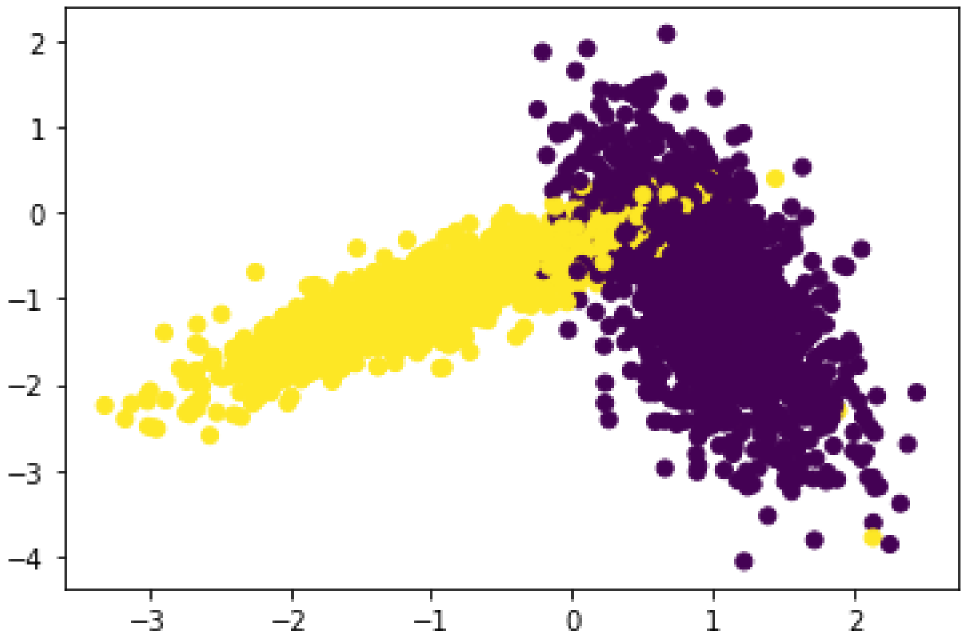
RandomSearchCV

February 16, 2021

[1]:
```
from sklearn.datasets import make_classification
from sklearn.model_selection import train_test_split
from sklearn.preprocessing import StandardScaler
import numpy
from tqdm import tqdm
import numpy as np
from sklearn.metrics.pairwise import euclidean_distances


x,y = make_classification(n_samples=10000, n_features=2, n_informative=2,␣
 ↪n_redundant= 0, n_clusters_per_class=1, random_state=60)
X_train, X_test, y_train, y_test =␣
 ↪train_test_split(x,y,stratify=y,random_state=42)

# del X_train,X_test
```

[2]:
```
%matplotlib inline
import matplotlib.pyplot as plt
colors = {0:'red', 1:'blue'}
plt.scatter(X_test[:,0], X_test[:,1],c=y_test)
plt.show()
```



1 Implementing Custom RandomSearchCV

[3]:
```
def RandomSearchCV(x_train,y_train,classifier, param_range, folds):
    """
    This function takes the train dataset, testdataset, classifier, a tuple and
    the number of folds     10 random numbers are chosen between the tuple range
    as the number of neighbours
    """
    # Getting 10 random numbers from uniform distribution in the specified range
    params_l = numpy.random.uniform(param_range[0], param_range[1], 10)

    # Creating two empty lists to store the train scores and the test scores
    trainscores = []
    testscores = []

    # Since the random numbers are going to be float values, converting them to␣
↪integers and sorting them
    params_l = [int(i) for i in params_l]
    params_l.sort()

    for param in params_l:
        # fold_size stores the size of each fold of the datset. fold_nums is a␣
↪list containing numbers
        # from 0 to the number of folds
```

