Credit Card Model | Fraud Detection

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Summary

Overview:

This dataset contains credit card transactions in September 2013 by European cardholders.

Purpose:

The goal is to detect fraudulent and non fraudulent transactions.

Objectives:

1] Data Analysis
2] Data Visualization
3] Data Preprocessing
4] Model Implementation5] Future Improvements
6] Learning Outcomes

Overview of Dataset

- This dataset has 28 numerical input variables as the result of a PCA transformation.
- The other inputs that have not been transformed are 'Time' and 'Amount'.
- The variable 'Time' contains the seconds elapsed between each transaction and the first transaction in the dataset.
- The variable 'Amount' is the transaction Amount.
- The variable 'Class' is the response variable and it takes value 1 in case of fraud and 0 otherwise.

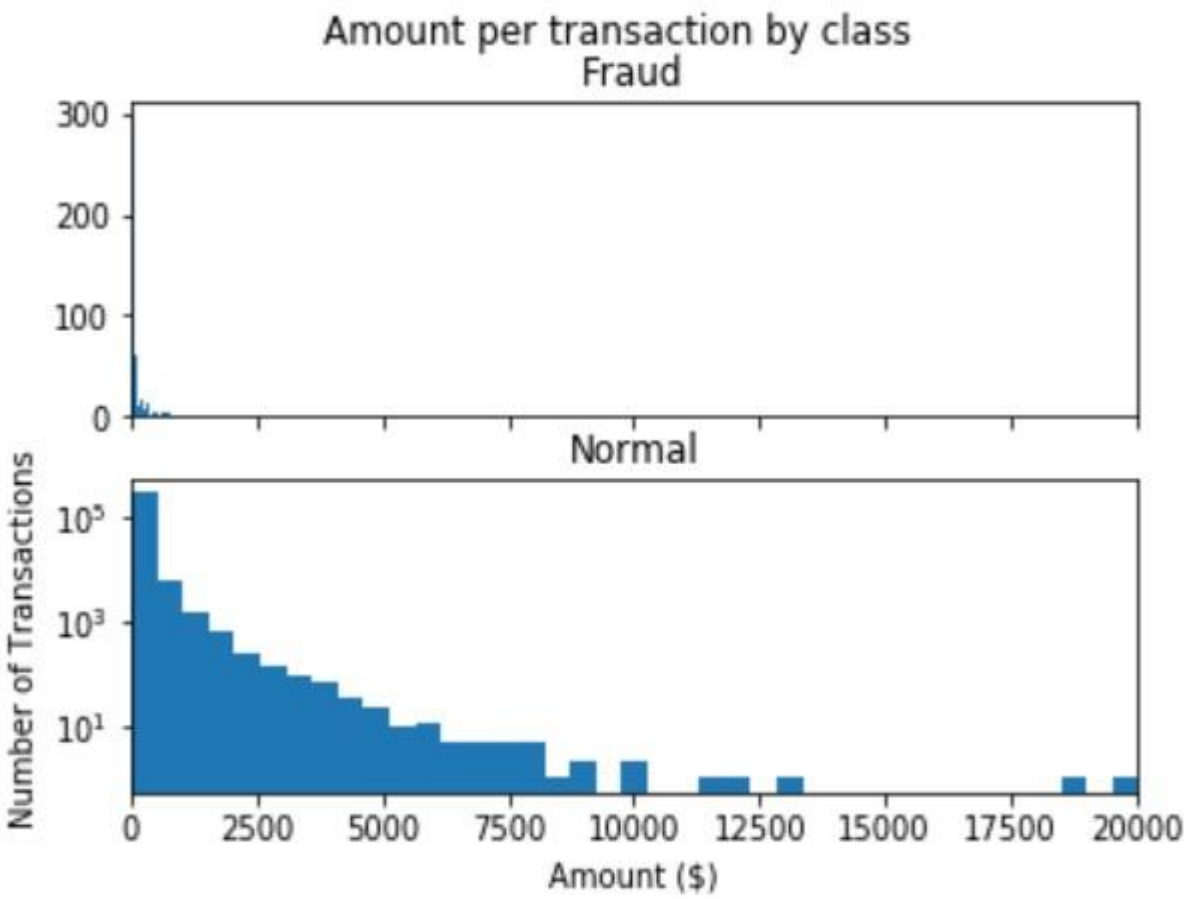
Data Analysis and Data Cleaning

Simple checkpoints:

