Fraud Detection

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Data Analysis

This dataset includes information of financial transactions. The target shows if a transaction is fraud or not. Our task in this project is that detect the fraud transactions using classifications model.

The dataset includes following features:

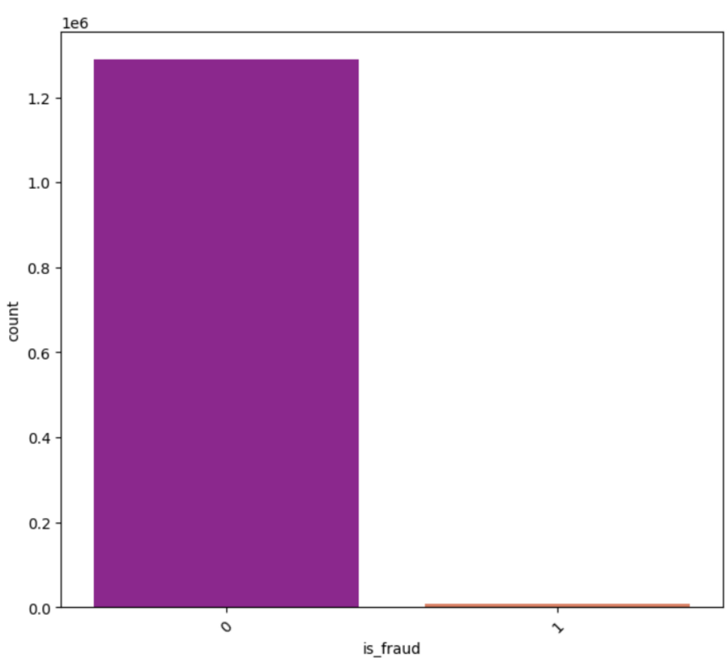
- trans_date_trans_time
- cc_num
- merchant
- category
- amt
- first
- last
- gender
- street
- city
- state
- zip
- lat
- long
- city_pop
- job
- dob
- trans_num
- unix_time
- merch_lat
- merch_long
- is_fraud

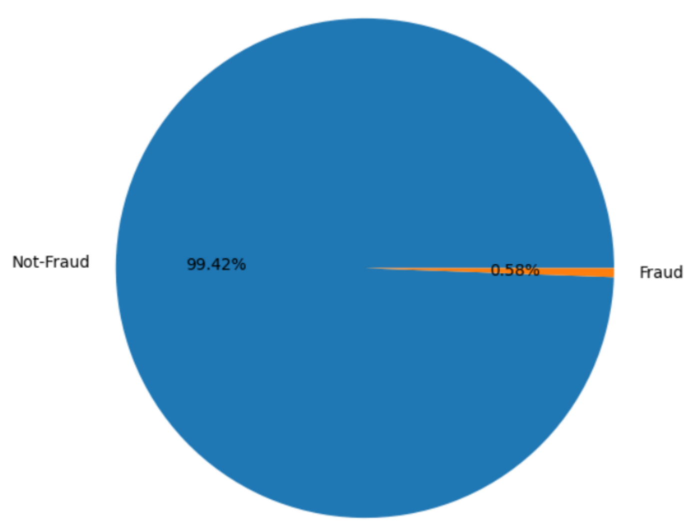
Data Preprocessing

1. **Drop some columns:**
   In this step we eliminated some columns which we thought that are not necessary to predict if a transaction is fraud or not.

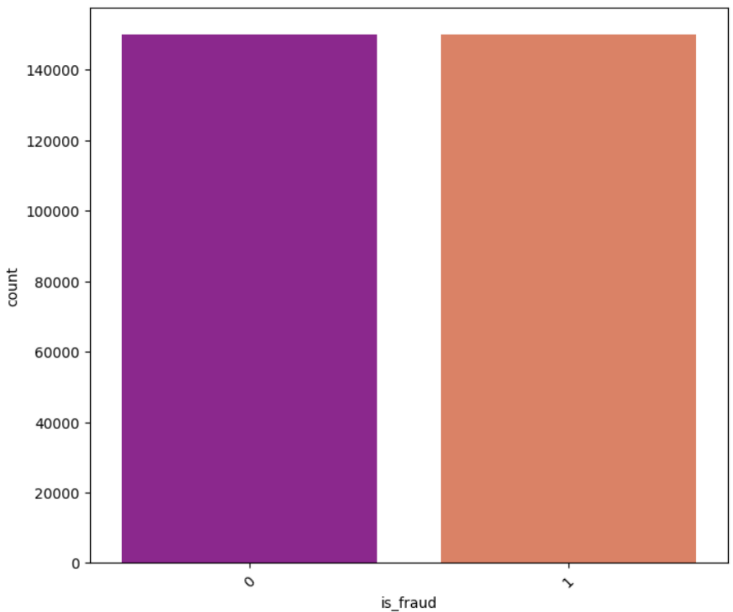
Thes columns are:
First – last – trans_date_trans_time – dob – trans_num
Also, we omitted some features which were highly correlated or which have the same meaning as other features these features includes:
Merch_lat – merch_long – city – state – street

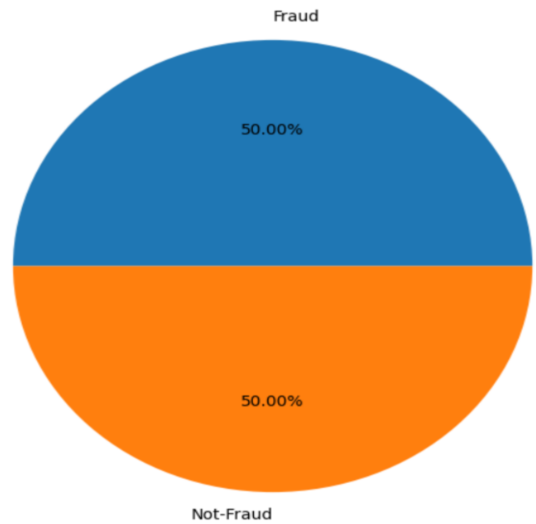
2. **Data Encoding:**
   In this step we have some categorical and some string data that we should change them so that we can give them as input to the model. For *gender* it is obvious that we should use *OneHotEncoder.*
   But for other features consisting of *job, category* and *merchant* we've used count encoding.
3. **Data Balancing:**
   This is the most important step in our preprocessing.
   According to the following plots the target of this dataset is imbalanced.
   So we must use some techniques to balance data. We have used "sklearn" OverSampler and UnderSampler simultaneously.





At the end we have 300000 data record with this portion:





4. Data Scaling:

At the end of preprocessing step we have scaled train and test data.

Model Selection

In this step we should train six kinds of classification models on our data, and we will report the results for each model.

These six models are:

Logistic Regression – SVM – Decision Tree – Random Forest – KNN – Naive Bayes

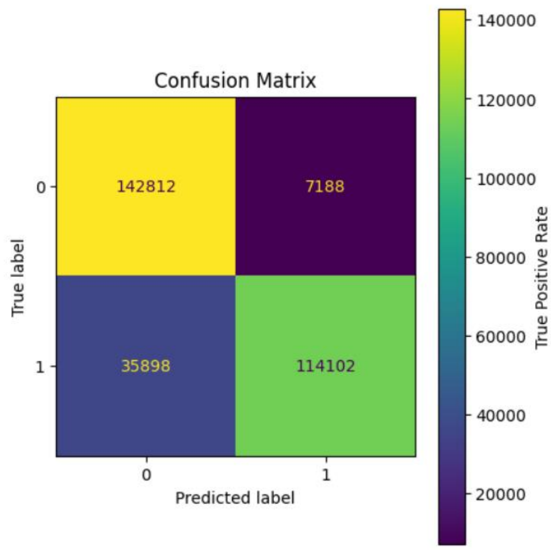
In the following we will report results for each model on the train and test data.