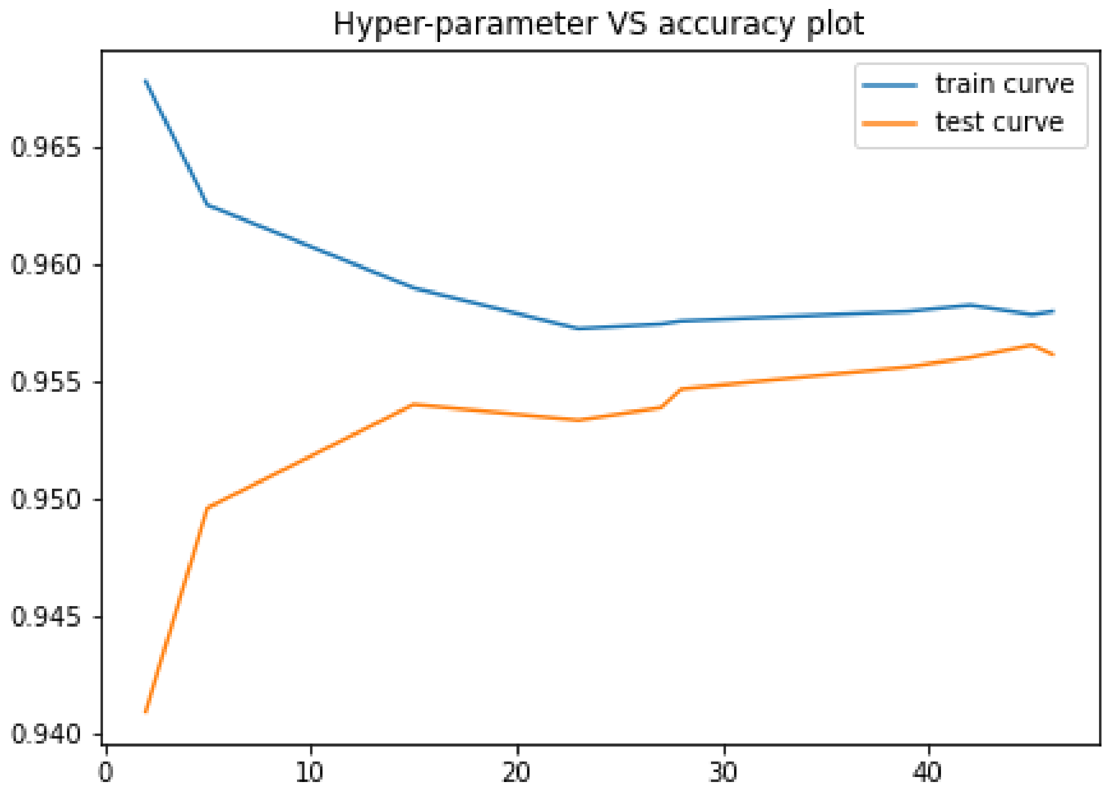
```
        fold_size = len(X_train)/folds
        fold_nums = numpy.arange(folds)

        # trainscores_folds and testscores_folds store the train and test␣
↪scores of each fold
        trainscores_folds = []
        testscores_folds  = []

        # Iterating over fold_nums
        for i in fold_nums.tolist():

            # X_temp and y_temp are copies of X_train and y_train. Creating␣
↪copies as it'll be easier to delete
            # the test fold from the datasets and use the remaining as train set
            X_temp = X_train
            y_temp = y_train

            # test_s and test_e will contain the starting and ending indices of␣
↪test fold
            test_s = int(i*fold_size)
            test_e = int(((i+1)*fold_size)-1)

            # splicing the test fold. Deleting the test fold from temp dataset␣
↪and using them as train folds
            x_test_fold = X_train[test_s:test_e]
            x_train_fold = numpy.delete(X_temp, [i for i in range(test_s,␣
↪test_e)], axis = 0)
            y_test_fold = y_train[test_s:test_e]
            y_train_fold = numpy.delete(y_temp, [i for i in range(test_s,␣
↪test_e)], axis = 0)

            # param is the number of neighbours. Fitting the classifier to the␣
↪x and y train folds
            classifier.n_neighbors = param
            classifier.fit(x_train_fold,y_train_fold)

            # Predicting and calulating the test score for this fold
            y_predicted = classifier.predict(x_test_fold)
            testscores_folds.append(accuracy_score(y_test_fold, y_predicted))

            # Predicting and calculating the train score for this fold
            y_predicted = classifier.predict(x_train_fold)
            trainscores_folds.append(accuracy_score(y_train_fold, y_predicted))

        # Appending the mean of the trainscore and testscores obtained from␣
↪various fold combinations to the trainscores
```

```python
        # and testscores arrays. These two arrays will be returned
        trainscores.append(np.mean(np.array(trainscores_folds)))
        testscores.append(np.mean(np.array(testscores_folds)))

    # Returning the trainscores, testscores and the parameters
    return trainscores,testscores,params_l
```

[4]:
```python
# Importing libraries
from sklearn.metrics import accuracy_score
from sklearn.neighbors import KNeighborsClassifier
import matplotlib.pyplot as plt
import random
import warnings
warnings.filterwarnings("ignore")
```

[5]:
```python
# Creating a classifier
neigh = KNeighborsClassifier()

# Calling the function and storing the return values
trainscores,testscores, params = RandomSearchCV(X_train, y_train, neigh,␣
 ↪(1,50), 3)
```

[6]:
```python
# Plotting the results obtained
f = plt.figure()
f.set_figwidth(7)
f.set_figheight(5)
plt.plot(params,trainscores, label='train curve')
plt.plot(params,testscores, label='test curve')
plt.title('Hyper-parameter VS accuracy plot')
plt.legend()
plt.show()
```



Train curve and Test curve appear to be closest at 45.

[7]:
```
# Printing the params
params
```

[7]: [2, 5, 15, 23, 27, 28, 39, 42, 45, 46]

[8]:
```
# understanding this code line by line is not that importent
def plot_decision_boundary(X1, X2, y, clf):
        # Create color maps
    cmap_light = ListedColormap(['#FFAAAA', '#AAFFAA', '#AAAAFF'])
    cmap_bold = ListedColormap(['#FF0000', '#00FF00', '#0000FF'])

    x_min, x_max = X1.min() - 1, X1.max() + 1
    y_min, y_max = X2.min() - 1, X2.max() + 1

    xx, yy = np.meshgrid(np.arange(x_min, x_max, 0.02), np.arange(y_min, y_max,␣
 ↪0.02))
    Z = clf.predict(np.c_[xx.ravel(), yy.ravel()])
    Z = Z.reshape(xx.shape)

    plt.figure()
```

```python
    plt.pcolormesh(xx, yy, Z, cmap=cmap_light)
    # Plot also the training points
    plt.scatter(X1, X2, c=y, cmap=cmap_bold)

    plt.xlim(xx.min(), xx.max())
    plt.ylim(yy.min(), yy.max())
    plt.title("2-Class classification (k = %i)" % (clf.n_neighbors))
    plt.show()
```

[10]:

```python
from matplotlib.colors import ListedColormap
neigh = KNeighborsClassifier(n_neighbors = 45)
neigh.fit(X_train, y_train)
plot_decision_boundary(X_train[:, 0], X_train[:, 1], y_train, neigh)
```