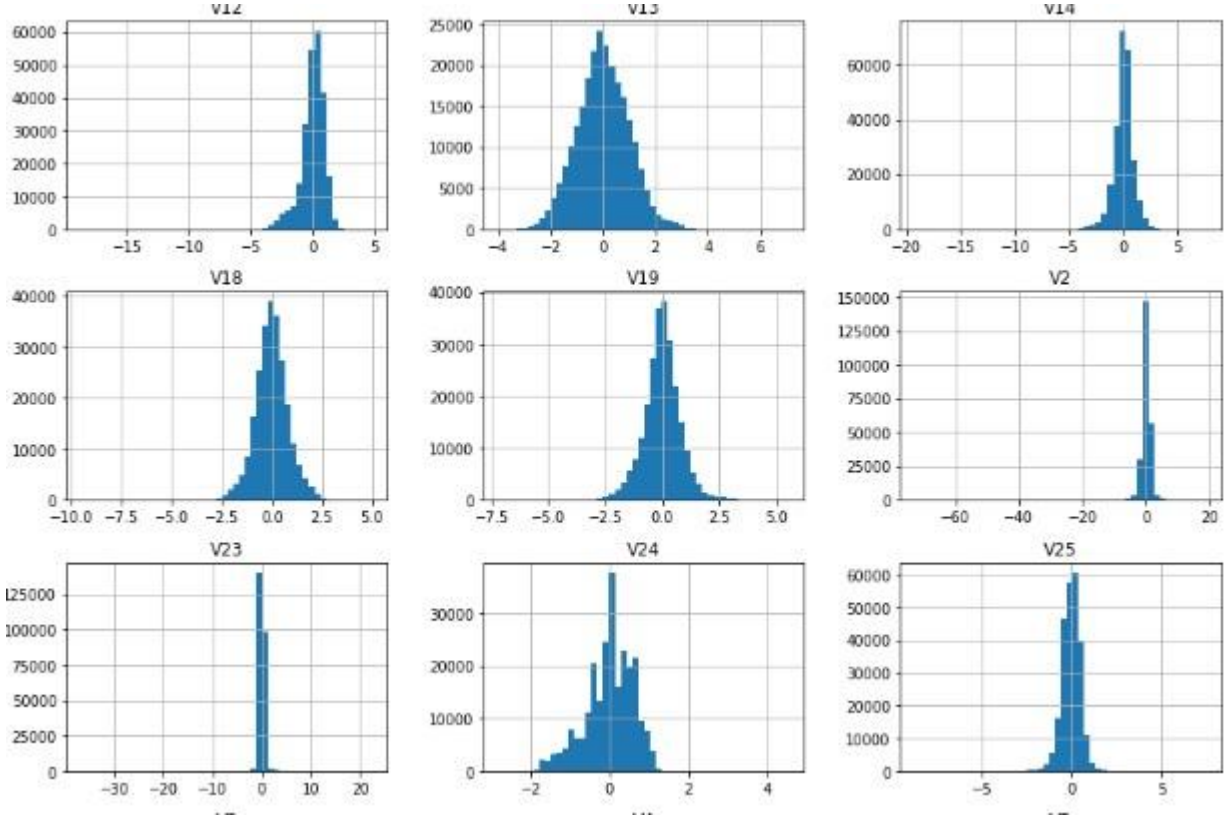
- Missing values- checked for missing values in dataset
- Unique values- checked for unique values of transaction id

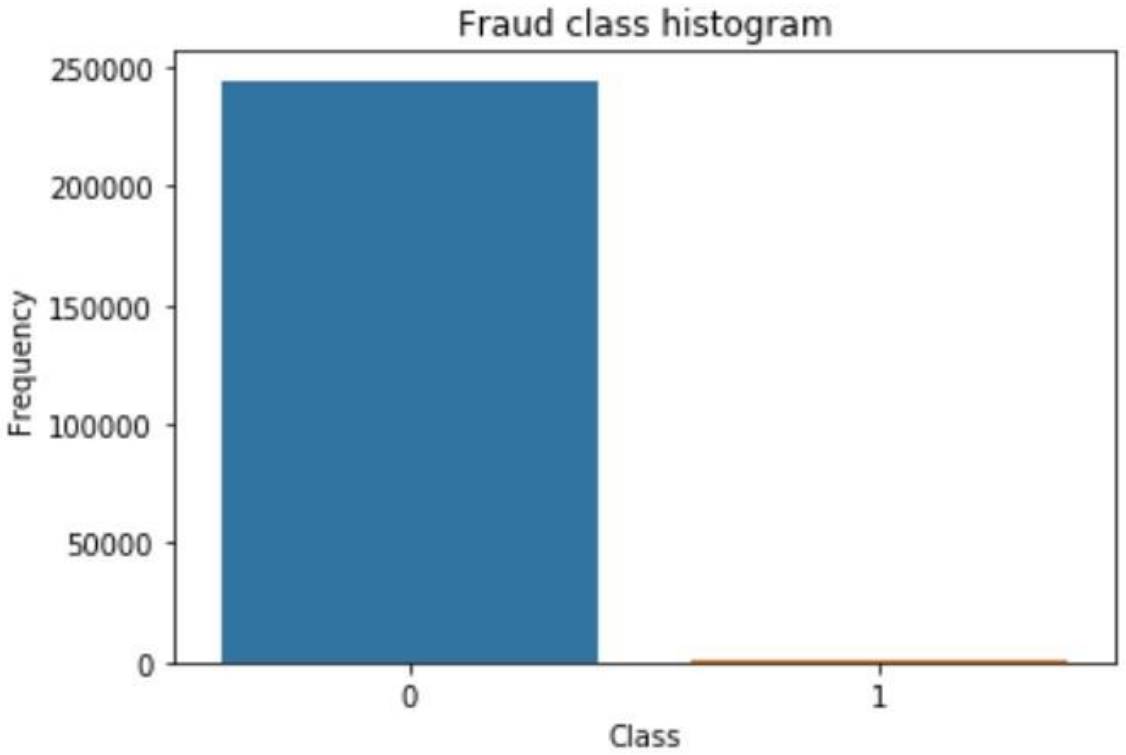
Statistical Analysis:

- There is no metadata about the original features provided, so pre-analysis or feature study could not be done.
- The transaction amount is relatively small.
- The mean of all the amounts made is approximately USD 88.
- The maximum transaction amount is USD 25691.



Data Visualization





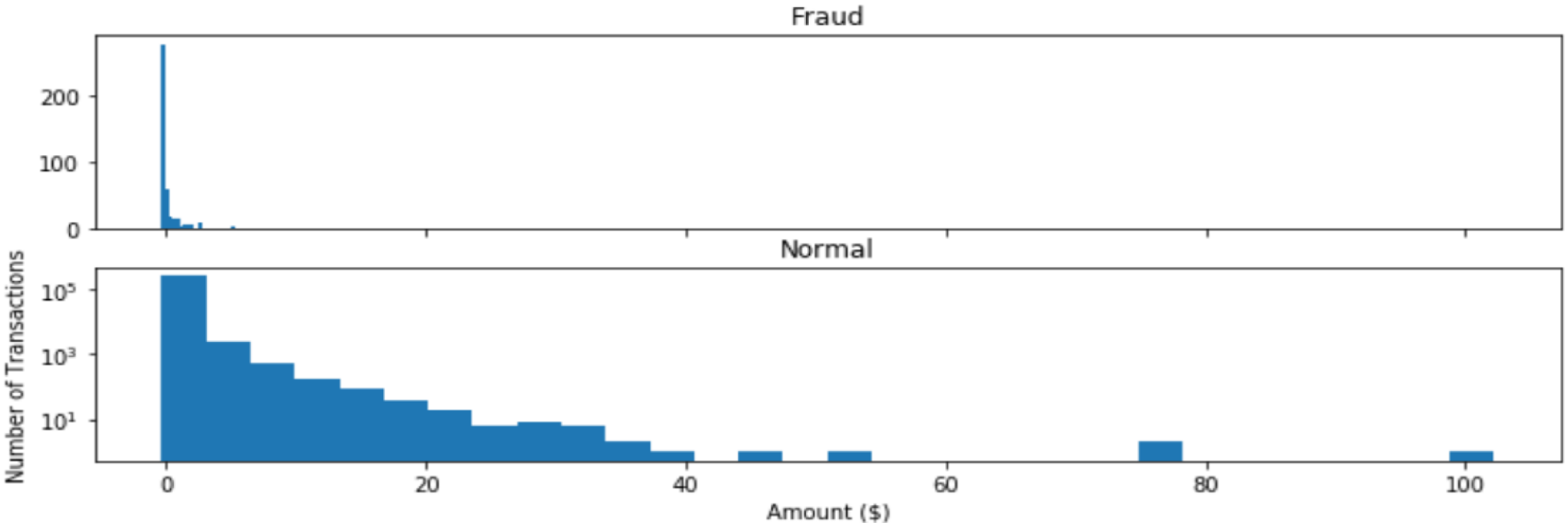
Observations:

- All the PCA transformed features are scaled
- Amount and Time input are not scaled
- In fig 2. we can see that most of the transactions(99.9%) are non –fraud and very few(0.172%) are fraud

Data Preprocessing

Scaling:

- As observed from histograms most of the features are scaled except Amount and Time
- I have scaled the Amount column and created new column norm_amount
- Dropped Time, Amount, ID columns
- In the fig. we can see number of transactions v/s for Fraud and Non- Fraud Categories



Data Preprocessing

Need of sampling :

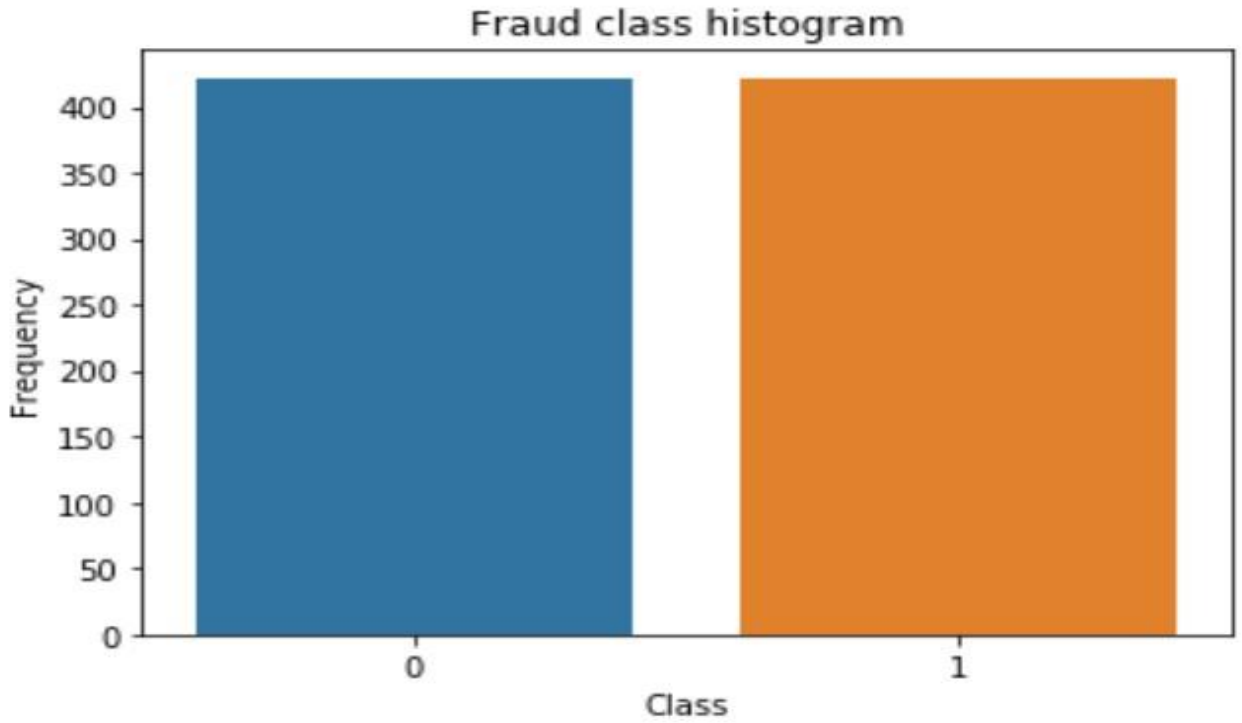
- Fit logistic regression on imbalanced dataset
- Got accuracy of 99.9% But it's not true.
- As most of the labels 0, even random guess gives 99% accuracy.
- So use Recall as a accuracy measure which measures the ability of model to predict right for a given label.
- Recall is very Low 64.814%

```
Logistic Regression Cross Validation Score(Recall):  60.16%
Recall: 0.6481481481481481
Log Loss: 0.021162677654140833
Precision: 0.9090909090909091
Accurcay: 0.9993872799313753
AUC:  0.8240263478860329
F1 Score: 0.7567567567567568
Confusion matrix:
 [[73328     7]
 [   38    70]]
```

Data Preprocessing

Under sampling:

- Under sampling is one of the techniques used for handling class imbalance.
- In this technique, we under sample majority class to match the minority class and make sure that the training data has equal amount of fraud and non-fraud samples.
- In the fig we can see that training dataset has equal number of fraud and non-fraud Transactions.



Feature Selection

Filter Method using correlation:

- If we try to correlate class and features on imbalanced dataset then it will be of no use because we will not see true correlations of features with result.
- Try correlating class and features on under sampled dataset
- Fitted the model with best possible features
- But it resulted in poor performance

```
#negative correlations smaller than -0.5
corr = under_sample.corr()
corr = corr[['Class']]
corr[corr.Class < -0.6]
```

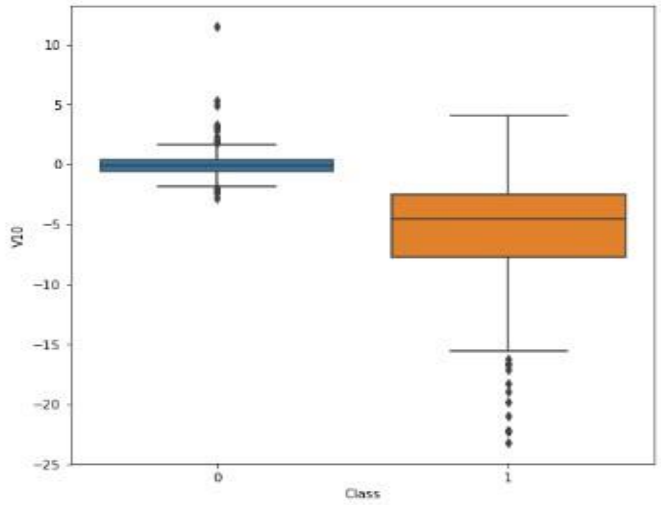
	Class
V10	-0.625164
V12	-0.681065
V14	-0.740324

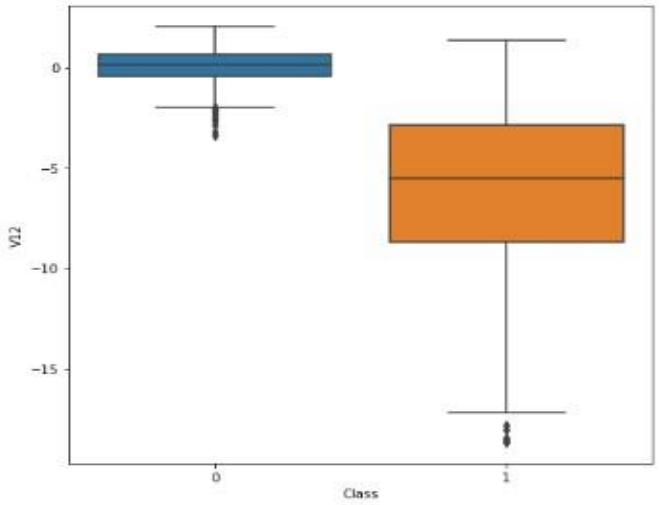
```
#positive correlations greater than 0.5
corr[corr.Class > 0.6]
```

