Predicting Loan Approval for a Customer

By Avi Hritwik

1. Introduction

1.1 Background

In present days a lot of people apply for loans as it is a convenient way to fulfil their necessary requirements. And most of the bank have a lengthy process to approve their customer's loan, so this is advantageous to predict approval of
loan for a customer in a short time. So that the customer have a idea about their request.

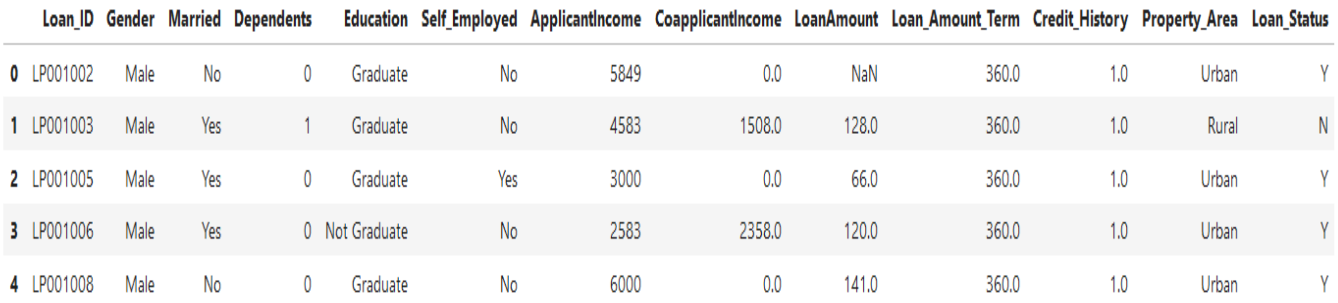
1.2 Problem

Data that might contribute to determine loan approval for a customer might include his credit history, Income, Gender (as there are many schemes provided for different gender), Education and income of co applicant. This project aims to predict whether a loan will be approved based on these data.

1.3 Interest

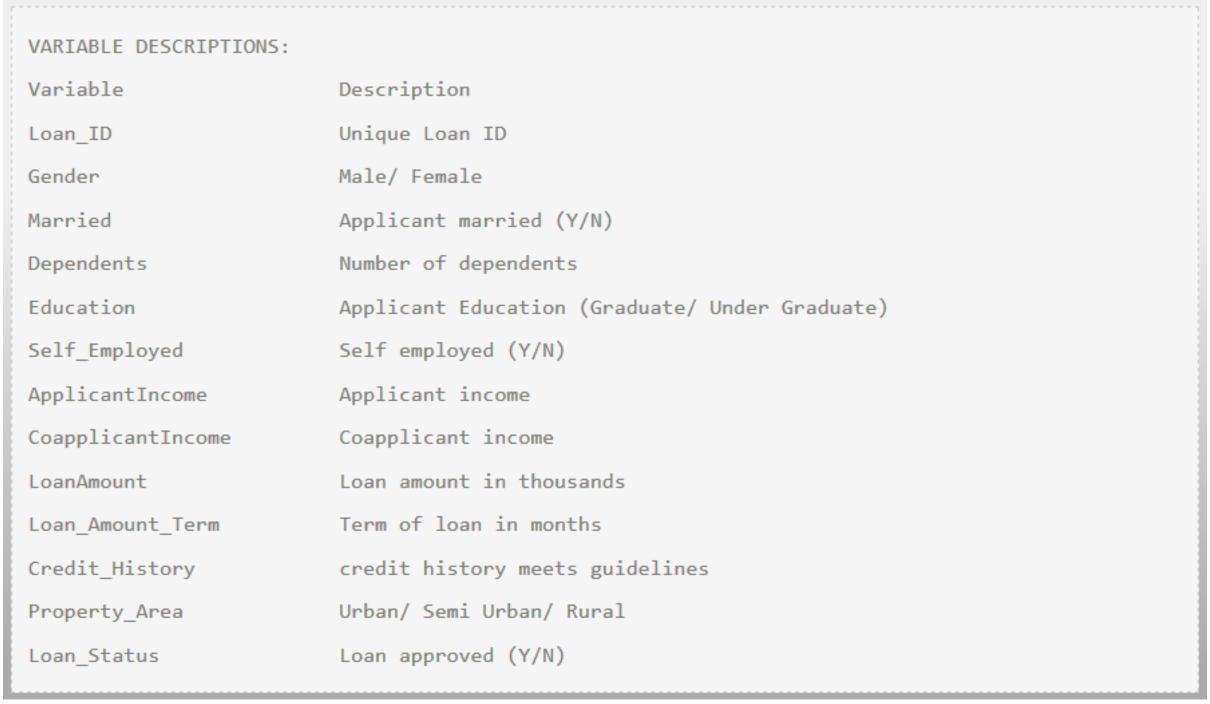
The loan company will be interested in accurate prediction of loan approval as it will help them provide a better and confident service to their customer. And even customer will be able to know about their status.

2. Data



	Loan_ID	Gender	Married	Dependents	Education	Self_Employed	ApplicantIncome	CoapplicantIncome	LoanAmount	Loan_Amount_Term	Credit_History	Property_Area	Loan_Status
0	LP001002	Male	No	0	Graduate	No	5849	0.0	NaN	360.0	1.0	Urban	Y
1	LP001003	Male	Yes	1	Graduate	No	4583	1508.0	128.0	360.0	1.0	Rural	N
2	LP001005	Male	Yes	0	Graduate	Yes	3000	0.0	66.0	360.0	1.0	Urban	Y
3	LP001006	Male	Yes	0	Not Graduate	No	2583	2358.0	120.0	360.0	1.0	Urban	Y
4	LP001008	Male	No	0	Graduate	No	6000	0.0	141.0	360.0	1.0	Urban	Y

This is the sample of data set I am going to use for this model.



```
VARIABLE DESCRIPTIONS:
Variable                  Description
Loan_ID                   Unique Loan ID
Gender                    Male/ Female
Married                   Applicant married (Y/N)
Dependents                Number of dependents
Education                 Applicant Education (Graduate/ Under Graduate)
Self_Employed             Self employed (Y/N)
ApplicantIncome           Applicant income
CoapplicantIncome         Coapplicant income
LoanAmount                Loan amount in thousands
Loan_Amount_Term          Term of loan in months
Credit_History            credit history meets guidelines
Property_Area             Urban/ Semi Urban/ Rural
Loan_Status               Loan approved (Y/N)
```

3. Data Acquisition and cleaning

2.1 Data Sources

The data I have for different customer are available here in csv format https://datahack.analyticsvidhya.com/contest/practice-problem-loan-prediction-iii/download/test-file .

2.2 Data Cleaning

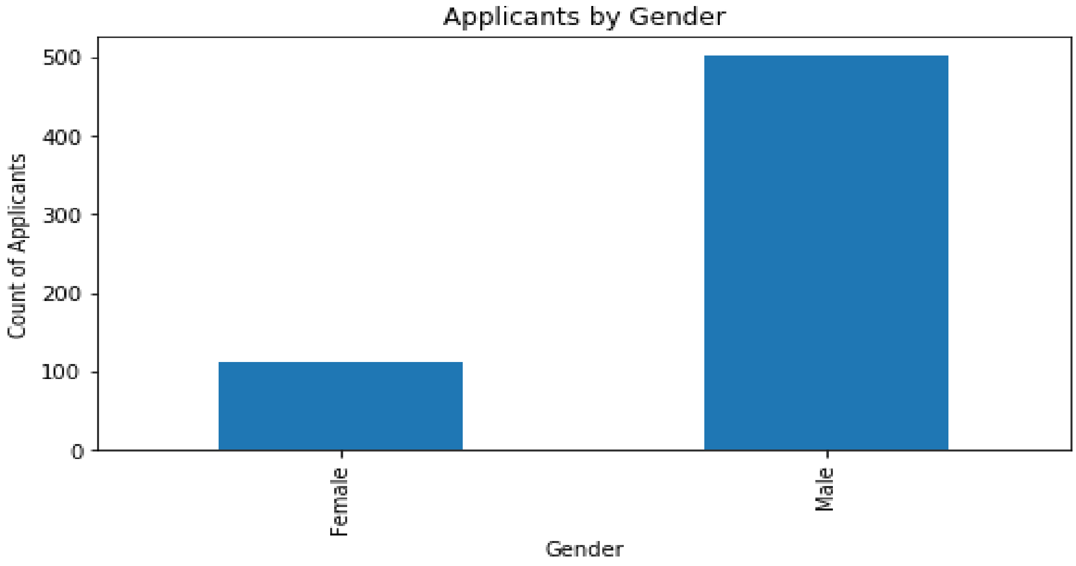
As data which I scrapped from the source was not processed, so it contained a lot missing value. And a lot loan were having duplicate values, So I had to clean that up ad make a more organised and usable data set.

