Data preprocessing and cleaning

- Delete all date-related columns in loan_default_data.xlsx; the remaining 27 features.
- Convert loan_default_data.xlsx to CSV format file and renamed to **data.csv** [*total data **38480**: 25 features not including column id and repay_fail*].
  File: dataclean.jpynb
- R1 - File data.csv imported to **dataclean.jpynb**.
- R2 - take out all null rows [*total data **37426***].
- R3 – check data types for all features to find which is not int/float
- R4 – count all variables in features that is not numeric.
- R5 – take out any string or symbol in features & change string variables to numeric variables & convert the features data type to int/float.

term: take out month	home_ownership: mortage = 0 none = 1 other = 2 own = 3 rent = 4	verification_status: Verified = 0 Not Verified = 1 Source Verified = 2	loan_status: Charged Off = 0 Current = 1 Default = 2 Does not meet the credit policy. Status: Charged Off = 3 Does not meet the credit policy. Status: Fully Paid = 4 Fully Paid = 5 In Grace Period = 6 Late (16-30 days) = 7 Late (31-120 days) = 8	purpose: small_business=0 credit_card=1 other=2 home_improvement=3 debt_consolidation=4 house=5 educational=6 major_purchase=7 renewable_energy=8 moving=9 wedding=10 vacation=11 medical=12 car=13	revolving_utillization: take out "%"

- R6 – save data set as **cleanData.csv** [total data 37426].
- R7 – randomly take out sample 0=2000 & 1=500 and save as **Book25features.csv** [*total data **2500**: 25features not including column id and repay_fail*] – this will be used as sample to test the model prediction.
- R8 - Save the remaining data (data - sample) as **remainingdata.csv** [*total data **34926**: 25features not including column id and repay_fail*].

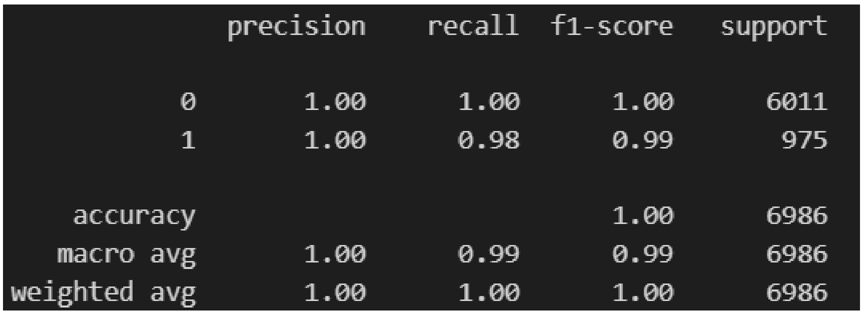
Training, testing and evaluation

File: RF25feature.jyp

- R1 - import remainingdata.csv.
- R2 - count how repay_fail variable (0 and 1) to see if the data balance or not – imbalanced data.

```
repay_fail
0    29836
1     5090
```

- R3 – use heatmap; to see relationships between two variables. Observe if there are any patterns in value for one or both variables.
- R4 - split data to train and test with test size 0.2.
- R5 - Train the model using the training data.
- R6 - evaluates the performance of a classification model using a confusion matrix and calculates the accuracy score.
- R7 - evaluates the performance of your classification model using a Receiver Operating Characteristic (ROC) curve.
- R8 - Print a detailed classification report.



```
              precision    recall  f1-score   support

           0       1.00      1.00      1.00      6011
           1       1.00      0.98      0.99       975

    accuracy                           1.00      6986
   macro avg       1.00      0.99      0.99      6986
weighted avg       1.00      1.00      1.00      6986
```

- R9 - save trained model named “**modelDataInbalance_25features**”

File: RF9feature.jyp

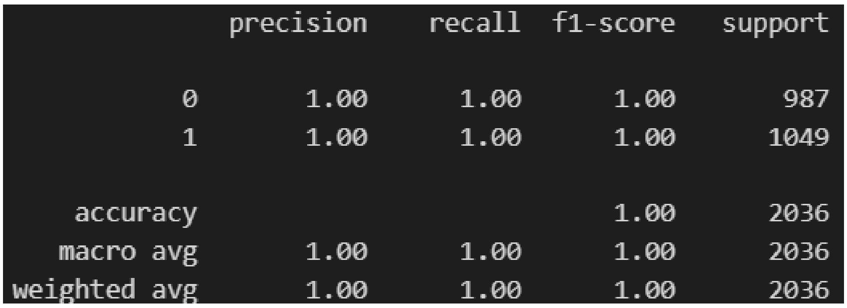
- R1 - import remainingdata.csv.
- R2 - count how repay_fail variable (0 and 1) to see if the data balance or not – imbalanced data.

```
repay_fail
0    29836
1     5090
```

- R3 - Downsample the majority class to match the number of samples in the minority class - balance the data

```
repay_fail
1    5090
0    5090
```

- R4 - drop features that is has low relationships between two variables: no linear relationship between the variables by referring to heatmap in R5 – [9 remaining features].
- R5 – use heatmap; to see relationships between two variables. Observe if there are any patterns in value for one or both variables.
- R6 - split data to train and test with test size 0.2.
- R7 - Train the model using the training data.
- R8 - evaluates the performance of a classification model using a confusion matrix and calculates the accuracy score.
- R7 - evaluates the performance of your classification model using a Receiver Operating Characteristic (ROC) curve.
- R8 - Print a detailed classification report



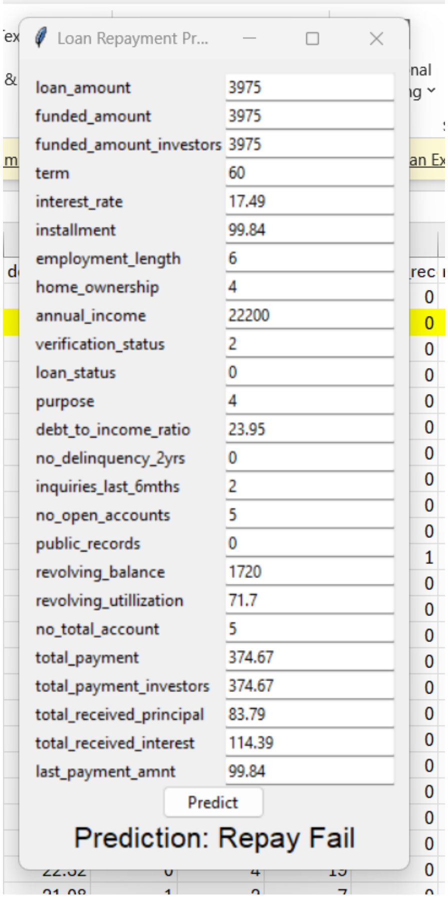
```
              precision    recall  f1-score   support

           0       1.00      1.00      1.00       987
           1       1.00      1.00      1.00      1049

    accuracy                           1.00      2036
   macro avg       1.00      1.00      1.00      2036
weighted avg       1.00      1.00      1.00      2036
```

- R9 - save trained model named “**modelDataBalance_9features**”

