

```
In [1]: import numpy as np
import pandas as pd
import matplotlib.pyplot as plt
from sklearn import datasets
data_brut = pd.read_csv('/Users/thesard/Doctorat/These2018/ISEP/Developpements/EspaceIntelliJ/LearningAllInPython/Learning_IHM_Features/datasets/imported_datasets/shuttle-unsupervised-ad_2019-06-14 17:33:02.493755.csv', header=None, index_col=None)
X = data_brut[[0, 1, 2, 3, 4, 5, 6, 7, 8]]
y_brut = data_brut[[9]]
```

```
In [2]: # To encode qualitative data into quantitative data
from sklearn.preprocessing import LabelEncoder
encoder = LabelEncoder()
y = encoder.fit_transform(y_brut)
y
```

/Users/thesard/anaconda3/lib/python3.7/site-packages/sklearn/preprocessing/label.py:235: DataConversionWarning: A column-vector y was passed when a 1d array was expected. Please change the shape of y to (n_samples,), for example using ravel().

```
y = column_or_1d(y, warn=True)
```

```
Out[2]: array([1, 1, 1, ..., 0, 0, 0])
```

```
In [3]: data = pd.concat([
    X,
    pd.DataFrame(y, dtype=np.int)
], axis=1, ignore_index=True)
#data
```

```
In [4]: from sklearn.neighbors import LocalOutlierFactor
from scipy.stats import randint as sp_randint
import random
n_neighbors = sp_randint(1, 100)
contamination = random.uniform(0, 0.5)
#clf = LocalOutlierFactor(n_neighbors=n_neighbors, contamination=contamination, novelty=True)
clf = LocalOutlierFactor(novelty=True)
```

```
In [5]: from sklearn.model_selection import cross_validate
from sklearn.metrics import recall_score
scoring = ['precision_macro', 'recall_macro']
scores = cross_validate(clf, X, y, scoring=scoring, cv=5)
```

/Users/thesard/anaconda3/lib/python3.7/site-packages/sklearn/neighbors/lof.py:236: FutureWarning: default contamination parameter 0.1 will change in version 0.22 to "auto". This will change the predict method behavior.

```
FutureWarning)
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```
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```

```
In [6]: sorted(scores.keys())
```

```
Out[6]: ['fit_time',
        'score_time',
        'test_precision_macro',
        'test_recall_macro',
        'train_precision_macro',
        'train_recall_macro']
```

```
In [7]: scores
```

```
/Users/thesard/anaconda3/lib/python3.7/site-packages/sklearn/utils/deprecation.py:125: FutureWarning: You are accessing a training score ('train_precision_macro'), which will not be available by default any more in 0.21. If you need training scores, please set return_train_score=True
  warnings.warn(*warn_args, **warn_kwargs)
/Users/thesard/anaconda3/lib/python3.7/site-packages/sklearn/utils/deprecation.py:125: FutureWarning: You are accessing a training score ('train_recall_macro'), which will not be available by default any more in 0.21. If you need training scores, please set return_train_score=True
  warnings.warn(*warn_args, **warn_kwargs)
```

```
Out[7]: {'fit_time': array([2.61133695, 3.56657505, 3.52172804, 3.64714193,
        3.62651896]),
        'score_time': array([1.42752385, 1.6171751 , 1.66301489, 1.58526301,
        1.64391112]),
        'test_precision_macro': array([8.88060033e-05, 0.00000000e+00, 0.00000000e+00,
        0.00000000e+00, 0.00000000e+00]),
        'train_precision_macro': array([0.          , 0.00683427, 0.00681317,
        0.00676389, 0.0067812 ]),
        'test_recall_macro': array([0.0007593, 0.          , 0.          , 0.          ,
        0.          ]),
        'train_recall_macro': array([0.          , 0.2634776 , 0.2627183 ,
        0.26044039, 0.2611997 ])}

```

```
In [8]: scores['test_recall_macro']
```

```
Out[8]: array([0.0007593, 0.          , 0.          , 0.          , 0.          ])
```

