# Kelompok 3 C2

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Data NPL untuk mendeteksi nasabah yang kreditnya akan macet. Field yang akan diprediksi adalah "flag_kredit_macet".

## IMPORT LIBRARY

In [1]:
```
# display
%matplotlib inline
# numerik
import numpy as np
# analisis
import pandas as pd
# plot
import matplotlib.pyplot as plt
# visualisasi
import seaborn as sns
sns.set()
warnings.filterwarnings("ignore")
from sklearn.ensemble import RandomForestClassifier
from sklearn.metrics import classification_report
from sklearn.metrics import accuracy_score
from xgboost import XGBClassifier
from sklearn.tree import DecisionTreeClassifier
from sklearn.naive_bayes import GaussianNB
```

## READ FILE

In [2]:
```
data=pd.read_csv("npl_train.txt")
data.head(3)
```

Out[2]:

| | X | jumlah_kartu | outstanding | limit_kredit | tagihan | total_pemakaian_tunai | total_pemakaian_retail | sisa_tagihan_tidak_terbayar | kode_cabang | rasio_pembayaran | ... | flag_kredit_macet | jumlah_tahun |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **0** | 1 | 2 | 36150 | 70000000.0 | 23437.0 | 0.0 | 94.0 | 26323.0 | I | 102.19 | ... | 0 | |
| **1** | 2 | 2 | 268691 | 100000000.0 | 254564.0 | 0.0 | 1012.0 | 0.0 | A | 0.00 | ... | 0 | |
| **2** | 3 | 3 | 6769149 | 280000000.0 | 4159779.0 | 0.0 | 0.0 | 0.0 | A | 100.00 | ... | 0 | |

3 rows × 24 columns

In [3]:
```
data.info()
```

```
<class 'pandas.core.frame.DataFrame'>
RangeIndex: 15493 entries, 0 to 15492
Data columns (total 24 columns):
 #   Column                      Non-Null Count  Dtype  
---  ------                      --------------  -----  
 0   X                           15493 non-null  int64  
 1   jumlah_kartu                15493 non-null  int64  
 2   outstanding                 15493 non-null  int64  
 3   limit_kredit                15493 non-null  float64
 4   tagihan                     15493 non-null  float64
 5   total_pemakaian_tunai       15493 non-null  float64
 6   total_pemakaian_retail      15493 non-null  float64
 7   sisa_tagihan_tidak_terbayar 15493 non-null  float64
 8   kode_cabang                 15393 non-null  object 
 9   rasio_pembayaran            15493 non-null  float64
 10  persentasi_overlimit        15493 non-null  float64
 11  rasio_pembayaran_3bulan     15493 non-null  float64
 12  rasio_pembayaran_6bulan     15493 non-null  float64
 13  skor_delikuensi             15493 non-null  int64  
 14  flag_kredit_macet           15493 non-null  int64  
 15  jumlah_tahun_sejak_pembukaan_kredit  15493 non-null  float64
 16  total_pemakaian             15493 non-null  float64
 17  sisa_tagihan_per_jumlah_kartu  15493 non-null  float64
 18  sisa_tagihan_per_limit      15493 non-null  float64
 19  total_pemakaian_per_limit   15493 non-null  float64
 20  pemakaian_3bln_per_limit    15493 non-null  float64
 21  pemakaian_6bln_per_limit    15493 non-null  float64
 22  utilisasi_3bulan            15493 non-null  float64
 23  utilisasi_6bulan            15493 non-null  float64
dtypes: float64(18), int64(5), object(1)
memory usage: 2.8+ MB
```

## Menghapus Kode Cabang

kode_cabang dan X dihapus karena kedua tidak memiliki katan dengan hasil akhir.

In [4]:
```
data = data.drop(["kode_cabang","X"], axis=1)
```

In [5]:
```
data["flag_kredit_macet"].value_counts()
```

Out[5]:
```
0   14134
1    1359
Name: flag_kredit_macet, dtype: int64
```

## SPLIT DATA

In [6]:
```
from sklearn.model_selection import train_test_split
```

In [7]:
```
data_train, data_test=train_test_split(data,test_size=0.4,random_state=1)
```

In [8]:
```
data_train.head(5)
```

Out[8]:

| | jumlah_kartu | outstanding | limit_kredit | tagihan | total_pemakaian_tunai | total_pemakaian_retail | sisa_tagihan_tidak_terbayar | rasio_pembayaran | persentasi_overlimit | rasio_pembayaran_3bulan |
|---|---|---|---|---|---|---|---|---|---|---|
| **10502** | 4 | 24962677 | 230000000.0 | 22575640.0 | 0.0 | 2957906.0 | 25136225.0 | 0.0 | 8.62 | 7.88 |
| **14010** | 2 | 7474329 | 70000000.0 | 2901653.0 | 0.0 | 0.0 | 2133750.0 | 60.9 | 2.07 | 83.90 |
| **5089** | 3 | 596113 | 44000000.0 | 530033.0 | 0.0 | 0.0 | 0.0 | 0.00 | 0.00 | 18.10 |
| **7683** | 3 | 4853906 | 100000000.0 | 4748881.0 | 0.0 | 1130000.0 | 4746073.0 | 23.1 | 0.00 | 30.50 |
| **5692** | 2 | 76966 | 80000000.0 | 78000.0 | 0.0 | 196.0 | 0.0 | 0.0 | 0.00 | 25.20 |

5 rows × 22 columns

In [9]:
```
data_test=data_test.drop("flag_kredit_macet", 1)
```

In [10]:
```
data_train.info()
```

```
<class 'pandas.core.frame.DataFrame'>
Int64Index: 9295 entries, 10502 to 13349
Data columns (total 22 columns):
 #   Column                      Non-Null Count  Dtype  
---  ------                      --------------  -----  
 0   jumlah_kartu                9295 non-null   int64  
 1   outstanding                 9295 non-null   int64  
 2   limit_kredit                9295 non-null   float64
 3   tagihan                     9295 non-null   float64
 4   total_pemakaian_tunai       9295 non-null   float64
 5   total_pemakaian_retail      9295 non-null   float64
 6   sisa_tagihan_tidak_terbayar 9295 non-null   float64
 7   rasio_pembayaran            9295 non-null   float64
 8   persentasi_overlimit        9295 non-null   float64
 9   rasio_pembayaran_3bulan     9295 non-null   float64
 10  rasio_pembayaran_6bulan     9295 non-null   float64
 11  skor_delikuensi             9295 non-null   int64  
 12  flag_kredit_macet           9295 non-null   int64  
 13  jumlah_tahun_sejak_pembukaan_kredit  9295 non-null   float64
 14  total_pemakaian             9295 non-null   float64
 15  sisa_tagihan_per_jumlah_kartu  9295 non-null   float64
 16  sisa_tagihan_per_limit      9295 non-null   float64
 17  total_pemakaian_per_limit   9295 non-null   float64
 18  pemakaian_3bln_per_limit    9295 non-null   float64
 19  pemakaian_6bln_per_limit    9295 non-null   float64
 20  utilisasi_3bulan            9295 non-null   float64
 21  utilisasi_6bulan            9295 non-null   float64
dtypes: float64(18), int64(4)
memory usage: 1.6 MB
```

## Kelas Target

In [11]:
```
X=data_train.drop("flag_kredit_macet",1)
```

In [12]:
```
X.head(5)
```

Out[12]:

| | jumlah_kartu | outstanding | limit_kredit | tagihan | total_pemakaian_tunai | total_pemakaian_retail | sisa_tagihan_tidak_terbayar | rasio_pembayaran | persentasi_overlimit | rasio_pembayaran_3bulan |
|---|---|---|---|---|---|---|---|---|---|---|
| **10502** | 4 | 24962677 | 230000000.0 | 22575640.0 | 0.0 | 2957906.0 | 25136225.0 | 0.0 | 8.62 | 7.88 |
| **14010** | 2 | 7474329 | 70000000.0 | 2901653.0 | 0.0 | 0.0 | 2133750.0 | 60.9 | 2.07 | 83.90 |
| **5089** | 3 | 596113 | 44000000.0 | 530033.0 | 0.0 | 0.0 | 0.0 | 0.00 | 0.00 | 18.10 |
| **7683** | 3 | 4853906 | 100000000.0 | 4748881.0 | 0.0 | 1130000.0 | 4746073.0 | 23.1 | 0.00 | 30.50 |
| **5692** | 2 | 76966 | 80000000.0 | 78000.0 | 0.0 | 196.0 | 0.0 | 0.0 | 0.00 | 25.20 |

5 rows × 21 columns

In [13]:
```
y=data_train[["flag_kredit_macet"]]
```

In [14]:
```
y.head(5)
```

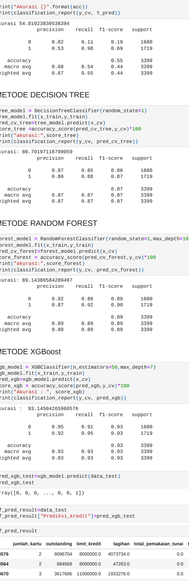
Out[14]:

| | flag_kredit_macet |
|---|---|
| **10502** | 0 |
| **14010** | 0 |
| **5089** | 1 |
| **7683** | 0 |
| **5692** | 1 |

## DATA IMBALANCE

In [15]:
```
plt.figure(figsize=(15,8))
plt.subplot(1,2,1)
y.value_counts().plot.pie(autopct='%1.1f%%')
centre=plt.Circle((0,0),0.7,fc='white')
fig=plt.gcf()
fig.gca().add_artist(centre)
```

Out[15]:
```
<matplotlib.patches.Circle at 0x29bef0bc110>
```




In [16]:
```
from imblearn.over_sampling import SMOTE
over=SMOTE()
X_over,y_over=over.fit_resample(X,y)
```

In [17]:
```
x_train,x_cv,y_train,y_cv=train_test_split(X,y,test_size=0.2,random_state=1)
```

In [18]:
```
plt.figure(figsize=(15,8))
plt.subplot(1,2,1)
y.value_counts().plot.pie(autopct='%1.1f%%')
centre=plt.Circle((0,0),0.7,fc='white')
fig=plt.gcf()
fig.gca().add_artist(centre)
```

Out[18]:
```
<matplotlib.patches.Circle at 0x229bfa14110>
```


## METODE NAIVE BAYES

In [19]:
```
nb_model = GaussianNB()
nb_model.fit(x_train, y_train)
Y_pred = nb_model.predict(x_cv)
acc = accuracy_score(y_cv, Y_pred)*100

print("Akurasi {}".format(acc))
print(classification_report(y_cv, Y_pred))
```

```
Akurasi 54.81623836583834
              precision    recall  f1-score   support

           0       0.82      0.11      0.19      1680
           1       0.53      0.98      0.69      1719

    accuracy                           0.55      3399
   macro avg       0.68      0.54      0.44      3399
weighted avg       0.67      0.55      0.44      3399
```

## METODE DECISION TREE

In [20]:
```
tree_model = DecisionTreeClassifier(random_state=1)
tree_model.fit(x_train,y_train)
pred_cv_tree=tree_model.predict(x_cv)
score_tree = accuracy_score(pred_cv_tree,y_cv)*100
print('Akurasi',score_tree)
print(classification_report(y_cv, pred_cv_tree))
```

```
Akurasi: 86.70197116799059
              precision    recall  f1-score   support

           0       0.87      0.85      0.86      1680
           1       0.86      0.88      0.87      1719

    accuracy                           0.87      3399
   macro avg       0.87      0.87      0.87      3399
weighted avg       0.87      0.87      0.87      3399
```

## METODE RANDOM FOREST

In [21]:
```
forest_model = RandomForestClassifier(random_state=1,max_depth=10,n_estimators=50)
forest_model.fit(x_train,y_train)
pred_cv_forest=forest_model.predict(x_cv)
score_forest = accuracy_score(pred_cv_forest,y_cv)*100
print('Akurasi:',score_forest)
print(classification_report(y_cv, pred_cv_forest))
```

```
Akurasi: 89.14386584289497
              precision    recall  f1-score   support

           0       0.92      0.86      0.89      1680
           1       0.87      0.92      0.90      1719

    accuracy                           0.89      3399
   macro avg       0.89      0.89      0.89      3399
weighted avg       0.89      0.89      0.89      3399
```

## METODE XGBoost

In [22]:
```
xgb_model = XGBClassifier(n_estimators=50,max_depth=7)
xgb_model.fit(x_train,y_train)
pred_xgb=xgb_model.predict(x_cv)
score_xgb = accuracy_score(pred_xgb,y_cv)*100
print('Akurasi : ', score_xgb)
print(classification_report(y_cv, pred_xgb))
```

```
Akurasi :  93.14504265960576
              precision    recall  f1-score   support

           0       0.95      0.91      0.93      1680
           1       0.92      0.95      0.93      1719

    accuracy                           0.93      3399
   macro avg       0.93      0.93      0.93      3399
weighted avg       0.93      0.93      0.93      3399
```

In [23]:
```
pred_xgb_test=xgb_model.predict(data_test)
pred_xgb_test
```

Out[23]:
```
array([0, 0, 0, ..., 0, 0, 1])
```

In [24]:
```
df_pred_result=data_test
df_pred_result["Prediksi_kredit"]=pred_xgb_test
```

In [25]:
```
df_pred_result
```

Out[25]:

| | jumlah_kartu | outstanding | limit_kredit | tagihan | total_pemakaian_tunai | total_pemakaian_retail | sisa_tagihan_tidak_terbayar | rasio_pembayaran | persentasi_overlimit | rasio_pembayaran_3bulan |
|---|---|---|---|---|---|---|---|---|---|---|
| **3576** | 2 | 8096704 | 80000000.0 | 4073734.0 | 0.0 | 1903325.0 | 5213856.0 | 65.5 | 1.24 | 37.90 |
| **8564** | 2 | 684568 | 80000000.0 | 472818.0 | 0.0 | 538655.0 | 0.0 | 100.0 | 0.00 | 100.00 |
| **13670** | 3 | 3617686 | 110000000.0 | 1933276.0 | 0.0 | 5860000.0 | 3155317.0 | 100.0 | 0.00 | 100.00 |
| **13243** | 2 | 3119979 | 30000000.0 | 3007042.0 | 0.0 | 100000.0 | 3097253.0 | 10.1 | 3.84 | 12.40 |
| **804** | 2 | 139723 | 40000000.0 | 148961.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.00 | 39.46 |
| **...** | ... | ... | ... | ... | ... | ... | ... | ... | ... | ... |
| **8367** | 4 | 4733242 | 40000000.0 | 4505202.0 | 0.0 | 165000.0 | 4766229.0 | 46.7 | 16.90 | 17.10 |
| **9881** | 2 | 2294072 | 40000000.0 | 1115000.0 | 0.0 | 849587.0 | 1925403.0 | 81.7 | 0.00 | 98.80 |
| **5995** | 6 | 22629564 | 180000000.0 | 20209542.0 | 0.0 | 3927461.0 | 22643270.0 | 40.1 | 11.90 | 58.00 |
| **12277** | 2 | 8153311 | 80000000.0 | 3644008.0 | 0.0 | 946400.0 | 7961240.0 | 0.0 | 1.24 | 97.00 |
| **12644** | 2 | 8479101 | 70000000.0 | 8528016.0 | 0.0 | 0.0 | 8464004.0 | 2 | 21.70 | 45.50 |

6198 rows × 22 columns

In [26]:
```
from sklearn.metrics import confusion_matrix
confusion_matrix(pred_xgb,y_cv)
```

Out[26]:
```
array([[1528,   81],
       [ 152, 1638]], dtype=int64)
```