```
import numpy as np
import pandas as pd
import matplotlib.pyplot as plt
import seaborn as sns

data = pd.read_csv("train data credit card.csv")
data.head(3)
```

```
         ID  Gender  Age Region_Code     Occupation Channel_Code
Vintage  \
0  NNVBBKZB  Female   73       RG268          Other           X3
43
1  IDD62UNG  Female   30       RG277       Salaried           X1
32
2  HD3DSEMC  Female   56       RG268  Self_Employed           X3
26

  Credit_Product  Avg_Account_Balance Is_Active  Is_Lead
0             No              1045696        No        0
1             No               581988        No        0
2             No              1484315       Yes        0
```

Check correlation wrt independent features

```
# divide data into x & y

data.drop("ID", axis = 1, inplace = True)

data.head(2)
```

```
   Gender  Age Region_Code Occupation Channel_Code  Vintage
Credit_Product  \
0  Female   73       RG268      Other           X3       43
No
1  Female   30       RG277   Salaried           X1       32
No

   Avg_Account_Balance Is_Active  Is_Lead
0              1045696        No        0
1               581988        No        0
```

```
X = data.drop("Is_Lead", axis = 1) # independent feature
Y = data["Is_Lead"]

X
```

```
        Gender  Age Region_Code     Occupation Channel_Code
Vintage  \
0       Female   73       RG268          Other           X3       43
```

```
1       Female   30       RG277       Salaried           X1        32
2       Female   56       RG268  Self_Employed           X3        26
3         Male   34       RG270       Salaried           X1        19
4       Female   30       RG282       Salaried           X1        33
...        ...  ...         ...            ...          ...       ...
245720    Male   51       RG284  Self_Employed           X3       109
245721    Male   27       RG268       Salaried           X1        15
245722  Female   26       RG281       Salaried           X1        13
245723  Female   28       RG273       Salaried           X1        31
245724    Male   29       RG269       Salaried           X1        21

       Credit_Product  Avg_Account_Balance Is_Active
0                  No              1045696        No
1                  No               581988        No
2                  No              1484315       Yes
3                  No               470454        No
4                  No               886787        No
...               ...                  ...       ...
245720            NaN              1925586        No
245721             No               862952       Yes
245722             No               670659        No
245723             No               407504        No
245724             No              1129276        No

[245725 rows x 9 columns]
```

```
X.info()
```

```
<class 'pandas.core.frame.DataFrame'>
RangeIndex: 245725 entries, 0 to 245724
Data columns (total 9 columns):
 #   Column               Non-Null Count   Dtype
---  ------               --------------   -----
 0   Gender               245725 non-null  object
 1   Age                  245725 non-null  int64
 2   Region_Code          245725 non-null  object
 3   Occupation           245725 non-null  object
 4   Channel_Code         245725 non-null  object
 5   Vintage              245725 non-null  int64
 6   Credit_Product       216400 non-null  object
 7   Avg_Account_Balance  245725 non-null  int64 
 8   Is_Active            245725 non-null  object
dtypes: int64(3), object(6)
memory usage: 16.9+ MB
```

```
X.isnull().sum()
```

```
Gender                     0
Age                        0
Region_Code                0
Occupation                 0
Channel_Code               0
Vintage                    0
Credit_Product         29325
Avg_Account_Balance        0
Is_Active                  0
dtype: int64
```

```
X = X.fillna("Pending")
```

```
X.isnull().sum()
```

```
Gender                 0
Age                    0
Region_Code            0
Occupation             0
Channel_Code           0
Vintage                0
Credit_Product         0
Avg_Account_Balance    0
Is_Active              0
dtype: int64
```

```
X.Credit_Product.value_counts()
```

```
No         144357
Yes         72043
Pending     29325
Name: Credit_Product, dtype: int64
```

```
from sklearn.preprocessing import LabelEncoder
```

```
X.columns
```

```
Index(['Gender', 'Age', 'Region_Code', 'Occupation', 'Channel_Code', 
'Vintage',
       'Credit_Product', 'Avg_Account_Balance', 'Is_Active'],
      dtype='object')
```

```
categorical_col = X.select_dtypes(include = "object").columns
categorical_col
```

```
Index([], dtype='object')
```

```
categorical_col = X.select_dtypes(include = "object").columns
for col in categorical_col:
    le = LabelEncoder()
    X[col] = le.fit_transform(X[col])
X
```

```
        Gender  Age  Region_Code  Occupation  Channel_Code  Vintage  \
0            0   73           18           1             2       43   
1            0   30           27           2             0       32   
2            0   56           18           3             2       26   
3            1   34           20           2             0       19   
4            0   30           32           2             0       33   
...        ...  ...          ...         ...           ...      ...   
245720       1   51           34           3             2      109   
245721       1   27           18           2             0       15   
245722       0   26           31           2             0       13   
245723       0   28           23           2             0       31   
245724       1   29           19           2             0       21   

        Credit_Product  Avg_Account_Balance  Is_Active  
0                    0              1045696          0  
1                    0               581988          0  
2                    0              1484315          1  
3                    0               470454          0  
4                    0               886787          0  
...                ...                  ...        ...  
245720               1              1925586          0  
245721               0               862952          1  
245722               0               670659          0  
245723               0               407504          0  
245724               0              1129276          0  

[245725 rows x 9 columns]
```

```
X.info()
```

```
<class 'pandas.core.frame.DataFrame'>
RangeIndex: 245725 entries, 0 to 245724
Data columns (total 9 columns):
 #   Column               Non-Null Count   Dtype
---  ------               --------------   -----
 0   Gender               245725 non-null  int32
 1   Age                  245725 non-null  int64
 2   Region_Code          245725 non-null  int32
 3   Occupation           245725 non-null  int32
 4   Channel_Code         245725 non-null  int32
 5   Vintage              245725 non-null  int64
 6   Credit_Product       245725 non-null  int32
 7   Avg_Account_Balance  245725 non-null  int64
 8   Is_Active            245725 non-null  int32
dtypes: int32(6), int64(3)
memory usage: 11.2 MB
```

```python
X.Credit_Product.value_counts()
```

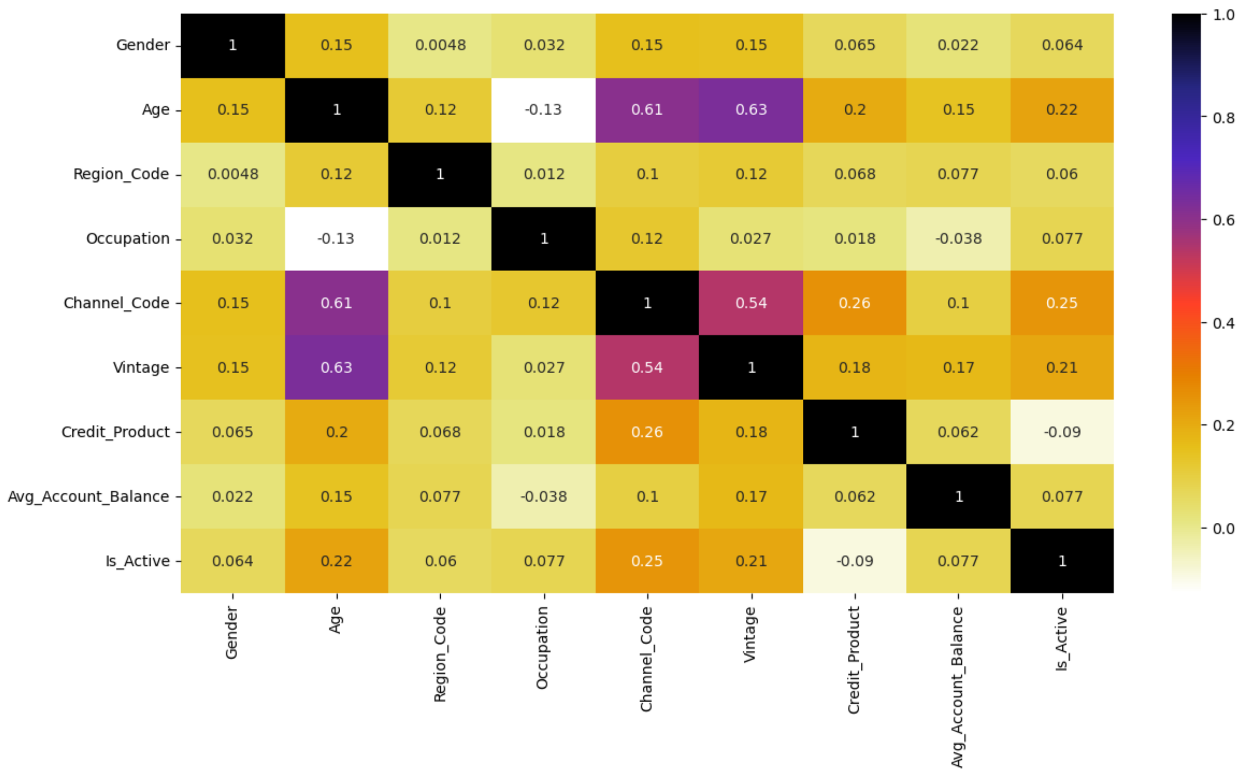
```
0    144357
2     72043
1     29325
Name: Credit_Product, dtype: int64
```

```python
X.corr().columns # Pearson --> -1 , +1
```

```
Index(['Gender', 'Age', 'Region_Code', 'Occupation', 'Channel_Code',
'Vintage',
       'Credit_Product', 'Avg_Account_Balance', 'Is_Active'],
      dtype='object')
```

```python
# steps:
# 1. Gender --> high value


import seaborn as sns

plt.figure(figsize = (14,7))
corr = X.corr()
sns.heatmap(corr, annot = True, cmap = plt.cm.CMRmap_r)
```

```
<Axes: >
```



	Gender	Age	Region_Code	Occupation	Channel_Code	Vintage	Credit_Product	Avg_Account_Balance	Is_Active
Gender	1	0.15	0.0048	0.032	0.15	0.15	0.065	0.022	0.064
Age	0.15	1	0.12	-0.13	0.61	0.63	0.2	0.15	0.22
Region_Code	0.0048	0.12	1	0.012	0.1	0.12	0.068	0.077	0.06
Occupation	0.032	-0.13	0.012	1	0.12	0.027	0.018	-0.038	0.077
Channel_Code	0.15	0.61	0.1	0.12	1	0.54	0.26	0.1	0.25
Vintage	0.15	0.63	0.12	0.027	0.54	1	0.18	0.17	0.21
Credit_Product	0.065	0.2	0.068	0.018	0.26	0.18	1	0.062	-0.09
Avg_Account_Balance	0.022	0.15	0.077	-0.038	0.1	0.17	0.062	1	0.077
Is_Active	0.064	0.22	0.06	0.077	0.25	0.21	-0.09	0.077	1

```python
def correlation(dataset, threshold):
    corr_col = set()
    corr_matrix = dataset.corr()
    for i in range(0,len(corr_matrix.columns)):
        for j in range(i):
            if abs(corr_matrix.iloc[i,j]) > threshold:
                col_name = corr_matrix.columns[i] # name of correlated
column threshold>60
                corr_col.add(col_name)
    return corr_col

corr_feature = correlation(X, 0.6)
print(corr_feature)
```

```
{'Channel_Code', 'Vintage'}
```

```python
X.drop(list(corr_feature), axis = 1, inplace = True)

X.shape
```

```
(245725, 7)
```

Feature Selection - Dropping the Constant Features

```
new_data = {"A" : [4,5,6,7],
            "B" : [1,2,4,5],
            "C" : [0,0,0,0],
            "D" : [1,1,1,1]}

df = pd.DataFrame(new_data)
df # C & D --< constant feature
```

```
   A  B  C  D
0  4  1  0  1
1  5  2  0  1
2  6  4  0  1
3  7  5  0  1
```

```
from sklearn.feature_selection import VarianceThreshold

vt = VarianceThreshold(threshold = 0.25) # threshold = 0.01 --> means
dropping column where 99% values are similar

vt.fit(df)
```

```
VarianceThreshold(threshold=0.25)
```

```
vt.get_support()
```

```
array([ True,  True, False, False])
```

```
zero_var_col = list(df.columns[vt.get_support() == False])
print(zero_var_col)
```

```
['C', 'D']
```

```
df.drop(zero_var_col, axis = 1, inplace = True)

df
```

```
   A  B
0  4  1
1  5  2
2  6  4
3  7  5
```

```
my_data = pd.read_csv("train data credit card.csv")
my_data.head(3)
```

```
         ID  Gender  Age Region_Code     Occupation Channel_Code
Vintage  \
0  NNVBBKZB  Female   73       RG268          Other            X3
43
1  IDD62UNG  Female   30       RG277       Salaried            X1
32
2  HD3DSEMC  Female   56       RG268  Self_Employed            X3
26

  Credit_Product  Avg_Account_Balance Is_Active  Is_Lead
0             No              1045696        No        0
1             No               581988        No        0
2             No              1484315       Yes        0

# drop id

my_data.drop("ID", axis = 1, inplace = True)

my_data.info()

<class 'pandas.core.frame.DataFrame'>
RangeIndex: 245725 entries, 0 to 245724
Data columns (total 10 columns):
 #   Column               Non-Null Count   Dtype
---  ------               --------------   -----
 0   Gender               245725 non-null  object
 1   Age                  245725 non-null  int64
 2   Region_Code          245725 non-null  object
 3   Occupation           245725 non-null  object
 4   Channel_Code         245725 non-null  object
 5   Vintage              245725 non-null  int64
 6   Credit_Product       216400 non-null  object
 7   Avg_Account_Balance  245725 non-null  int64
 8   Is_Active            245725 non-null  object
 9   Is_Lead              245725 non-null  int64
dtypes: int64(4), object(6)
memory usage: 18.7+ MB

X = my_data.drop("Is_Lead", axis = 1)
Y = my_data["Is_Lead"]

categorical_col = X.select_dtypes(include = "object").columns
for col in categorical_col:
    le = LabelEncoder()
    X[col] = le.fit_transform(X[col])
X

        Gender  Age  Region_Code  Occupation  Channel_Code  Vintage  \
0            0   73           18           1             2       43
1            0   30           27           2             0       32
2            0   56           18           3             2       26
3            1   34           20           2             0       19
4            0   30           32           2             0       33
```

```
...         ...  ...          ...         ...           ...      ...
245720        1   51           34           3             2      109
245721        1   27           18           2             0       15
245722        0   26           31           2             0       13
245723        0   28           23           2             0       31
245724        1   29           19           2             0       21

        Credit_Product  Avg_Account_Balance  Is_Active
0                    0              1045696          0
1                    0               581988          0
2                    0              1484315          1
3                    0               470454          0
4                    0               886787          0
...                ...                  ...        ...
245720               2              1925586          0
245721               0               862952          1
245722               0               670659          0
245723               0               407504          0
245724               0              1129276          0

[245725 rows x 9 columns]
```

```
var_thesh = VarianceThreshold(threshold = 0.25)
```

```
var_thesh.fit(X)
```

```
VarianceThreshold(threshold=0.25)
```

```
var_thesh.get_support()
```

```
array([False,  True,  True,  True,  True,  True,  True,  True, False])
```

```
zero_var_col = list(X.columns[var_thesh.get_support() == False])
print(zero_var_col)
```

```
['Gender', 'Is_Active']
```

```
X.drop(zero_var_col, axis = 1, inplace = True)
```

```
X
```

```
        Age  Region_Code  Occupation  Channel_Code  Vintage
Credit_Product  \
0        73           18           1             2       43
0
1        30           27           2             0       32
0
2        56           18           3             2       26
0
3        34           20           2             0       19
0
4        30           32           2             0       33
```

```
0
...     ...          ...          ...           ...      ...
...
245720   51           34            3             2      109
2
245721   27           18            2             0       15
0
245722   26           31            2             0       13
0
245723   28           23            2             0       31
0
245724   29           19            2             0       21
0

        Avg_Account_Balance
0                   1045696
1                    581988
2                   1484315
3                    470454
4                    886787
...                     ...
245720              1925586
245721               862952
245722               670659
245723               407504
245724              1129276

[245725 rows x 7 columns]
```

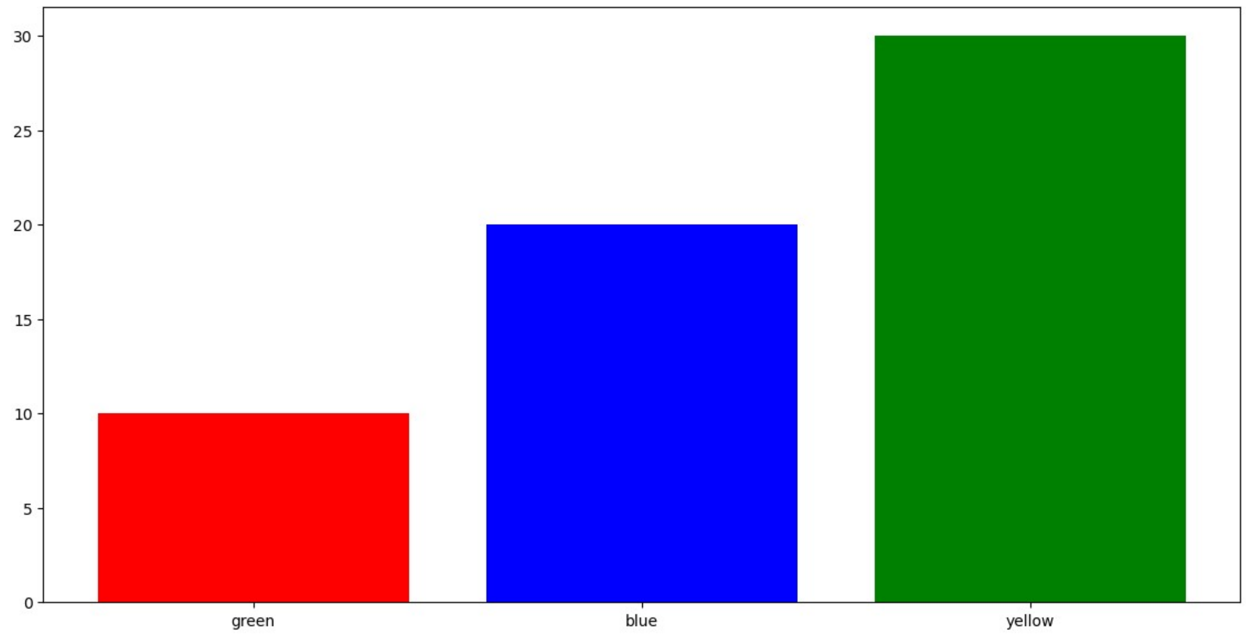
```
X.corr()
```

```
                          Age  Region_Code  Occupation
Channel_Code  \
Age                  1.000000     0.117914   -0.127753      0.605543

Region_Code          0.117914     1.000000    0.012186      0.103018

Occupation          -0.127753     0.012186    1.000000      0.123937

Channel_Code         0.605543     0.103018    0.123937      1.000000

Vintage              0.631242     0.118810    0.027156      0.537852

Credit_Product       0.263077     0.078779    0.015084      0.312914

Avg_Account_Balance  0.145232     0.076999   -0.038496      0.099911


                      Vintage  Credit_Product  Avg_Account_Balance
Age                  0.631242        0.263077             0.145232
Region_Code          0.118810        0.078779             0.076999
```

```
Occupation           0.027156        0.015084                 -0.038496
Channel_Code         0.537852        0.312914                  0.099911
Vintage              1.000000        0.270409                  0.167433
Credit_Product       0.270409        1.000000                  0.069385
Avg_Account_Balance  0.167433        0.069385                  1.000000
```

```
fig, ax = plt.subplots(figsize = (14,7))
x = ["green","blue","yellow"]
y = [10,20,30]
col = ["red","blue","green"]
ax.bar(x,y, color = col)
```

```
<BarContainer object of 3 artists>
```


green
blue
yellow