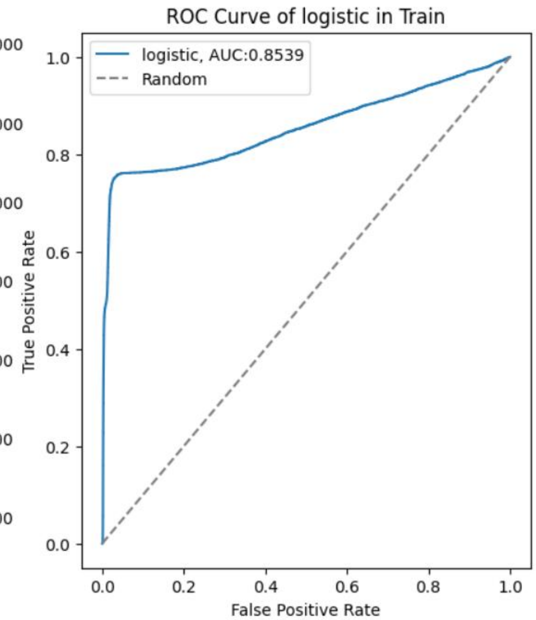
Logistic Regression

Train data:

Accuracy Score: 0.8563
F1 Score: 0.8411
Recall Score: 0.7606

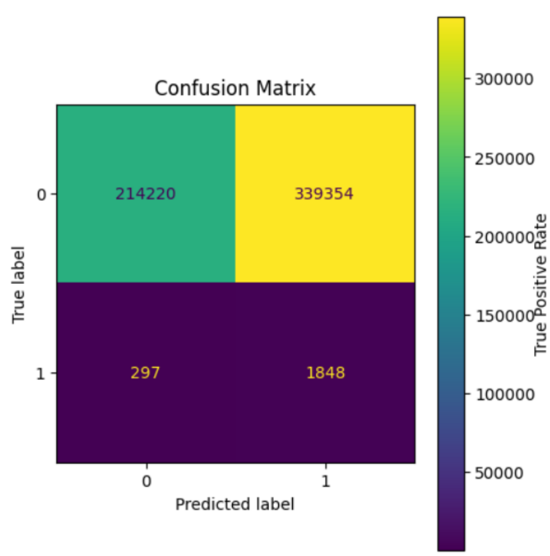
Precision Score: 0.9407
ROC AUC: 0.8538

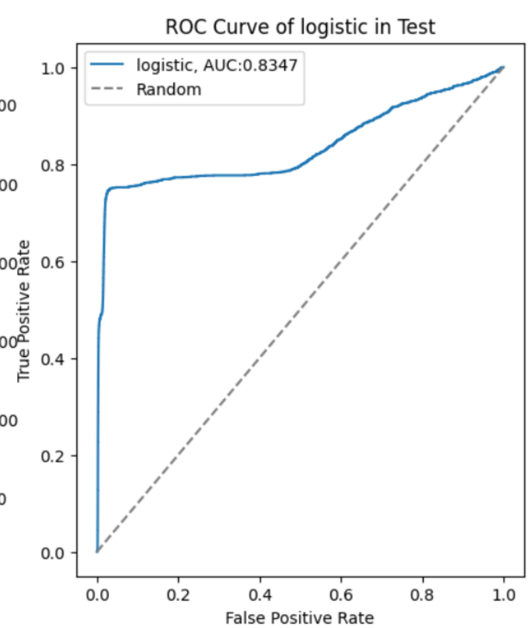




Test data:

Accuracy Score: 0.3888
F1 Score: 0.01076
Recall Score: 0.8615
Precision Score: 0.0054
ROC AUC: 0.8347

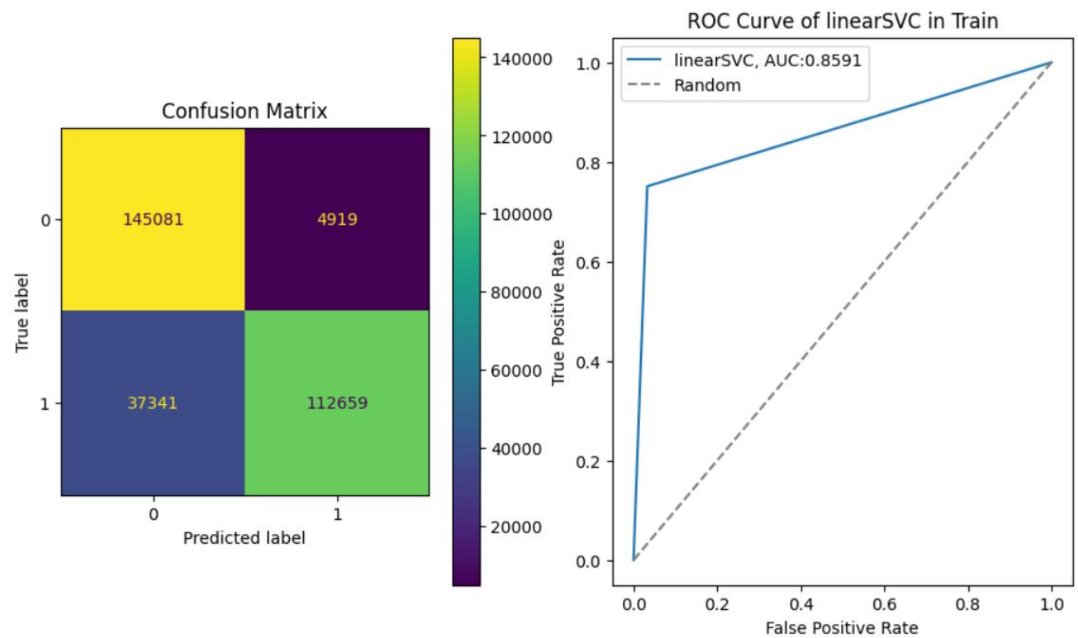




SVM

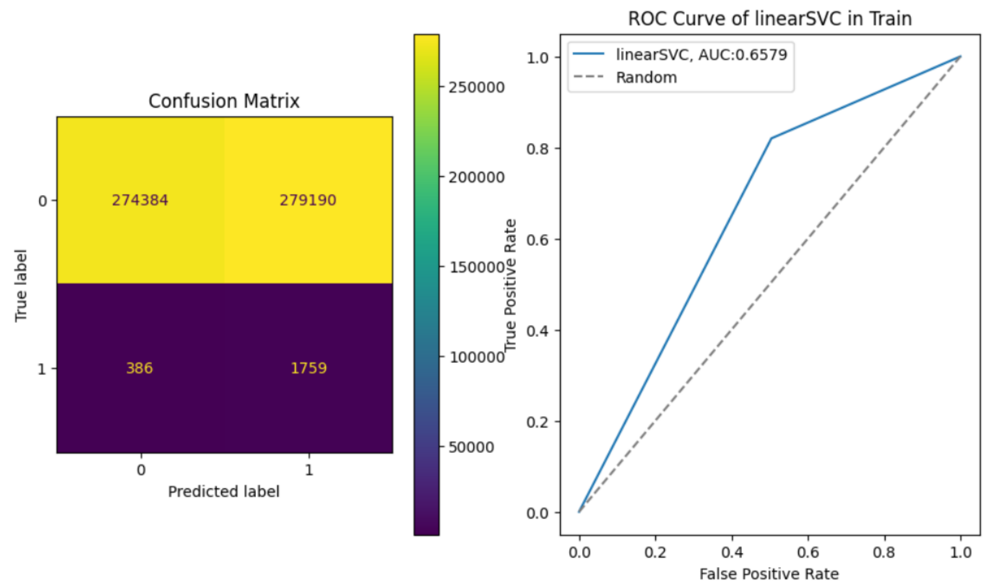
Train data:

Accuracy Score: 0.85913
F1 Score: 0.8420
Recall Score: 0.75106
Precision Score: 0.9581
ROC AUC: 0.8591



Test data:

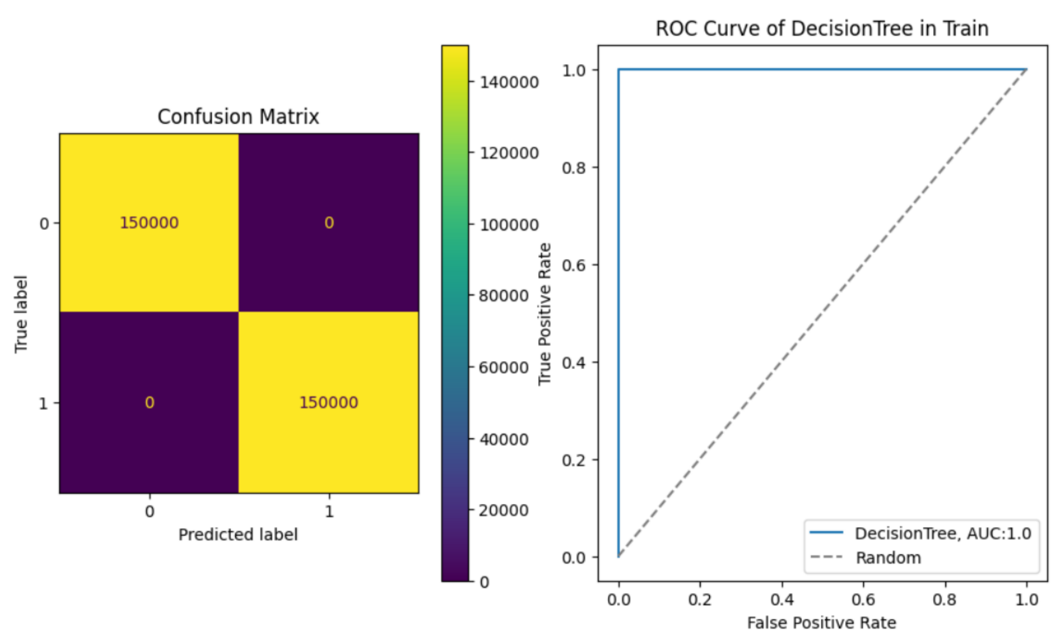
Accuracy Score: 0.4969
F1 Score: 0.012
Recall Score: 0.8200
Precision Score: 0.0062
ROC AUC: 0.6578



Decision Tree

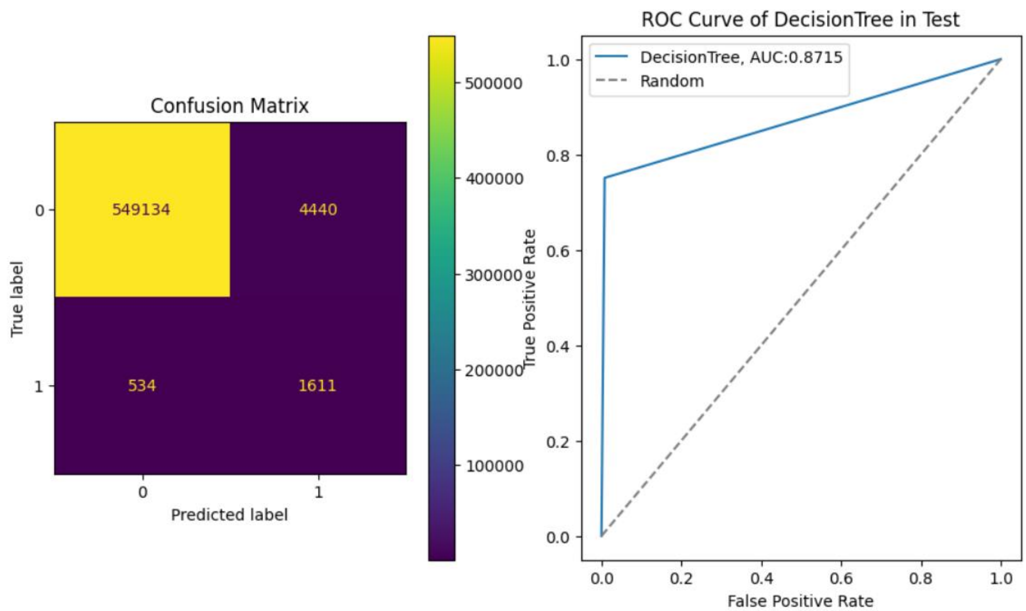
Train data:

Accuracy Score: 1.0
F1 Score: 1.0
Recall Score: 1.0
Precision Score: 1.0
ROC AUC: 1.0



Test data:

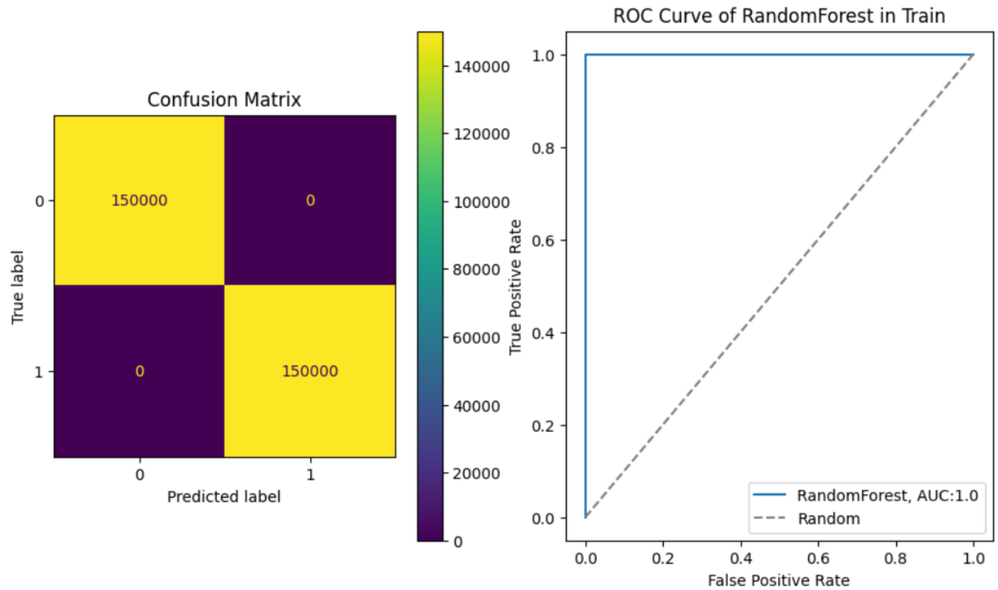
Accuracy Score: 0.9910
F1 Score: 0.3931
Recall Score: 0.7510
Precision Score: 0.2662
ROC AUC: 0.8715



Random Forest

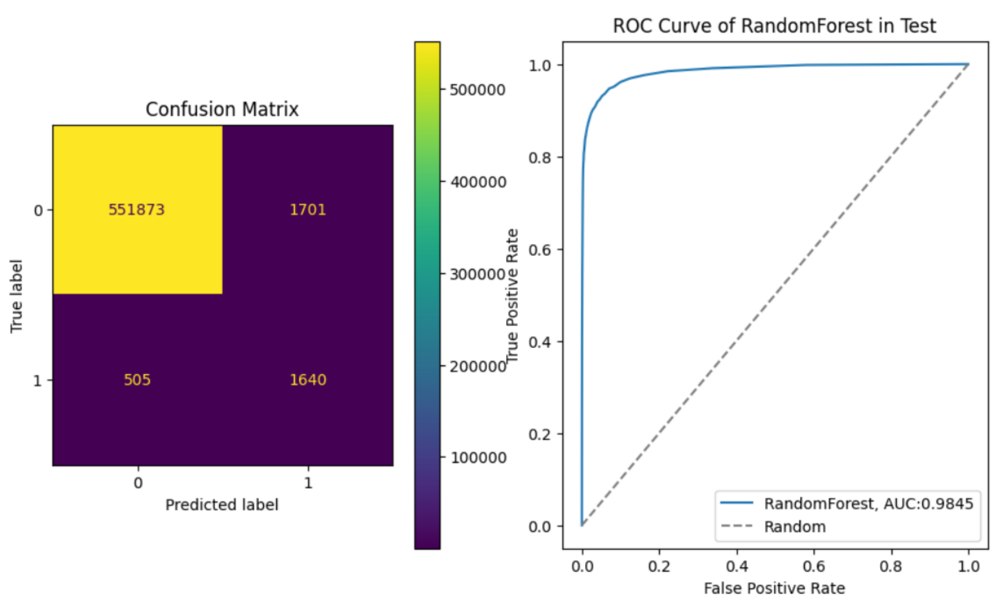
Train data:

Accuracy Score: 1.0
F1 Score: 1.0
Recall Score: 1.0
Precision Score: 1.0
ROC AUC: 1.0



Test data:

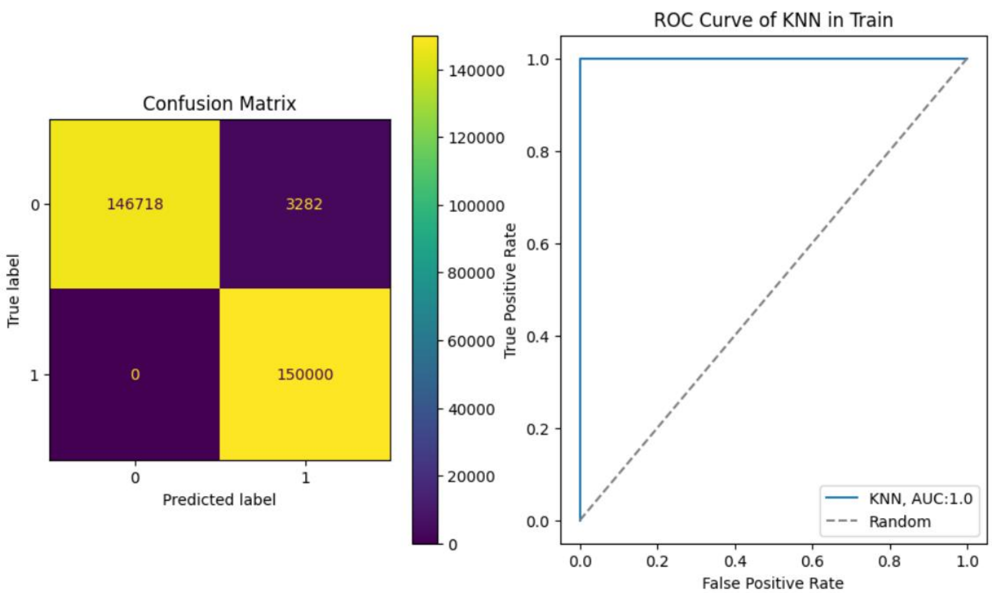
Accuracy Score: 0.9960
F1 Score: 0.5978
Recall Score: 0.7645
Precision Score: 0.4908
ROC AUC: 0.9845



KNN

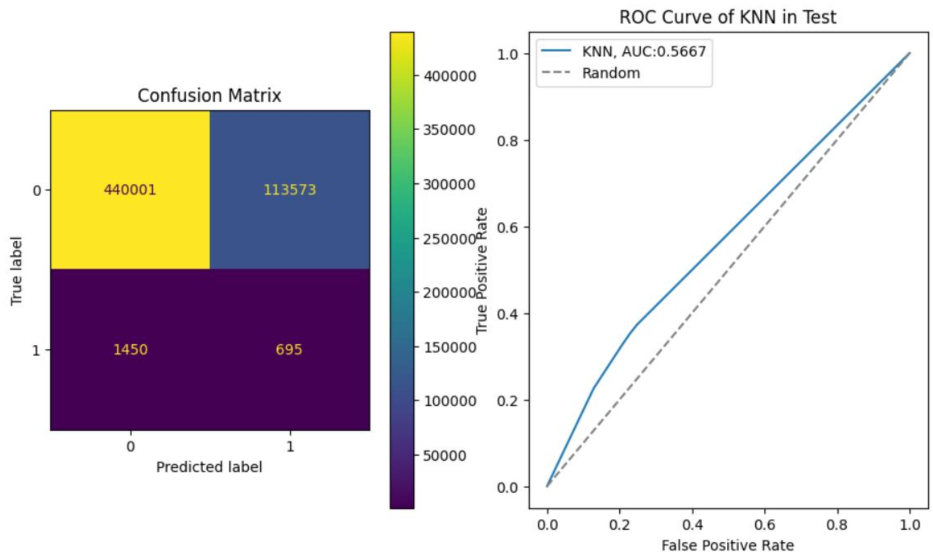
Train data:

Accuracy Score: 0.98906
F1 Score: 0.9891783884305696
Recall Score: 1.0
Precision Score: 0.9785884839707206
ROC AUC: 1.0



Test data:

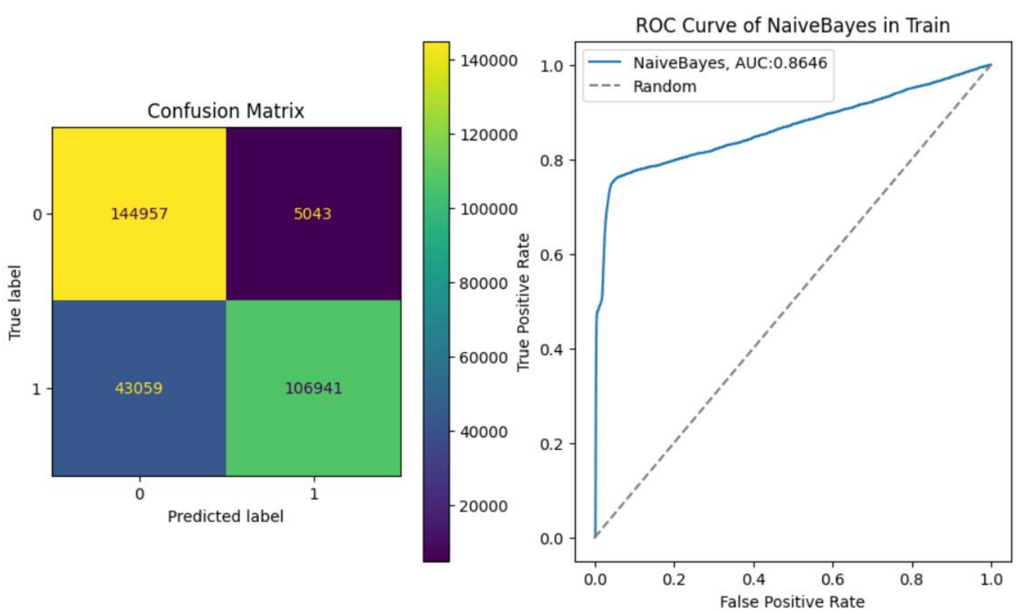
Accuracy Score: 0.7930194936649637
F1 Score: 0.011940247223248263
Recall Score: 0.32400932400932403
Precision Score: 0.006082192739874681
ROC AUC: 0.566735887128644



Naive Bayes

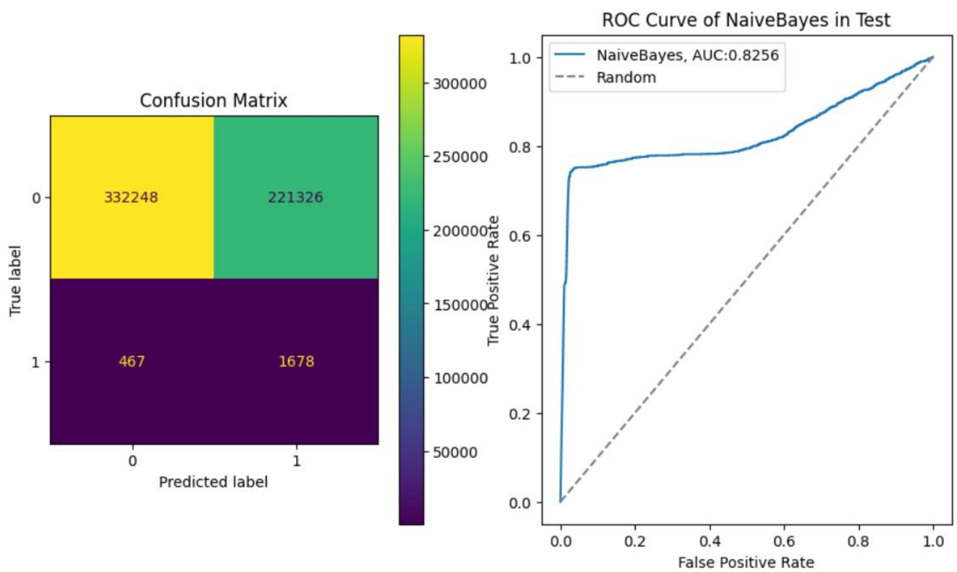
Train data:

Accuracy Score: 0.83966
F1 Score: 0.8163933675338951
Recall Score: 0.71294
Precision Score: 0.9549667809687098
ROC AUC: 0.8645951737333334



Test data:

Accuracy Score: 0.6008900181566583
F1 Score: 0.014905684679923073
Recall Score: 0.7822843822843822
Precision Score: 0.007524528708005238
ROC AUC: 0.8256198523579219



It is obvious that *Decision Tree* and *Random Forest* has the most accuracy and f1. So the results for these models are the best and *Logistic Regression* has the worst performance.