```
In [ ]: scores.get_params()
```

```
In [9]: # RandomizedSearchCV
        clf = LocalOutlierFactor()
```

```
In [10]: clf.get_params()
```

```
Out[10]: {'algorithm': 'auto',
          'contamination': 'legacy',
          'leaf_size': 30,
          'metric': 'minkowski',
          'metric_params': None,
          'n_jobs': None,
          'n_neighbors': 20,
          'novelty': False,
          'p': 2}
```

```
In [11]: # Utility function to report best scores
def report(results, n_top=3):
    for i in range(1, n_top + 1):
        candidates = np.flatnonzero(results['rank_test_score'] == i)

        for candidate in candidates:
            print("Model with rank: {0}".format(i))
            print("Mean validation score: {0:.3f} (std: {1:.3f})".format(
                results['mean_test_score'][candidate],
                results['std_test_score'][candidate]))
            print("Parameters: {0}".format(results['params'][candidate]))
            print("")
```

```
In [12]: #from scipy.stats import randint as sp_randint
import random
# specify parameters and distributions to sample from
#param_dist = {"algorithm": ['auto', 'ball_tree', 'kd_tree', 'brute'],
#              "contamination": [random.uniform(0, 0.5)],
#              "leaf_size": sp_randint(1, 100),
#              "metric": ['braycurtis', 'canberra', 'chebyshev',
#              'correlation', 'dice', 'hamming', 'jaccard', 'kulsinski',
#              'mahalanobis', 'minkowski', 'rogerstanimoto', 'russellra
#              o',
#              'seuclidean', 'sokalmichener', 'sokalsneath', 'sqeuclidean',
#              'yule'],
#              "n_jobs": [None],
#              "n_neighbors": sp_randint(1, 100),
#              "novelty": [True, False],
#              "p": sp_randint(1, 10)}
```

```
In [13]: # specify parameters and distributions to sample from
param_dist = {"algorithm": ['auto'],
              "contamination": [random.uniform(0, 0.5)],
              "leaf_size": sp_randint(1, 100),
              "metric": ['minkowski'],
              "n_jobs": [None],
              "n_neighbors": sp_randint(1, 100),
              "novelty": [True],
              "p": sp_randint(1, 10)}
```

```
In [15]: from time import time
from sklearn.model_selection import RandomizedSearchCV
# run randomized search
n_iter_search = 20
random_search = RandomizedSearchCV(clf, param_distributions=param_d
ist, n_iter=n_iter_search, cv=5,
                                iid=False, scoring="recall_macro
")
start = time()
random_search.fit(X, y)
print("RandomizedSearchCV took %.2f seconds for %d candidates"
      " parameter settings." % ((time() - start), n_iter_search))
report(random_search.cv_results_)
```

/Users/thesard/anaconda3/lib/python3.7/site-packages/sklearn/metrics/classification.py:1145: UndefinedMetricWarning: Recall is ill-defined and being set to 0.0 in labels with no true samples.

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RandomizedSearchCV took 4113.58 seconds for 20 candidates parameter settings.

Model with rank: 1

Mean validation score: 0.001 (std: 0.003)

Parameters: {'algorithm': 'auto', 'contamination': 0.03540998689724445, 'leaf_size': 97, 'metric': 'minkowski', 'n_jobs': None, 'n_neighbors': 7, 'novelty': True, 'p': 7}

Model with rank: 2

Mean validation score: 0.001 (std: 0.002)

Parameters: {'algorithm': 'auto', 'contamination': 0.03540998689724445, 'leaf_size': 63, 'metric': 'minkowski', 'n_jobs': None, 'n_neighbors': 15, 'novelty': True, 'p': 5}

Model with rank: 3

Mean validation score: 0.001 (std: 0.002)

Parameters: {'algorithm': 'auto', 'contamination': 0.03540998689724445, 'leaf_size': 45, 'metric': 'minkowski', 'n_jobs': None, 'n_neighbors': 9, 'novelty': True, 'p': 1}

In []: