# iction-of-loan-using-logisticreg12

December 12, 2023

[1]:
```
import pandas as pd
import numpy as np
import matplotlib.pyplot as plt
%matplotlib inline
import seaborn as sns
import warnings
warnings.filterwarnings('ignore')
```

[2]:
```
data=pd.read_csv(r"F:\Documents\project\Copy of loan.csv")
```

[3]:
```
data.head()
```

[3]:

| | Loan_ID | Gender | Married | Dependents | Education | Self_Employed | \ |
|---|---|---|---|---|---|---|---|
| 0 | LP001002 | Male | No | 0 | Graduate | No | |
| 1 | LP001003 | Male | Yes | 1 | Graduate | No | |
| 2 | LP001005 | Male | Yes | 0 | Graduate | Yes | |
| 3 | LP001006 | Male | Yes | 0 | Not Graduate | No | |
| 4 | LP001008 | Male | No | 0 | Graduate | No | |

| | ApplicantIncome | CoapplicantIncome | LoanAmount | Loan_Amount_Term | \ |
|---|---|---|---|---|---|
| 0 | 5849 | 0.0 | NaN | 360.0 | |
| 1 | 4583 | 1508.0 | 128.0 | 360.0 | |
| 2 | 3000 | 0.0 | 66.0 | 360.0 | |
| 3 | 2583 | 2358.0 | 120.0 | 360.0 | |
| 4 | 6000 | 0.0 | 141.0 | 360.0 | |

| | Credit_History | Property_Area | Loan_Status |
|---|---|---|---|
| 0 | 1.0 | Urban | Y |
| 1 | 1.0 | Rural | N |
| 2 | 1.0 | Urban | Y |
| 3 | 1.0 | Urban | Y |
| 4 | 1.0 | Urban | Y |

[4]:
```
data.info()
```

```
<class 'pandas.core.frame.DataFrame'>
RangeIndex: 614 entries, 0 to 613
Data columns (total 13 columns):
```

```
 #   Column             Non-Null Count  Dtype
---  ------             --------------  -----
 0   Loan_ID            614 non-null    object
 1   Gender             601 non-null    object
 2   Married            611 non-null    object
 3   Dependents         599 non-null    object
 4   Education          614 non-null    object
 5   Self_Employed      582 non-null    object
 6   ApplicantIncome    614 non-null    int64
 7   CoapplicantIncome  614 non-null    float64
 8   LoanAmount         592 non-null    float64
 9   Loan_Amount_Term   600 non-null    float64
 10  Credit_History     564 non-null    float64
 11  Property_Area      614 non-null    object
 12  Loan_Status        614 non-null    object
dtypes: float64(4), int64(1), object(8)
memory usage: 62.5+ KB
```

[5]:
```
data.shape
```

[5]:
```
(614, 13)
```

[6]:
```
data.describe()
```

[6]:
```
       ApplicantIncome  CoapplicantIncome  LoanAmount  Loan_Amount_Term  \
count       614.000000         614.000000  592.000000         600.00000
mean       5403.459283        1621.245798  146.412162         342.00000
std        6109.041673        2926.248369   85.587325          65.12041
min         150.000000           0.000000    9.000000          12.00000
25%        2877.500000           0.000000  100.000000         360.00000
50%        3812.500000        1188.500000  128.000000         360.00000
75%        5795.000000        2297.250000  168.000000         360.00000
max       81000.000000       41667.000000  700.000000         480.00000

       Credit_History
count      564.000000
mean         0.842199
std          0.364878
min          0.000000
25%          1.000000
50%          1.000000
75%          1.000000
max          1.000000
```

[7]:
```
list(data)
```

[7]:
```
['Loan_ID',
 'Gender',
 'Married',
 'Dependents',
 'Education',
 'Self_Employed',
 'ApplicantIncome',
 'CoapplicantIncome',
 'LoanAmount',
 'Loan_Amount_Term',
 'Credit_History',
 'Property_Area',
 'Loan_Status']
```

[8]:
```
data.isna().sum()
```

[8]:
```
Loan_ID               0
Gender               13
Married               3
Dependents           15
Education             0
Self_Employed        32
ApplicantIncome       0
CoapplicantIncome     0
LoanAmount           22
Loan_Amount_Term     14
Credit_History       50
Property_Area         0
Loan_Status           0
dtype: int64
```

[9]:
```
data['LoanAmount']=data['LoanAmount'].fillna(data['LoanAmount'].mean())
```

[10]:
```
data['Credit_History']=data['Credit_History'].fillna(data['Credit_History'].
↪median())
```

[11]:
```
data.dropna(inplace=True)
```

[12]:
```
data.isna().sum()
```

[12]:
```
Loan_ID              0
Gender               0
Married              0
Dependents           0
Education            0
Self_Employed        0
ApplicantIncome      0
```

```
CoapplicantIncome    0
LoanAmount           0
Loan_Amount_Term     0
Credit_History       0
Property_Area        0
Loan_Status          0
dtype: int64
```

[13]:
```
data.shape
```

[13]:
```
(542, 13)
```

[14]:
```
data.head()
```

[14]:

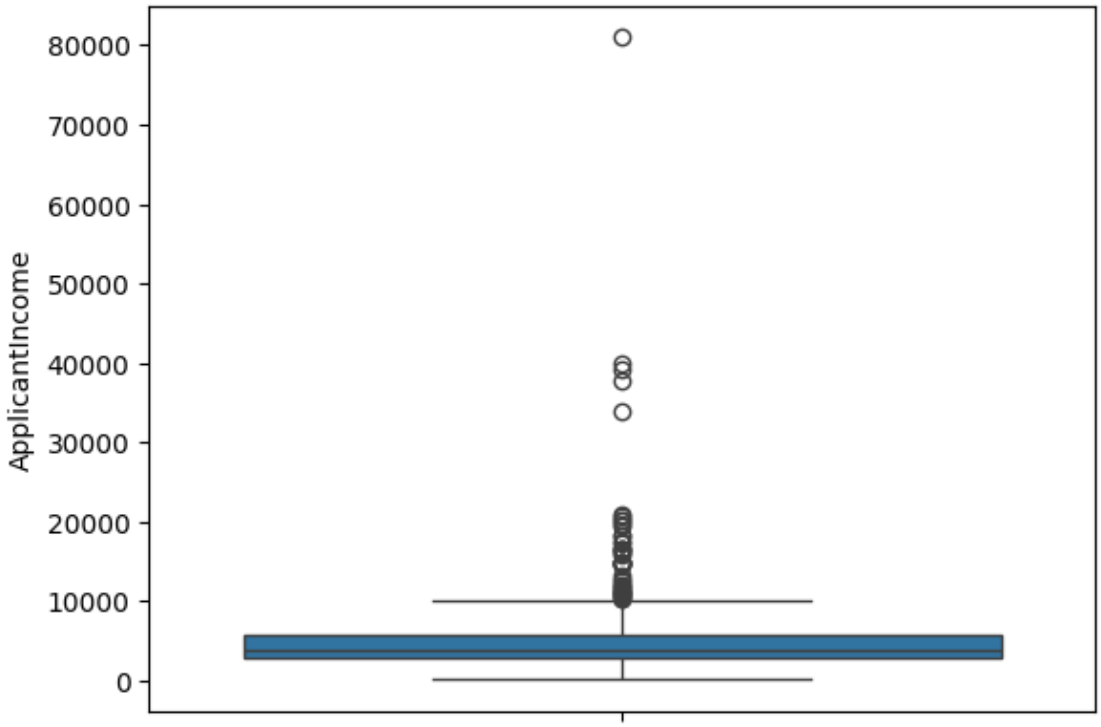
| | Loan_ID | Gender | Married | Dependents | Education | Self_Employed | \ |
|---|---|---|---|---|---|---|---|
| 0 | LP001002 | Male | No | 0 | Graduate | No | |
| 1 | LP001003 | Male | Yes | 1 | Graduate | No | |
| 2 | LP001005 | Male | Yes | 0 | Graduate | Yes | |
| 3 | LP001006 | Male | Yes | 0 | Not Graduate | No | |
| 4 | LP001008 | Male | No | 0 | Graduate | No | |

| | ApplicantIncome | CoapplicantIncome | LoanAmount | Loan_Amount_Term | \ |
|---|---|---|---|---|---|
| 0 | 5849 | 0.0 | 146.412162 | 360.0 | |
| 1 | 4583 | 1508.0 | 128.000000 | 360.0 | |
| 2 | 3000 | 0.0 | 66.000000 | 360.0 | |
| 3 | 2583 | 2358.0 | 120.000000 | 360.0 | |
| 4 | 6000 | 0.0 | 141.000000 | 360.0 | |

| | Credit_History | Property_Area | Loan_Status |
|---|---|---|---|
| 0 | 1.0 | Urban | Y |
| 1 | 1.0 | Rural | N |
| 2 | 1.0 | Urban | Y |
| 3 | 1.0 | Urban | Y |
| 4 | 1.0 | Urban | Y |

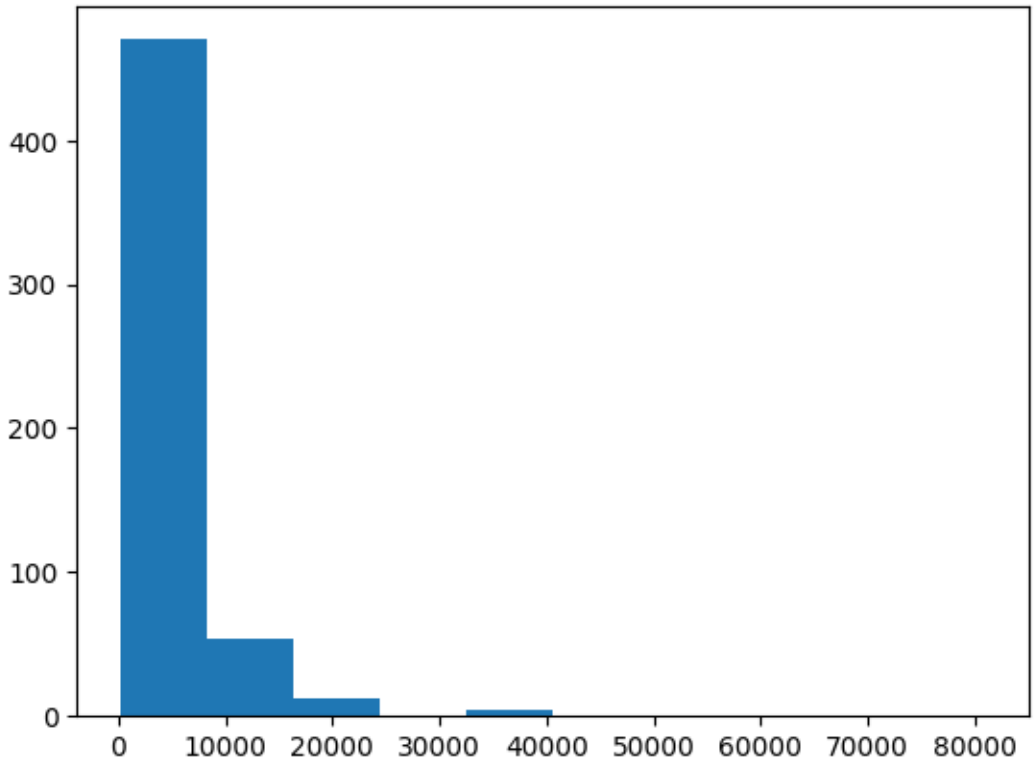
[15]:
```
import seaborn as sns
import matplotlib.pyplot as plt
sns.boxplot(data.ApplicantIncome)
```

[15]:
```
<Axes: ylabel='ApplicantIncome'>
```



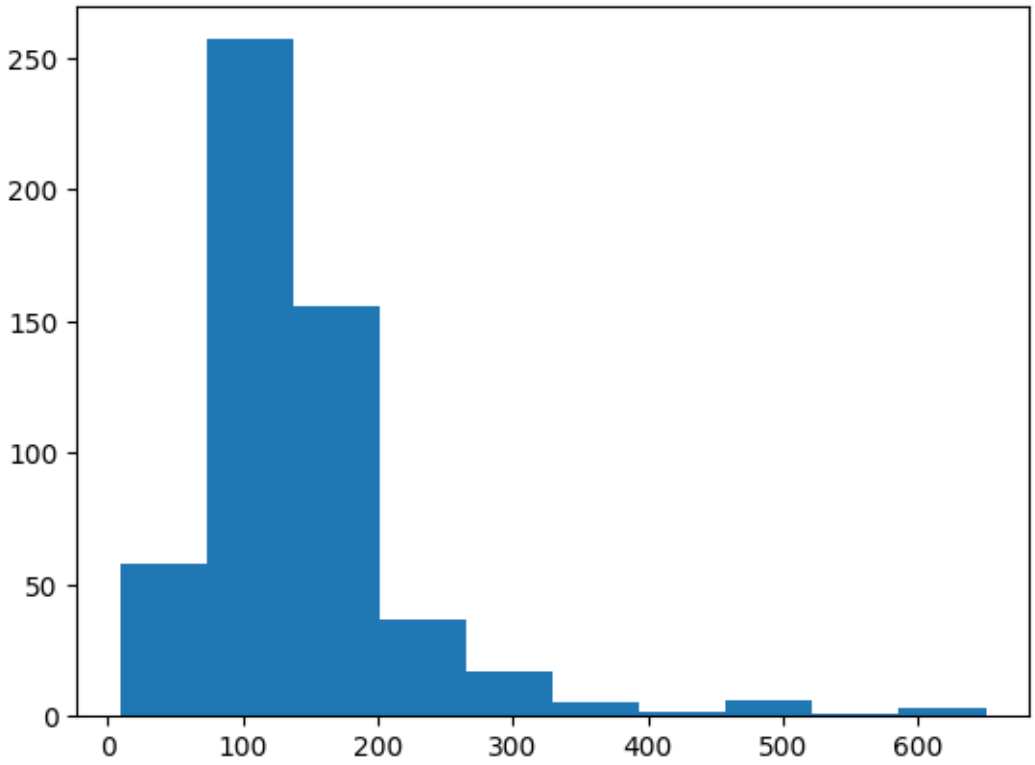

[16]:
```
plt.hist(data['ApplicantIncome'])
```

[16]:
```
(array([470.,  54.,  13.,   0.,   4.,   0.,   0.,   0.,   0.,   1.]),
 array([  150.,  8235., 16320., 24405., 32490., 40575., 48660., 56745.,
        64830., 72915., 81000.]),
 <BarContainer object of 10 artists>)
```




[17]:
```
plt.hist(data['LoanAmount'])
```

[17]:
```
(array([ 58., 257., 156.,  37.,  17.,   5.,   2.,   6.,   1.,   3.]),
 array([  9. ,  73.1, 137.2, 201.3, 265.4, 329.5, 393.6, 457.7, 521.8,
        585.9, 650. ]),
 <BarContainer object of 10 artists>)
```




[18]:
```
data['Loan_Status'].replace('Y',1,inplace=True)
data['Loan_Status'].replace('N',0,inplace=True)
```

[19]:
```
data['Loan_Status'].value_counts()
```

[19]:
```
Loan_Status
1    376
0    166
Name: count, dtype: int64
```

[20]:
```
data.Gender=data.Gender.map({'Male':1,'Female':0})
data['Gender'].value_counts()
```

[20]:
```
Gender
1    444
0     98
Name: count, dtype: int64
```

[21]:
```
data.Married=data.Married.map({'Yes':1,'No':0})
data['Married'].value_counts()
```

[21]:
```
Married
1    355
0    187
Name: count, dtype: int64
```

[22]:
```
data.Dependents=data.Dependents.map({'0':0,'1':1,'2':2,'3+':3})
data['Dependents'].value_counts()
```

[22]:
```
Dependents
0    309
1     94
2     94
3     45
Name: count, dtype: int64
```

[23]:
```
data.Education=data.Education.map({'Graduate':1,'Not Graduate':0})
data['Education'].value_counts()
```

[23]:
```
Education
1    425
0    117
Name: count, dtype: int64
```

[24]:
```
data.Self_Employed=data.Self_Employed.map({'Yes':1,'No':0})
data['Self_Employed'].value_counts()
```

[24]:
```
Self_Employed
0    467
1     75
Name: count, dtype: int64
```

[25]:
```
data.Property_Area=data.Property_Area.map({'Urban':2,'Rural':0,'Semiurban':1})
data['Property_Area'].value_counts()
```