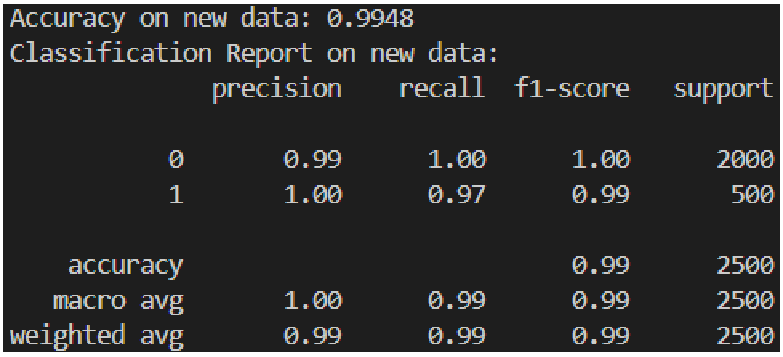
Gui 25 features



loan_amount 3975
funded_amount 3975
funded_amount_investors 3975
term 60
interest_rate 17.49
installment 99.84
employment_length 6
home_ownership 4
annual_income 22200
verification_status 2
loan_status 0
purpose 4
debt_to_income_ratio 23.95
no_delinquency_2yrs 0
inquiries_last_6mths 2
no_open_accounts 5
public_records 0
revolving_balance 1720
revolving_utillization 71.7
no_total_account 5
total_payment 374.67
total_payment_investors 374.67
total_received_principal 83.79
total_received_interest 114.39
last_payment_amnt 99.84

Prediction: Repay Fail

-
- Using **AutoEvaluation25features.py** to test the sample data **Book25features.csv** that consist 2500 with 25 features data that never been uses for train & test in model prediction.



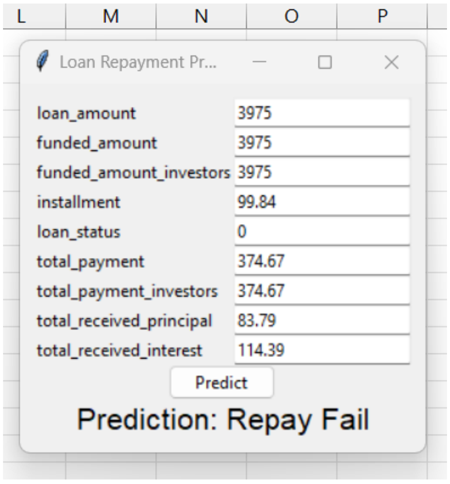
```
Accuracy on new data: 0.9948
Classification Report on new data:
              precision    recall  f1-score   support

           0       0.99      1.00      1.00      2000
           1       1.00      0.97      0.99       500

    accuracy                           0.99      2500
   macro avg       1.00      0.99      0.99      2500
weighted avg       0.99      0.99      0.99      2500
```

- The accuracy is 0.9948.

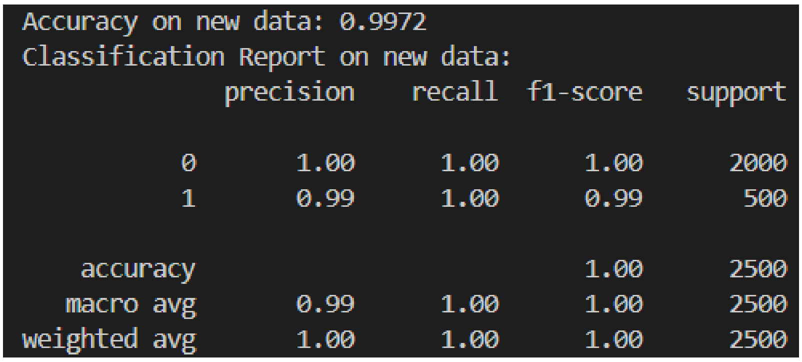
Gui 9 features



loan_amount	3975
funded_amount	3975
funded_amount_investors	3975
installment	99.84
loan_status	0
total_payment	374.67
total_payment_investors	374.67
total_received_principal	83.79
total_received_interest	114.39

Prediction: Repay Fail

-
- Using **AutoEvaluation9features.py** to test the sample data **Book9features.csv** that consist 2500 with 9 features data that never been uses for train & test in model prediction.



```
Accuracy on new data: 0.9972
Classification Report on new data:
              precision    recall  f1-score   support

           0       1.00      1.00      1.00      2000
           1       0.99      1.00      0.99       500

    accuracy                           1.00      2500
   macro avg       0.99      1.00      1.00      2500
weighted avg       1.00      1.00      1.00      2500
```

- The accuracy is 0.9972.