4. Exploratory Data Analysis

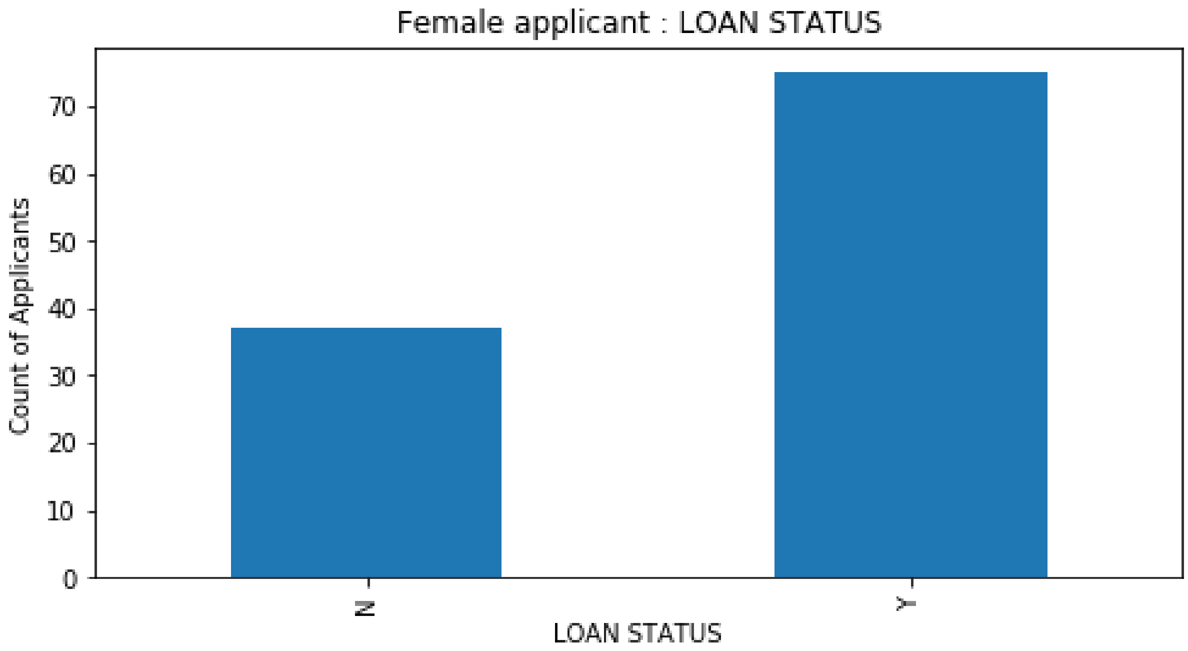
3.1 Target Variable

As the model had to predict loan approval the target variable should be the final status of the loan. So, in the data set the variable Loan_Status contains the outcome of the loan application.

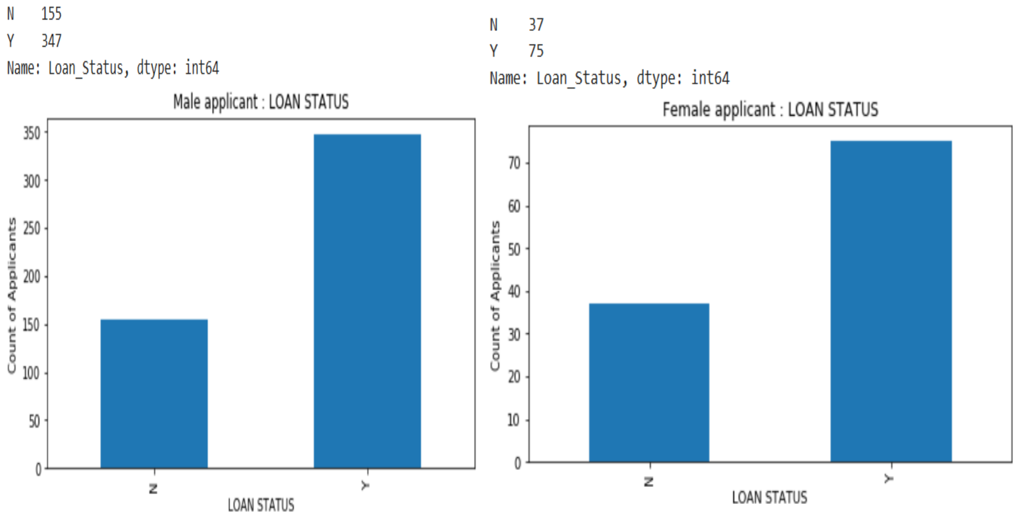
3.2 Relation between Gender and Loan applicants



As we can see the loan applications by male are more than female.



More than 70% of loan applied by female are likely to be approved.

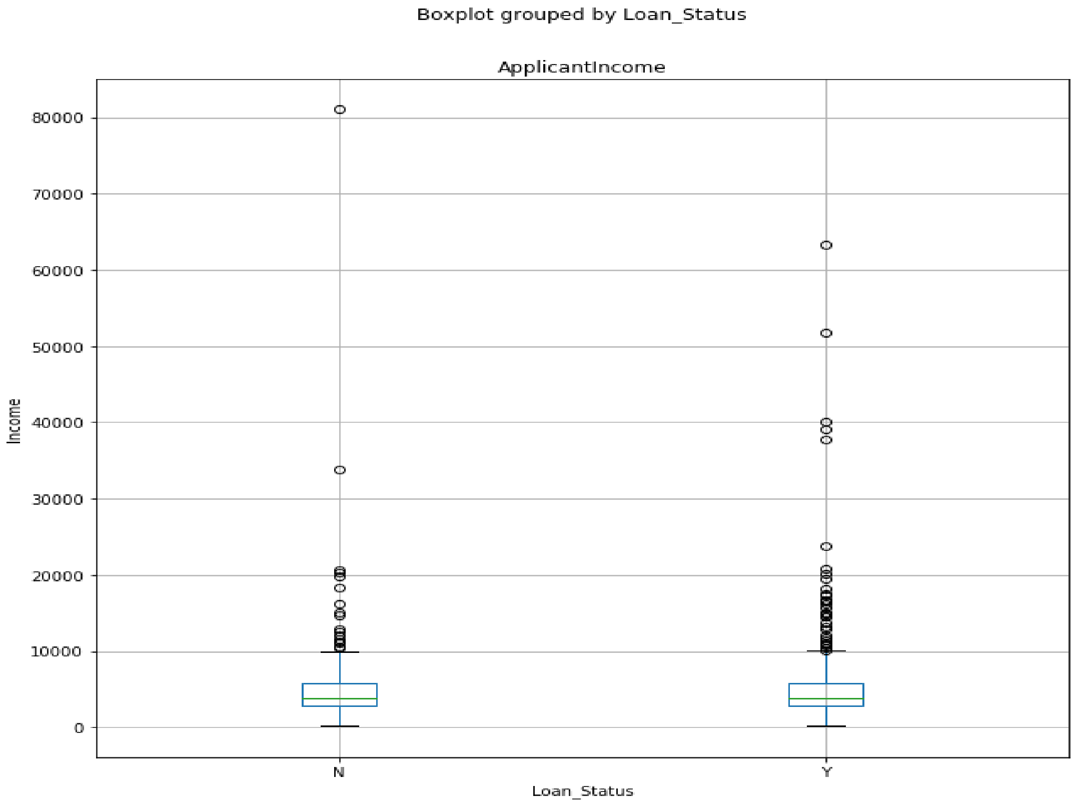


```
N    155
Y    347
Name: Loan_Status, dtype: int64
```

```
N    37
Y    75
Name: Loan_Status, dtype: int64
```

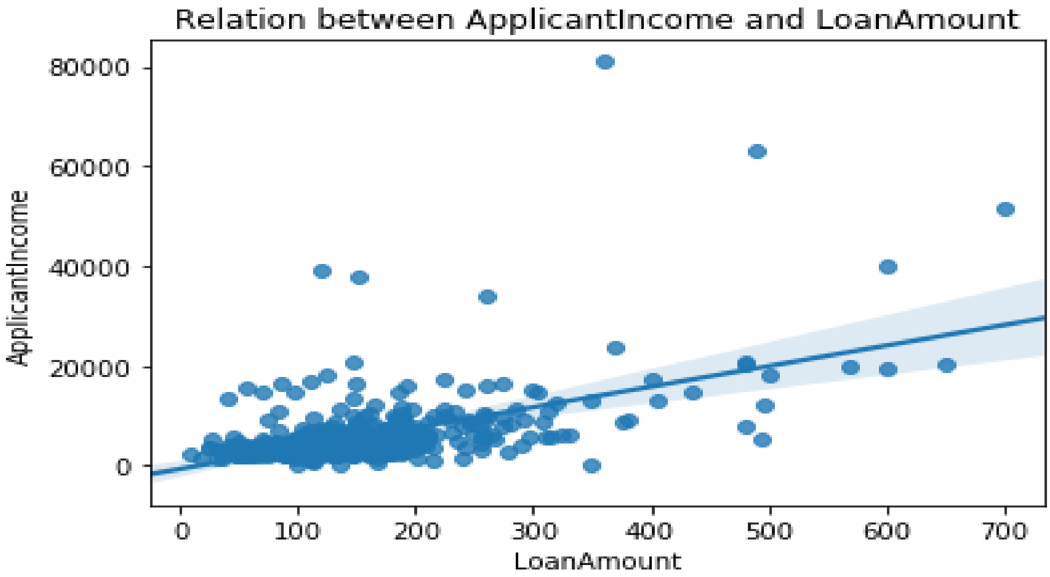
But the percentage approval for male is higher than female applicant

3.2 Relation between Applicant income and Loan Approval



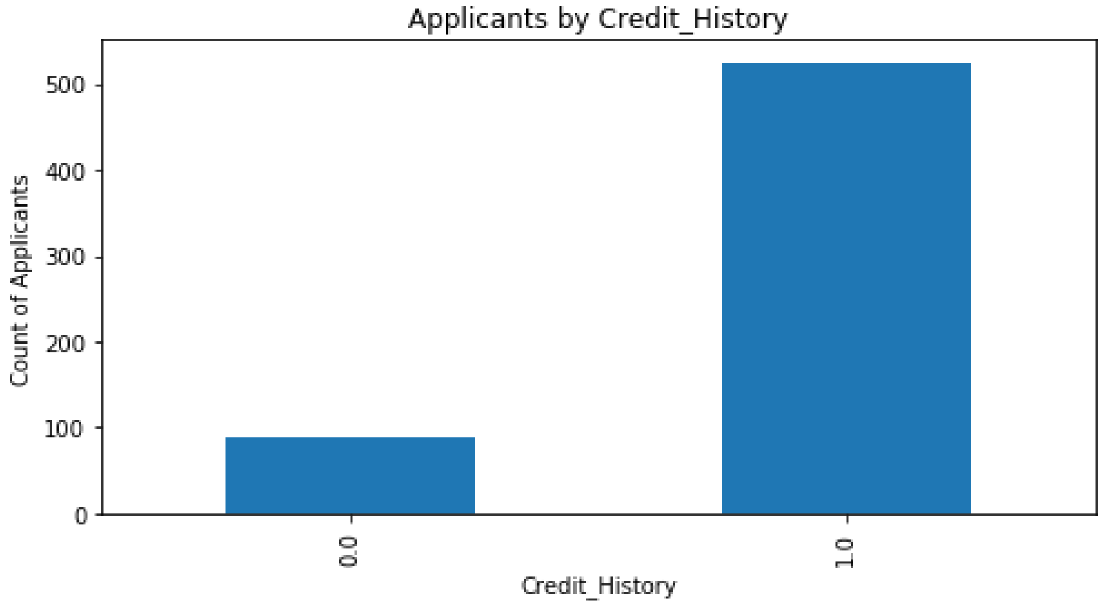
Both loan which are not approved or which are approved has a same mean income of the applicant. So, only feature income of applicant doesn't really affect the approval.

3.3 Relation between Gender and Loan applicants

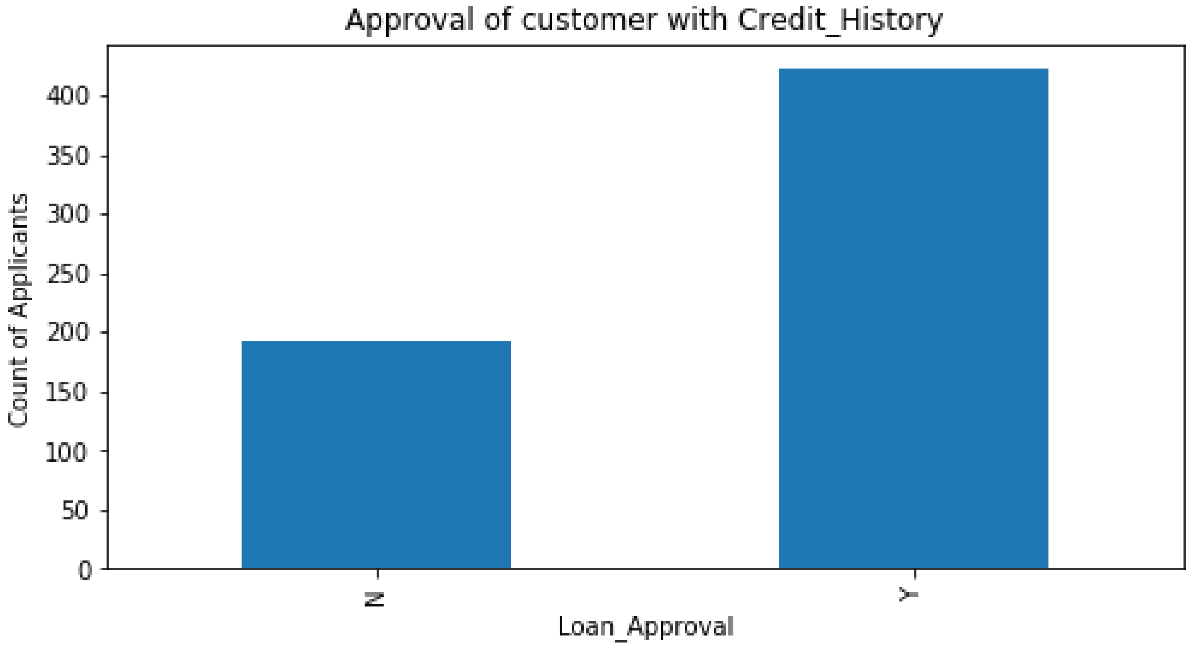


As the income of applicant increases the loan amount is also increasing. And most of the applicant belong to a narrow range of income as well as loan amount.

3.3 Relation between Credit history and Loan applicants



Most of the applicant are those who have already taken credits in past.



More than 66% of loans of customer with credit history were approved.

5. Predictive Modelling :-

There are two types of models, i.e. Regression and Classification, that be used to predict the loan approval. And also we can use supervised and Un-Supervised method for machine learning. But our goal is to provide a prediction based on a fixed dataset. So, we should use supervised learning.

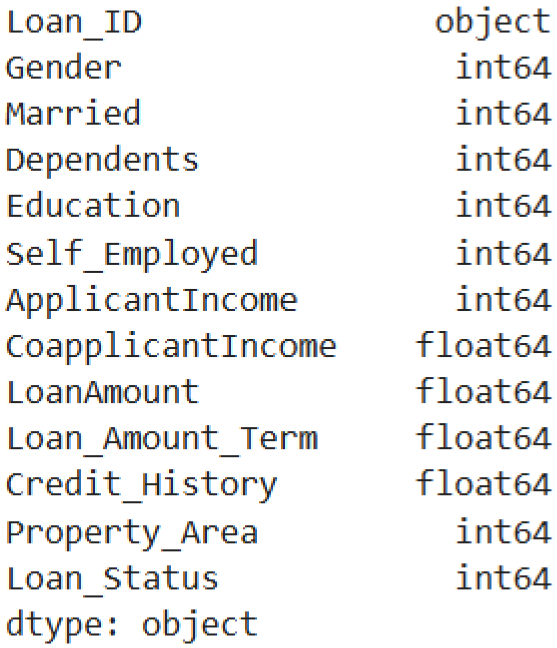
Also to choose the model between Regression and Classification. Regression is used for predicting value for a continuous variable. As our output is going to be a Loan Status which a categorial variable we will use classification.

4.1 Classification Model

For the loan prediction system we use Logistic Regression.

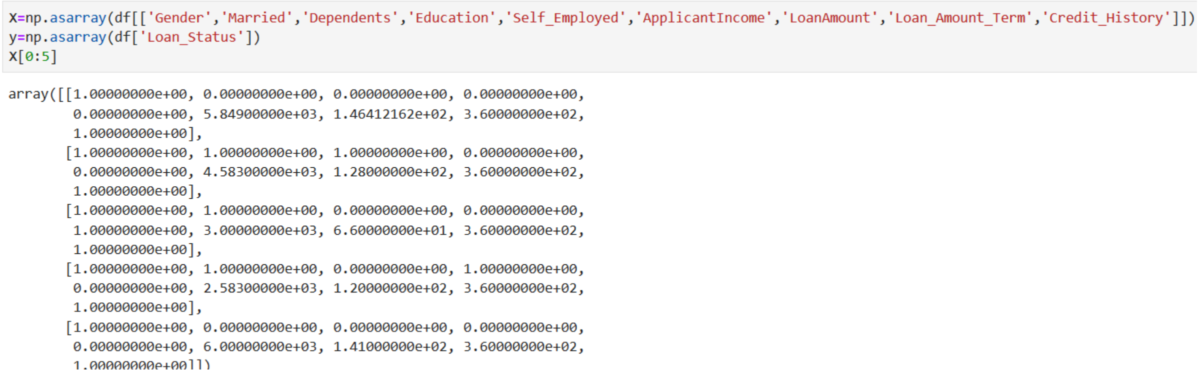
As we are using sci-kit library for our building predictive model. And it uses numerical data to give the output. So, first of all we convert all the variables into numerical data type. For that we are label encoding.

In label ending, if a variable have 3 different value, it assigns each value a number and then replace the values with those number correspondingly.



```
Loan_ID                object
Gender                  int64
Married                 int64
Dependents              int64
Education               int64
Self_Employed           int64
ApplicantIncome         int64
CoapplicantIncome     float64
LoanAmount            float64
Loan_Amount_Term      float64
Credit_History        float64
Property_Area           int64
Loan_Status             int64
dtype: object
```

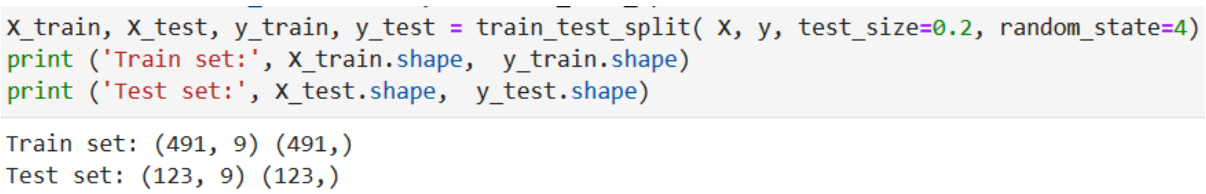
Then, we choose the columns for applying Logistic Regression and store and create a dataset.



```
X=np.asarray(df[['Gender','Married','Dependents','Education','Self_Employed','ApplicantIncome','LoanAmount','Loan_Amount_Term','Credit_History']])
y=np.asarray(df['Loan_Status'])
X[0:5]
```

```
array([[1.00000000e+00, 0.00000000e+00, 0.00000000e+00, 0.00000000e+00,
        0.00000000e+00, 5.84900000e+03, 1.46412162e+02, 3.60000000e+02,
        1.00000000e+00],
       [1.00000000e+00, 1.00000000e+00, 1.00000000e+00, 0.00000000e+00,
        0.00000000e+00, 4.58300000e+03, 1.28000000e+02, 3.60000000e+02,
        1.00000000e+00],
       [1.00000000e+00, 1.00000000e+00, 0.00000000e+00, 0.00000000e+00,
        1.00000000e+00, 3.00000000e+03, 6.60000000e+01, 3.60000000e+02,
        1.00000000e+00],
       [1.00000000e+00, 1.00000000e+00, 0.00000000e+00, 1.00000000e+00,
        0.00000000e+00, 2.58300000e+03, 1.20000000e+02, 3.60000000e+02,
        1.00000000e+00],
       [1.00000000e+00, 0.00000000e+00, 0.00000000e+00, 0.00000000e+00,
        0.00000000e+00, 6.00000000e+03, 1.41000000e+02, 3.60000000e+02,
        1.00000000e+00]])
```

Then, we split the data in train and test set, So that we can use one of the set to train our model and other one to test the performance of the model.

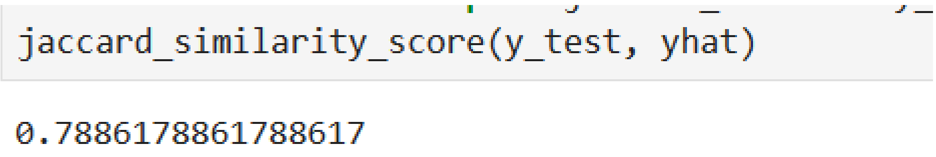


```
X_train, X_test, y_train, y_test = train_test_split( X, y, test_size=0.2, random_state=4)
print ('Train set:', X_train.shape,  y_train.shape)
print ('Test set:', X_test.shape,  y_test.shape)
```

```
Train set: (491, 9) (491,)
Test set: (123, 9) (123,)
```

Then we train the model and use that model to predict the status of test set

4.1 Error



```
jaccard_similarity_score(y_test, yhat)
```

```
0.7886178861788617
```

I am using Jacard's Index to check the error in our prediction. In Jacard's Index, if the all the prediction is same as the real status then the value will be 1. It's worst value can be 0.0 .

The result .78 represent a good predicting system.

6. Result

I have created a model which can predict the loan approval with the a Jacard’s Similarity of 0.78. This can be used to predict the loan approval for different customers.

7. Conclusion

In this study, I have seen relationship between Loan amount and loan approval, Gender and Loan approval. How the credit history affect the loan approval and also the trend of loan application by different class of customer.