[25]:
```
Property_Area
1    209
2    174
0    159
Name: count, dtype: int64
```

[26]:
```
data.head()
```

[26]:

| | Loan_ID | Gender | Married | Dependents | Education | Self_Employed | \ |
|---|---|---|---|---|---|---|---|
| 0 | LP001002 | 1 | 0 | 0 | 1 | 0 | |
| 1 | LP001003 | 1 | 1 | 1 | 1 | 0 | |
| 2 | LP001005 | 1 | 1 | 0 | 1 | 1 | |
| 3 | LP001006 | 1 | 1 | 0 | 0 | 0 | |

```
4  LP001008       1        0           0          1               0

   ApplicantIncome  CoapplicantIncome  LoanAmount  Loan_Amount_Term  \
0             5849                0.0  146.412162             360.0
1             4583             1508.0  128.000000             360.0
2             3000                0.0   66.000000             360.0
3             2583             2358.0  120.000000             360.0
4             6000                0.0  141.000000             360.0

   Credit_History  Property_Area  Loan_Status
0             1.0              2            1
1             1.0              0            0
2             1.0              2            1
3             1.0              2            1
4             1.0              2            1
```

[27]:
```
data.shape
```

[27]:
```
(542, 13)
```

[28]:
```
data['Credit_History'].value_counts()
```

[28]:
```
Credit_History
1.0    468
0.0     74
Name: count, dtype: int64
```

[29]:
```
y=data['Loan_Status']
x=data.drop(['Loan_Status','Loan_ID'],axis=1)
```

[30]:
```
x
```

[30]:
```
      Gender  Married  Dependents  Education  Self_Employed  ApplicantIncome  \
0          1        0           0          1              0             5849
1          1        1           1          1              0             4583
2          1        1           0          1              1             3000
3          1        1           0          0              0             2583
4          1        0           0          1              0             6000
..       …        …           …          …              …                …
609        0        0           0          1              0             2900
610        1        1           3          1              0             4106
611        1        1           1          1              0             8072
612        1        1           2          1              0             7583
613        0        0           0          1              1             4583

     CoapplicantIncome  LoanAmount  Loan_Amount_Term  Credit_History  \
0                  0.0  146.412162             360.0             1.0
```

```
1               1508.0  128.000000             360.0             1.0
2                  0.0   66.000000             360.0             1.0
3               2358.0  120.000000             360.0             1.0
4                  0.0  141.000000             360.0             1.0
..                 …         …                 …                 …
609                0.0   71.000000             360.0             1.0
610                0.0   40.000000             180.0             1.0
611              240.0  253.000000             360.0             1.0
612                0.0  187.000000             360.0             1.0
613                0.0  133.000000             360.0             0.0

     Property_Area
0                2
1                0
2                2
3                2
4                2
..             …
609              0
610              0
611              2
612              2
613              1

[542 rows x 11 columns]
```

[31]:
```
from sklearn.model_selection import train_test_split
from sklearn import metrics
x_train,x_test,y_train,y_test=train_test_split(x,y,test_size=0.3,random_state=0)
```

[32]:
```
from sklearn.linear_model import LogisticRegression
Classifier=LogisticRegression()
Classifier.fit(x_train,y_train)
```

[32]:
```
LogisticRegression()
```

[33]:
```
y_pred=Classifier.predict(x_test)
y_pred
```

[33]:
```
array([1, 1, 1, 1, 1, 1, 0, 1, 0, 1, 1, 1, 0, 0, 1, 1, 0, 1, 1, 0, 1, 1,
       1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 0, 1, 1, 1, 1, 0, 1, 1, 1, 0, 1,
       1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1,
       1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 0, 1, 1, 1, 1,
       1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1,
       0, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 0,
       1, 1, 1, 1, 1, 1, 1, 1, 0, 1, 1, 1, 1, 0, 1, 1, 1, 1, 0, 1, 1, 1,
       1, 0, 1, 1, 1, 1, 1, 1, 1], dtype=int64)
```

[34]:
```
from sklearn.metrics import confusion_matrix
confusion_matrix(y_test,y_pred)
```

[34]:
```
array([[ 16,  31],
       [  0, 116]], dtype=int64)
```

[35]:
```
from sklearn.metrics import accuracy_score
accuracy_score(y_test,y_pred)
```

[35]:
```
0.8098159509202454
```

[ ]:

[ ]:

[ ]: