02_Modelling.ipynb

September 23, 2021

[ ]:
```
# Importations
import sys
sys.path.append('..')

import pandas as pd
import numpy as np
from sklearn.model_selection import train_test_split
from sklearn.model_selection import StratifiedKFold, RepeatedStratifiedKFold
from sklearn.model_selection import cross_validate
from imblearn.pipeline import Pipeline

from sklearn.linear_model import SGDClassifier
from sklearn.ensemble import RandomForestClassifier
from lightgbm import LGBMClassifier
from sklearn.metrics import confusion_matrix, classification_report
from imblearn.combine import SMOTETomek
from imblearn.under_sampling import TomekLinks
from preprocessing import preprocessor as prep
from preprocessing import preprocessor_no_scaler as prep_no_scl
from styles import *
```

[ ]:
```
# Initialisation
train = pd.read_csv('../02_data/application_train.csv')
test = pd.read_csv('../02_data/application_test.csv')

id_error_msg = lambda x: '`SK_ID_CURR` is not unic for {} set!'.format(x)
assert len(train.SK_ID_CURR.unique()) == train.shape[0], id_error_msg('train')
assert len(test.SK_ID_CURR.unique()) == test.shape[0], id_error_msg('test')
train.set_index('SK_ID_CURR', inplace=True)
test.set_index('SK_ID_CURR', inplace=True)

print('Training set dimensions :', train.shape)

cls_size = train.TARGET.value_counts()
cls_freq = train.TARGET.value_counts(normalize=True)
print(pd.DataFrame({'size': cls_size,
                    'freq': cls_freq.apply(lambda x: '%.3f' % x)}))
```

```
Training set dimensions : (307511, 121)
     size   freq
0  282686  0.919
1   24825  0.081
```

[ ]:
```
train_sample = train[::10]
print('Sampled training set dimensions :', train_sample.shape)
cls_size = train.TARGET.value_counts()
cls_freq = train.TARGET.value_counts(normalize=True)
print(pd.DataFrame({'size': cls_size,
                    'freq': cls_freq.apply(lambda x: '%.3f' % x)}))
```

```
Sampled training set dimensions : (30752, 121)
     size   freq
0  282686  0.919
1   24825  0.081
```

[ ]:
```
X, y = train.iloc[:, 1:], train.iloc[:, 0].values.reshape(-1,1)
Xs, ys = train_sample.iloc[:, 1:], train_sample.iloc[:, 0].values.reshape(-1,1)
X_train, X_test, y_train, y_test = train_test_split(Xs, ys, test_size=.2)
print('X_train:', X_train.shape)
print('y_train:', y_train.shape)
print('X_test:', X_test.shape)
print('y_test:', y_test.shape)
```

```
X_train: (24601, 120)
y_train: (24601, 1)
X_test: (6151, 120)
y_test: (6151, 1)
```

1 Modèle 1 : SGD Classifier

[ ]:
```
sgd = Pipeline([('p', prep), ('m', SGDClassifier())])
cv = StratifiedKFold(n_splits=6, shuffle=True, random_state=42)
#cv = RepeatedStratifiedKFold(n_splits=5, n_repeats=3, random_state=42)
scoring = ['precision_macro','recall_macro']
sgd_scor = cross_validate(sgd, X_train, y_train, scoring=scoring, cv=cv)
print('Model 1\n' + line_decor)
print(sgd_scor['test_precision_macro'])
print(sgd_scor['test_recall_macro'])
#print('Mean Accuracy: %.4f' % np.mean(sgd_scores['test_accuracy']))
print('Mean Precision: %.4f' % np.nanmean(sgd_scor['test_precision_macro']))
print('Mean Recall: %.4f' % np.nanmean(sgd_scor['test_recall_macro']))
```

```
Model 1
--------
[       nan        nan        nan 0.4602439  0.46036585 0.46036585]
```

```
[nan nan nan 0.5 0.5 0.5]
Mean Precision: 0.4603
Mean Recall: 0.5000
```

[ ]:
```
resampler = SMOTETomek(tomek=TomekLinks(sampling_strategy='majority'))
sgd_imb = Pipeline([('p', prep), ('r', resampler), ('m', SGDClassifier())])
cv = StratifiedKFold(n_splits=6, shuffle=True, random_state=42)
#cv = RepeatedStratifiedKFold(n_splits=5, n_repeats=3, random_state=42)
scoring = ['precision_macro','recall_macro']
sgd_imb_scor = cross_validate(sgd_imb, X_train, y_train, scoring=scoring, cv=5)
print(sgd_scor['test_precision_macro'])
print(sgd_scor['test_recall_macro'])
print('Model 1 - with imbalance handling\n' + line_decor)
#print('Mean Accuracy: %.4f' % np.mean(sgd_imb_scores['test_accuracy']))
print('Mean Precision: %.4f' % np.nanmean(sgd_imb_scor['test_precision_macro']))
print('Mean Recall: %.4f' % np.nanmean(sgd_imb_scor['test_recall_macro']))
```

```
[       nan        nan        nan 0.4602439  0.46036585 0.46036585]
[nan nan nan 0.5 0.5 0.5]
Model 1 - with imbalance handling
--------
Mean Precision: 0.5517
Mean Recall: 0.6540
```

[ ]:
```
model1 = Pipeline([('p', prep), ('m', SGDClassifier())])
model1.fit(X_train, y_train)
y_pred = model1.predict(X_test)
conf_mat = confusion_matrix(y_test, y_pred)
print('Model 1\n' + line_decor)
print('Score: %.4f' % model1.score(X_test, y_test))
print(line_decor + '\nConfusion matrix\n' + str(conf_mat))
print(classification_report(y_test, y_pred))
```

```
Model 1
--------
Score: 0.9190
--------
Confusion matrix
[[56522     0]
 [ 4981     0]]
              precision    recall  f1-score   support

           0       0.92      1.00      0.96     56522
           1       0.00      0.00      0.00      4981

    accuracy                           0.92     61503
   macro avg       0.46      0.50      0.48     61503
weighted avg       0.84      0.92      0.88     61503
```

2 Modèle 2 : Random Forest Classifier

[ ]:
```
model2 = Pipeline([('p', prep_no_scl), ('m', RandomForestClassifier())])
cv = RepeatedStratifiedKFold(n_splits=10, n_repeats=3, random_state=1)
scoring = ['accuracy','precision_macro','recall_macro']
scores_model2 = cross_validate(model2, X_train, y_train, scoring=scoring, cv=cv,
                               n_jobs=-1)

print('Model 2\n' + 8 * '-')
print('Mean Accuracy: %.4f' % np.mean(scores_model2['test_accuracy']))
print('Mean Precision: %.4f' % np.mean(scores_model2['test_precision_macro']))
print('Mean Recall: %.4f' % np.mean(scores_model2['test_recall_macro']))
```

[ ]:
```
model2 = Pipeline([('p', prep_no_scl), ('m', RandomForestClassifier())])
model2.fit(X_train, y_train)
y_pred = model2.predict(X_test)
conf_mat = confusion_matrix(y_test, y_pred)
print('Model 2\n' + 8 * '-')
print('Score: %.4f' % model2.score(X_test, y_test))
print(8 * '-' + '\nConfusion matrix\n' + str(conf_mat))
print(classification_report(y_test, y_pred))
```

```
Model 1
--------
Score: 0.9185
--------
Confusion matrix
[[56485     4]
 [ 5011     3]]
              precision    recall  f1-score   support

           0       0.92      1.00      0.96     56489
           1       0.43      0.00      0.00      5014

    accuracy                           0.92     61503
   macro avg       0.67      0.50      0.48     61503
weighted avg       0.88      0.92      0.88     61503
```

[ ]:
```
y_pred = model2.predict(X_test)
conf_mat = confusion_matrix(y_test, y_pred)
print(conf_mat)
```

```
[[56512     5]
 [ 4979     7]]
```

[ ]:
```
model2.get_params()
```

[ ]:
```
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                                     'REGION_POPULATION_RELATIVE', 'DAYS_BIRTH',
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                                     'ORGANIZATION_TYPE', 'FONDKAPREMONT_MODE',
                                     'HOUSETYPE_MODE',
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```
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   'AMT_GOODS_PRICE',
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```

```
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  'ELEVATORS_MEDI',
  'ENTRANCES_MEDI',
  'FLOORSMAX_MEDI',
  'FLOORSMIN_MEDI',
  'LANDAREA_MEDI',
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  'ELEVATORS_MODE',
  'ENTRANCES_MODE',
  'FLOORSMAX_MODE',
  'FLOORSMIN_MODE',
  'LANDAREA_MODE',
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```

```
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loans'],
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                                              ['No', 'Yes'], ['M', 'F'],
                                              ['MONDAY', 'TUESDAY',
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                                               'THURSDAY', 'FRIDAY',
'SATURDAY',
                                               'SUNDAY']]))]),
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```
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```
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 'randomforestclassifier__ccp_alpha': 0.0,
 'randomforestclassifier__class_weight': None,
 'randomforestclassifier__criterion': 'gini',
 'randomforestclassifier__max_depth': None,
 'randomforestclassifier__max_features': 'auto',
 'randomforestclassifier__max_leaf_nodes': None,
 'randomforestclassifier__max_samples': None,
 'randomforestclassifier__min_impurity_decrease': 0.0,
 'randomforestclassifier__min_impurity_split': None,
 'randomforestclassifier__min_samples_leaf': 1,
 'randomforestclassifier__min_samples_split': 2,
 'randomforestclassifier__min_weight_fraction_leaf': 0.0,
 'randomforestclassifier__n_estimators': 100,
 'randomforestclassifier__n_jobs': None,
 'randomforestclassifier__oob_score': False,
 'randomforestclassifier__random_state': None,
 'randomforestclassifier__verbose': 0,
 'randomforestclassifier__warm_start': False}
```

3 Modèle 3 : LightGBM

[ ]:
```
model3 = Pipeline([('p', prep), ('m', LGBMClassifier())])
model3.fit(X_train, y_train)
print('Score:', model3.score(X_test, y_test))
```

```
Score: 0.9192071931450498
```

[ ]:
```
y_pred = model3.predict(X_test)
conf_mat = confusion_matrix(y_test, y_pred)
print(conf_mat)
```

```
[[56447    81]
 [ 4888    87]]
```

[ ]:
```
print(classification_report(y_test, y_pred))
```

```
              precision    recall  f1-score   support

           0       0.92      1.00      0.96     56528
           1       0.52      0.02      0.03      4975

    accuracy                           0.92     61503
   macro avg       0.72      0.51      0.50     61503
weighted avg       0.89      0.92      0.88     61503
```

[ ]:
```
# à faire

# smote tomek
# random search precision des deux classes (privilégier light_gbm)
#
# choisir optimisation recall(classe 1)
# fonction coût : manque à gagner pour chaque treshold
# treshold = + = + precision - recall
# precision élevée = on accepte tout le monde
# recall élevée = on refuse tout le monde
# regarder crer une colonne intérêts (amt credit - good price),
# optimiser mon threshold % de ça
```