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


ds = pd.read_csv('credit.csv')
ds.head()
```

	CUST_ID	BALANCE	BALANCE_FREQUENCY	PURCHASES	ONEOFF_PURCHASES	INSTALLMENTS_PURCHASES	CASH_ADVANCE	PURCHASES_FREQUENCY	ONEOFF_PURCHASES_FREQUENCY	PURCHASES_INSTALLMENTS_FREQUENCY
0	C10001	40.900749	0.818182	95.40	0.00	95.4	0.000000	0.166667	0.000000	0.083333
1	C10002	3202.467416	0.909091	0.00	0.00	0.0	6442.945483	0.000000	0.000000	0.000000
2	C10003	2495.148862	1.000000	773.17	773.17	0.0	0.000000	1.000000	1.000000	0.000000
3	C10004	1666.670542	0.636364	1499.00	1499.00	0.0	205.788017	0.083333	0.083333	0.000000
4	C10005	817.714335	1.000000	16.00	16.00	0.0	0.000000	0.083333	0.083333	0.000000

```
ds.isnull().sum()
```

```
CUST_ID                             0
BALANCE                             0
BALANCE_FREQUENCY                   0
PURCHASES                           0
ONEOFF_PURCHASES                    0
INSTALLMENTS_PURCHASES              0
CASH_ADVANCE                        0
PURCHASES_FREQUENCY                 0
ONEOFF_PURCHASES_FREQUENCY          0
PURCHASES_INSTALLMENTS_FREQUENCY    0
CASH_ADVANCE_FREQUENCY              0
CASH_ADVANCE_TRX                    0
PURCHASES_TRX                       0
CREDIT_LIMIT                        1
PAYMENTS                            0
MINIMUM_PAYMENTS                  313
PRC_FULL_PAYMENT                    0
TENURE                              0
dtype: int64
```

```
X = ds.loc[:,["CREDIT_LIMIT","MINIMUM_PAYMENTS"]].values
print(X)
```

```
[[1000.        139.509787]
 [7000.       1072.340217]
 [7500.        627.284787]
 ...
 [1000.         82.418369]
 [ 500.         55.755628]
 [1200.         88.288956]]
```

```
from sklearn.impute import SimpleImputer
si1 = SimpleImputer(missing_values=np.nan,strategy='mean')
si1.fit(X)
X = si1.transform(X)
```

```
X = pd.DataFrame(X,columns = ["CREDIT_LIMIT","MINIMUM_PAYMENTS"])
X.head()
```

	CREDIT_LIMIT	MINIMUM_PAYMENTS
0	1000.0	139.509787
1	7000.0	1072.340217
2	7500.0	627.284787
3	7500.0	864.206542
4	1200.0	244.791237

```
ds =ds.drop(['CUST_ID','CREDIT_LIMIT','MINIMUM_PAYMENTS'],axis = 1)
```

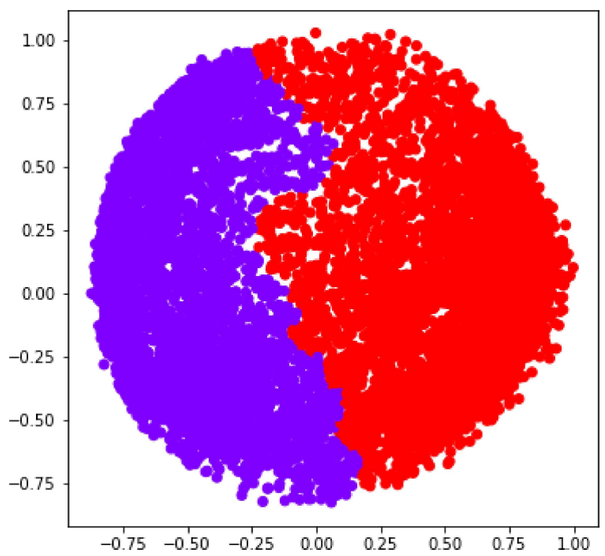
```
ds = pd.concat([ds, X], axis=1)
```

```
from sklearn.preprocessing import StandardScaler, normalize
scaler = StandardScaler()
ds = scaler.fit_transform(ds)
ds = normalize(ds)
print(ds)
```

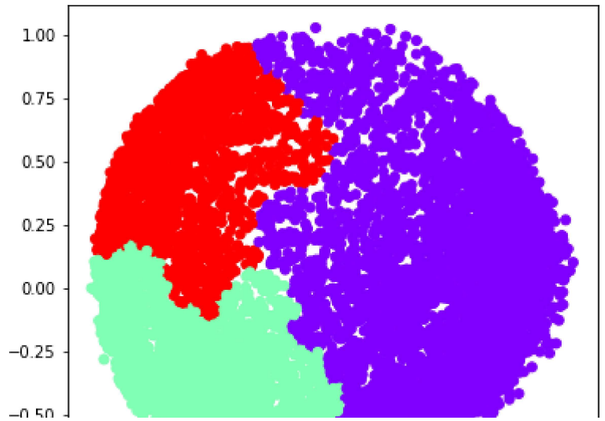
```
[[-0.31193826 -0.10629684 -0.1810716  ...  0.15370408 -0.40928997
  -0.13251924]
 [ 0.21992533  0.03753859 -0.13122171 ...  0.10079608  0.19244815
   0.02495877]
 [ 0.12668203  0.14678317 -0.03050449 ...  0.10218749  0.23403927
  -0.02880315]
 ...
 [-0.1569743  -0.03932355 -0.085222   ... -0.87408185 -0.20362471
  -0.07112317]
 [-0.15431961 -0.03841074 -0.09724043 ... -0.85379209 -0.22735718
  -0.07184155]
```

```
       [-0.11520725 -0.17888144  0.00848011 ... -0.82953785 -0.18218754
        -0.0669918111
```

```
from sklearn.decomposition import PCA

pca = PCA(n_components = 2)
ds = pca.fit_transform(ds)
ds = pd.DataFrame(ds)
ds.columns = ['P1' , 'P2']


from sklearn.cluster import AgglomerativeClustering

ac2 = AgglomerativeClustering(n_clusters = 2)

plt.figure(figsize =(6,6))
plt.scatter(ds['P1'],ds['P2'],
           c = ac2.fit_predict(ds), cmap = 'rainbow')
plt.show()
```




```
ac3 = AgglomerativeClustering(n_clusters = 3)

plt.figure(figsize =(6,6))
plt.scatter(ds['P1'],ds['P2'],
           c = ac3.fit_predict(ds), cmap = 'rainbow')
plt.show()
```




```
ac4 = AgglomerativeClustering(n_clusters = 4)

plt.figure(figsize =(6,6))
plt.scatter(ds['P1'],ds['P2'],
            c = ac4.fit_predict(ds), cmap = 'rainbow')
plt.show()
```