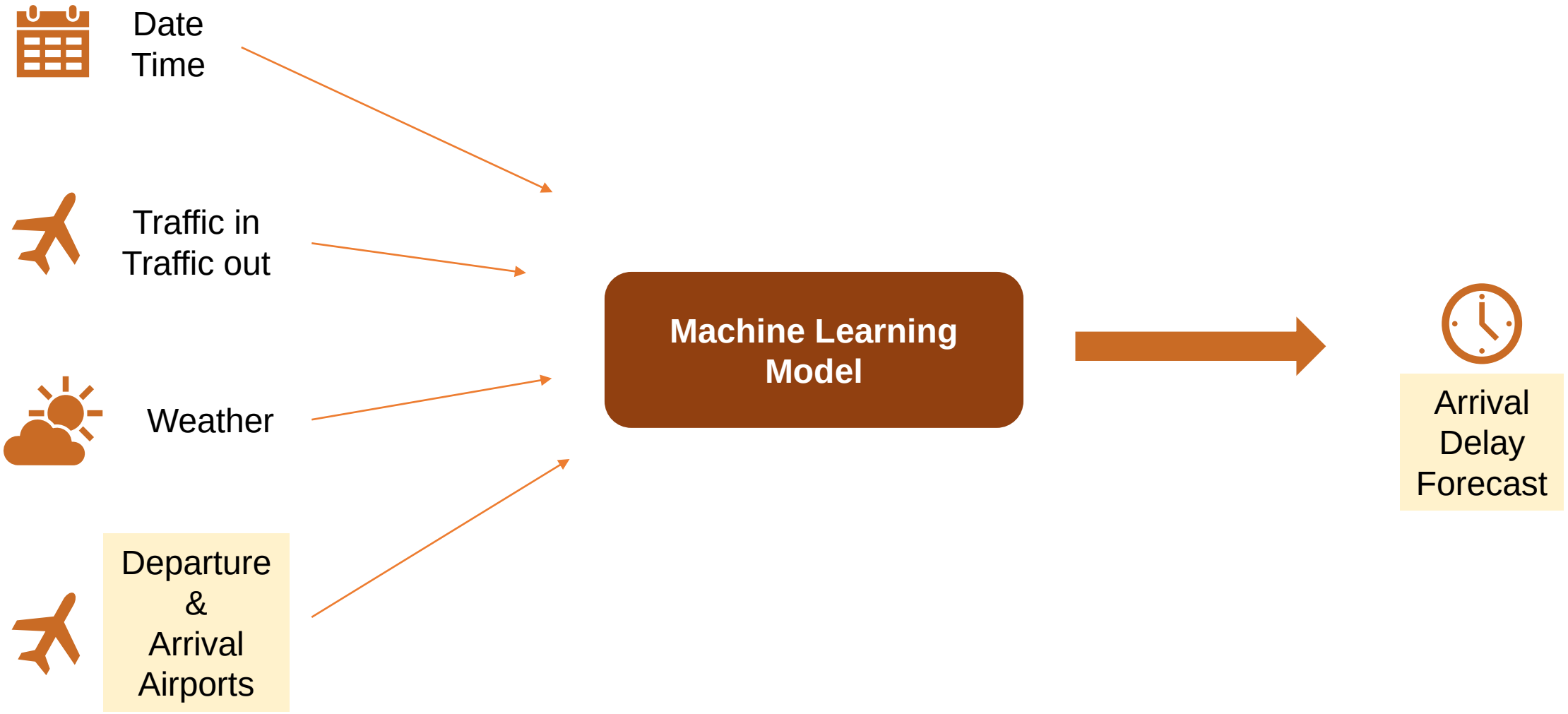


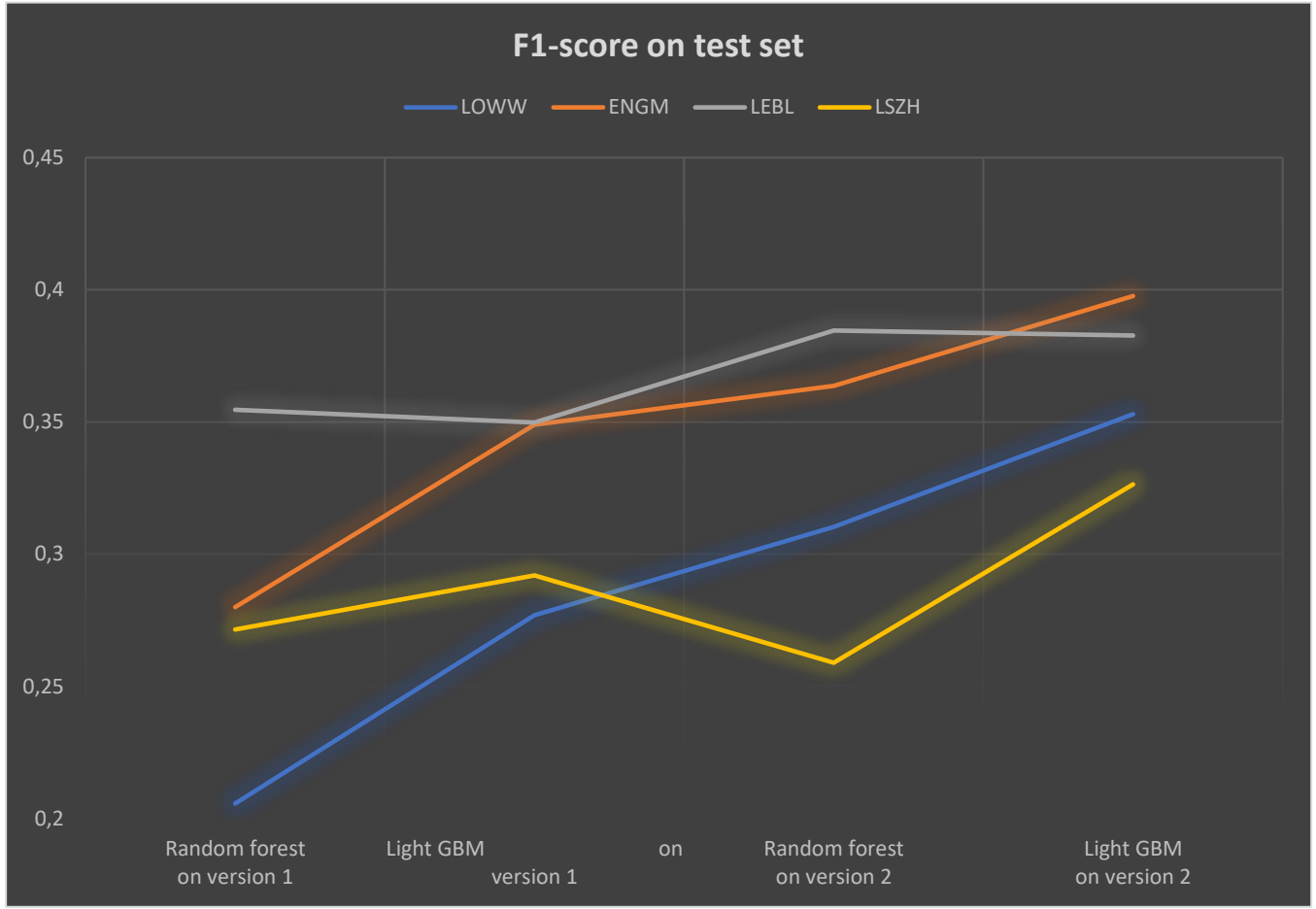
Classes distribution

Arrival model



Arrival

Trained on 227 ICAOS



Legend:

LOWW: Vienna International Airport

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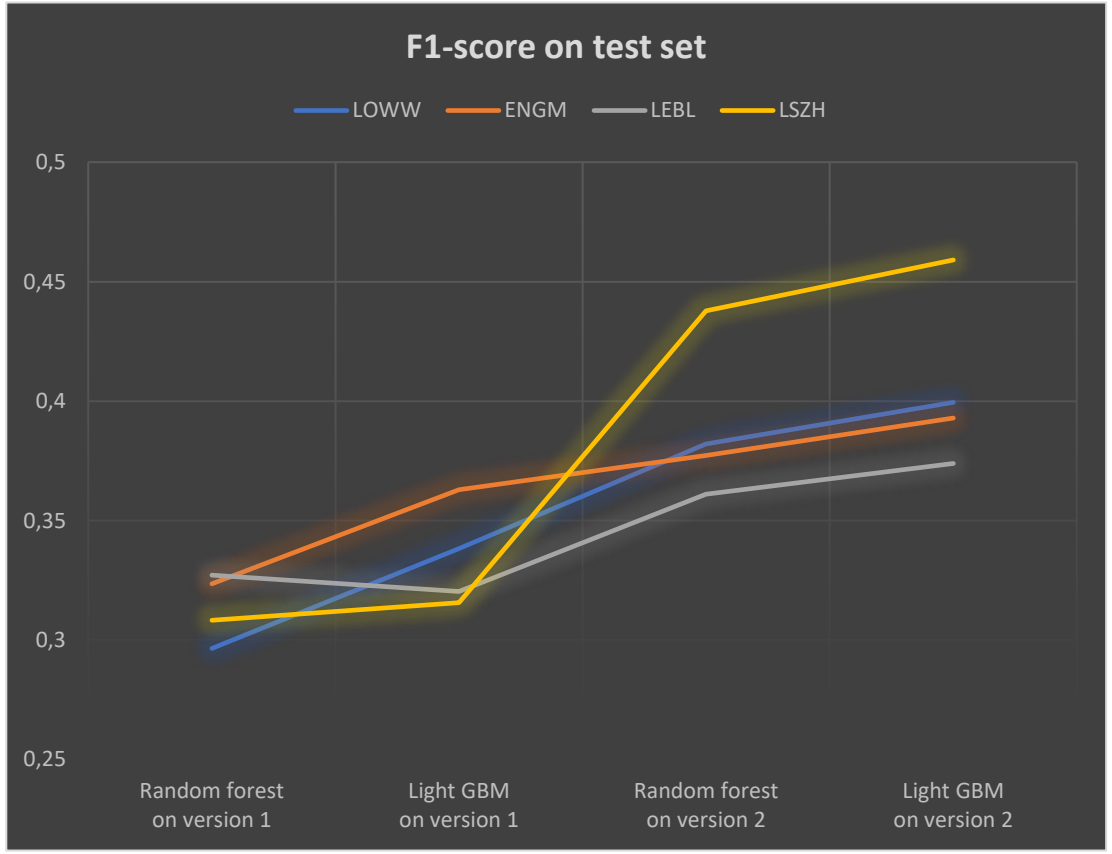
Additional experiments

In order to make a comparison, it was decided to run the same trainings using the same models and datasets on only 10 ICAOs, the most recurring ones within the entire dataset.

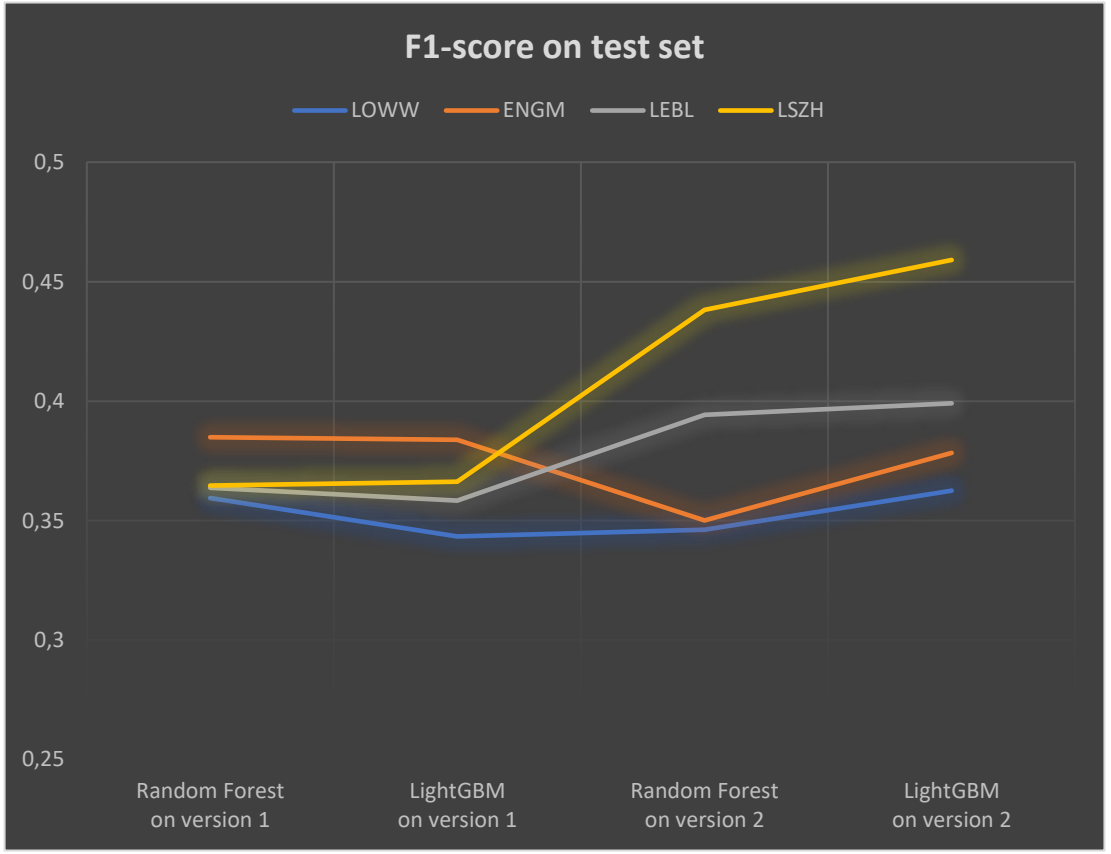
Training on 10 ICAOS: *LSZH, LTBA, LEBL, EKCH, ENGM, LOWW, LTFJ, EGKK, LFPO, ESSA*

Departure

Trained on 227 ICAOS

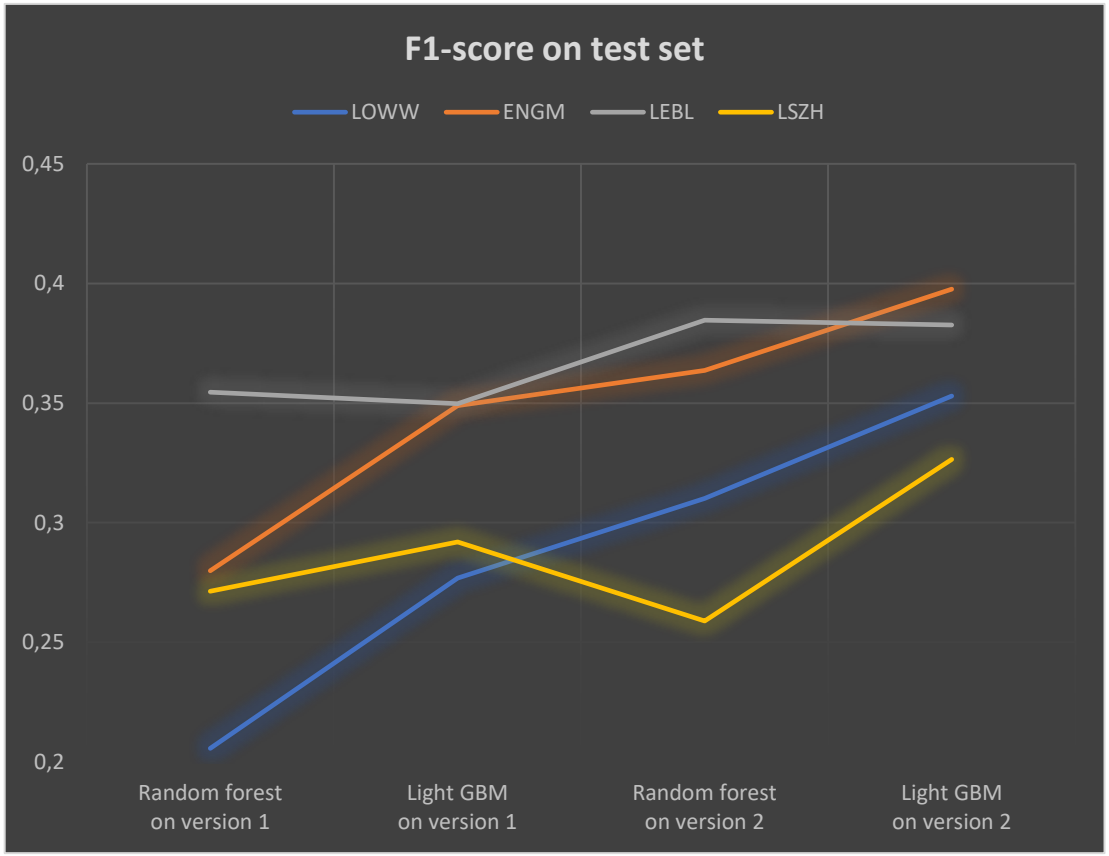


Trained on 10 ICAOS

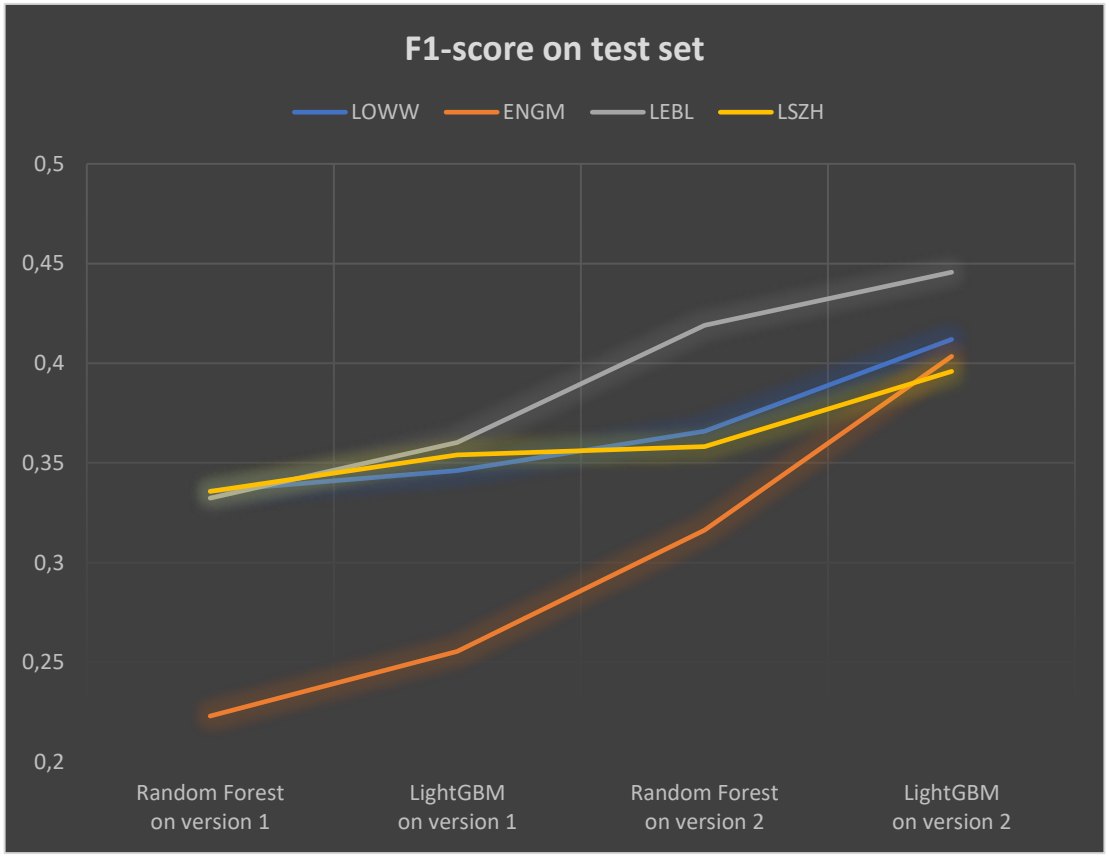


Arrival

Trained on 227 ICAOS



Trained on 10 ICAOS



Analysis

The model should be refined for being used in a real environment. The performance related to some airports should be improved.

Soul Software model's results are comparable with results provided by studies on the same topic as the one presented by Eurocontrol in the 2021

Future developments

The performance should improve through an enrichment of the dataset with weather information, airports features, etc...

Thank you for your attention!