ML Assignment 1 Report

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https://github.com/AlaaAldinHajjar/ML_A1

1- Introduction:

Imagine that you booked a flight to an important event in specific time, unfortunately a delay for the departure time happened and you missed the event, how would you feel about that?

That's why we tried to make a model to predict the flight delay using different ML algorithms, and the best possible results.

2- Dataset:

The Dataset comes from Innopolis University partner company analyzing flights delays. Each entry in the dataset file corresponds to a flight and the data was recorded over a period of 4 years. These flights are described according to 5 variables. A sneck peek of the dataset can be seen in the table below:

Departure Airport	Scheduled departure time	Destination Airport	Scheduled arrival time	Delay (in minutes)
SVO	2015-10-27 09:50:00	JFK	2015-10-27 20:35:00	2.0
OTP	2015-10-27 14:15:00	SVO	2015-10-27 16:40:00	9.0
SVO	2015-10-27 17:10:00	MRV	2015-10-27 19:25:00	14.0
MXP	2015-10-27 16:55:00	SVO	2015-10-27 20:25:00	0.0
...	...	...	...	...

The description of the 5 variables describing each flight are:

Variable name	Description
Departure Airport	Name of the airport where the flight departed. The name is given as airport international code
Scheduled departure time	Time scheduled for the flight take-off from origin airport
Destination Airport	Flight destination airport. The name is given as airport international code
Scheduled arrival time	Time scheduled for the flight touch-down at the destination airport
Delay (in minutes)	Flight delay in minutes

And we can add a new column which is the flight duration in hours and also converted the delay to hours because it is a very important feature.

3- Prepossessing steps:

3-1 Converting the dates:

These time features can be easily be extracted using pandas pandas.Series.dt.

3-2 Add Flight Delay:

We can calculate this from the date time.

3-3 Encode:

We used Ordinal encoder.

3-4 Imputing:

We used simple imputer most frequent.

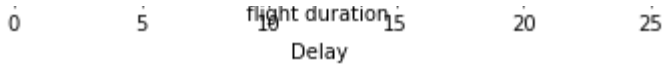
3-5 Outlier Detection & Removal:

In statistics, If a data distribution is approximately normal then about 68% of the data values lie within one standard deviation of the mean and about 95% are within two standard deviations, and about 99.7% lie within three standard deviations.

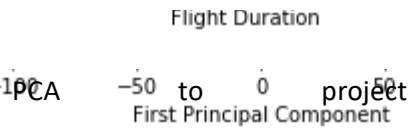
Therefore, if you have any data point that is more than 3 times the standard deviation, then those points are very likely to be anomalous or outliers.

We applied this for delay and flight duration.

Using box plot from sns to visualize the outlier.



4- Visualization:

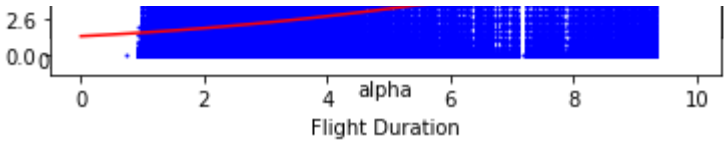


Using PCA to project the data to 2D

5-Models:

test	Simple Linear Regression	Multiple Linear Regression	Lasso with regularization	Ridge with regularization	Polynomial Regression with one feature (flight duration)	Polynomial Regression with all features	Using Neural Networks
MAE	0.1391	0.1506	0.1405	0.1506	0.1390	0.3283	0.0574
MSE	0.0494	0.0516	0.0497	0.0516	0.0494	0.1258	0.0494

RMSE	0.2224	0.2272	0.2230	0.2272	0.2223	0.3548	0.2224
R2-score	-0.0711	-0.1177	-0.0771	-0.1177	-0.0699	-1.7253	-0.0715
train	Simple Linear Regression	Multiple Linear Regression	Lasso with regularization	Ridge with regularization	Polynomial Regression with one feature (flight duration)	Polynomial Regression with all features	Using Neural Networks
MAE	0.1535	0.1521	0.1552	0.1521	0.1535	0.1500	0.1171
MSE	0.0766	0.0761	0.0772	0.0761	0.0766	0.0753	0.0909
RMSE	0.2769	0.2759	0.2779	0.2759	0.2768	0.2744	0.3016
R2-score	0.0074	0.0143	0.0	0.0142	0.0077	0.0253	-0.1776



We can see that most of the models does not over fit except Polynomial Regression with all feature, but at the end non of them have a positive R2 score, so I recommend to gather more data like the events and the plain type.

For polynomial regression the degree was 2.

I think the best model Is the NN because It has the best score overall it contain 3 layers first with 16 N second with 8 third with 1 and the activation is relu optimizer is adam.