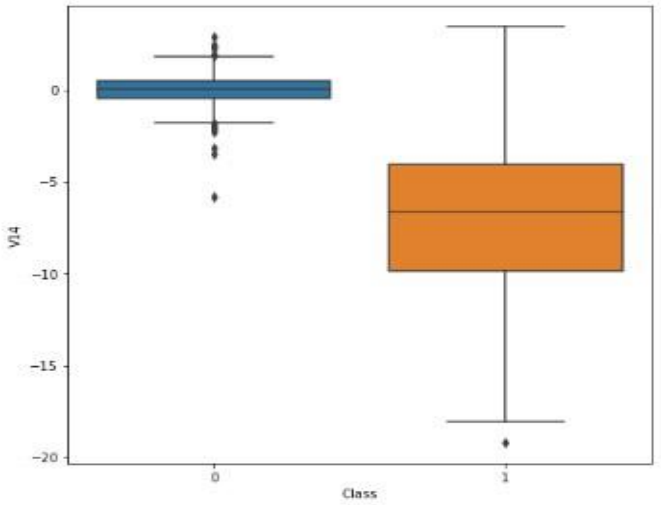
	Class
V4	0.708450
V11	0.686299
Class	1.000000

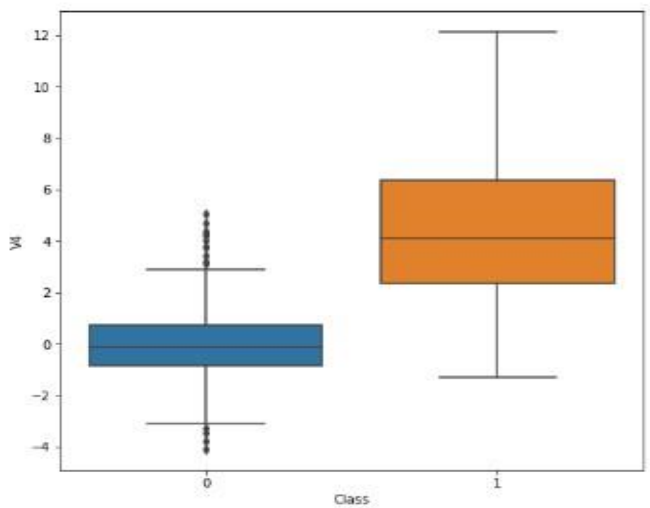
Box plots

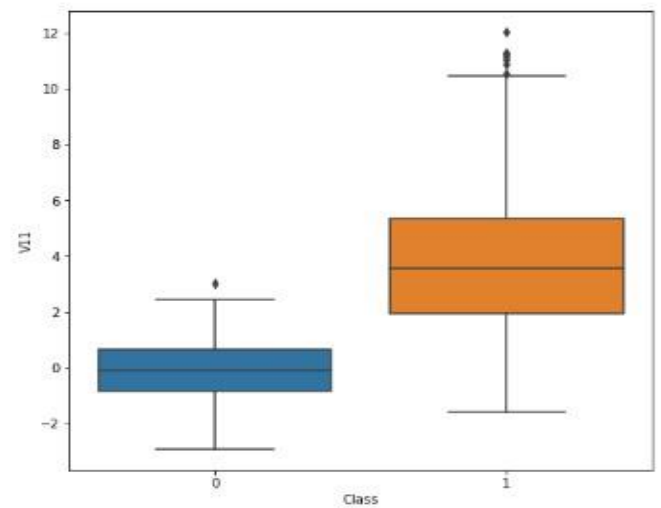
Features With High Correlation











Model Implementation

1] Logistic regression on imbalanced dataset

2] Logistic regression using class_weight: scikit-learn logistic regression has a option named class_weight when specified does class imbalance handling implicitly.

3] Logistic regression with tuning parameters[0.001, 0.1,1,10]

4] Decision Tree Classifier

Summary of models

Summary of models.

On logistic regression with c=0.1 its give

```
Logistic Regression Cross Validation Score(Recall):  88.99
Recall: 0.9047619047619048
Log Loss: 0.6154710192142357
Precision: 0.08428390367553866
Accurcay: 0.9829242887070913
AUC:  0.9439104496610123
F1 Score: 0.15420289855072467
Confusion matrix:
 [[83851  1445]
 [   14   133]]
```

Future Improvements

- More techniques can be explored for sampling like Over sampling, SMOTE
- In depth analysis for outlier detection
- Explore different techniques for feature selection
- Explore different machine learning algorithms like Random Forest Classifier, Support Vector etc
- Explore classification by changing threshold

Learning Outcomes

- Dealing with imbalanced dataset

- Learned analyzing and processing large dataset

- Implemented and interpreted some good visualizations

- Implemented various machine learning algorithm and evaluated their performances based on various accuracy metrics

Thank you!