Implement RandomSearchCV with k fold cross validation on KNN

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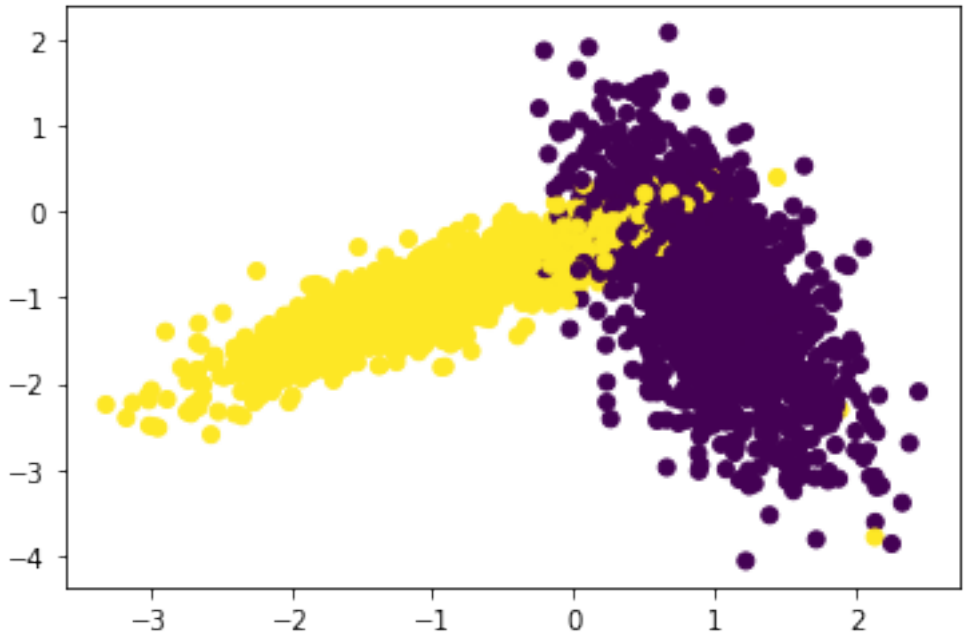
[1]:
```
from sklearn.datasets import make_classification
from sklearn.model_selection import train_test_split
from sklearn.preprocessing import StandardScaler
import numpy
from tqdm import tqdm
import numpy as np
from sklearn.metrics.pairwise import euclidean_distances
import random
from sklearn.metrics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


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_test, y_test
### only X_train and y_train important
```

[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

```
'''
    dry run
    ------train data-----
    count   = 2         1        0
            = g3       g2       g1

    count-1 = 1         0       -1
            = g2       g1       g3

train_x = (g3+g3) (g0+g1) (g1+g3)
    --------test data------
    count-2 = 0        -1       -2

train_x_cv = (g1)     (g3)     (g2)
'''
```

[3]:
```
def RandomSearchCV(x_train,y_train,classifier, param_range, folds):
    # x_train: its numpy array of shape, (n,d)
    # y_train: its numpy array of shape, (n,) or (n,1)
    # classifier: its typically KNeighborsClassifier()
    # param_range: its a tuple like (a,b) a < b
    # folds: an integer, represents number of folds we need to devide the data␣
 ↪and test our model
```

```
##### STEP-1 ---> Generate 10 unique value randomly in 'param_range'

param_ls = sorted(random.sample(range(1, param_range), 10))
param_ls # these are the hypyerparameter K in K-NN

##### STEP-2 ---> Divide the Training Data in "folds" number of time

        ## for x_train
size_per_fold = x_train.shape[0]//folds
train_1 = x_train[:size_per_fold]
train_2 = x_train[size_per_fold:(size_per_fold*2)]
train_3 = x_train[-size_per_fold:]

total_x_train = list([train_1, train_2, train_3])

        ## for y_train
test_1 = y_train[:size_per_fold]
test_2 = y_train[size_per_fold:(size_per_fold*2)]
test_3 = y_train[-size_per_fold:]

total_y_train = list([test_1, test_2, test_3])

#### SET-3 Do k-fold CV
train_score = []
test_score = []
for nn in tqdm(param_ls):

    # print(nn)

    count = 2
    for k in range(folds):
        train_fold = []
        test_fold = []

        train_x = np.vstack((total_x_train[count], total_x_train[count-1]))
        train_x_cv = total_x_train[count-2]
        train_y = np.hstack((total_y_train[count], total_y_train[count-1]))
        train_y_cv = total_y_train[count-2]


        count = count -1
        ### Setting up the nearest neighbors
        classifier.n_neighbors = nn
        classifier.fit(train_x, train_y)
```

```
            ### Train accuracies
            y_pred_train = classifier.predict(train_x)
            train_fold.append(accuracy_score(train_y,y_pred_train))

            ### Test accuracies
            y_pred = classifier.predict(train_x_cv)
            test_fold.append(accuracy_score(train_y_cv, y_pred))


            ### calculating the mean of accuracies
        train_score.append(np.mean(np.array(train_fold)))
        test_score.append(np.mean(np.array(test_fold)))
    return (train_score, test_score, param_ls)
```

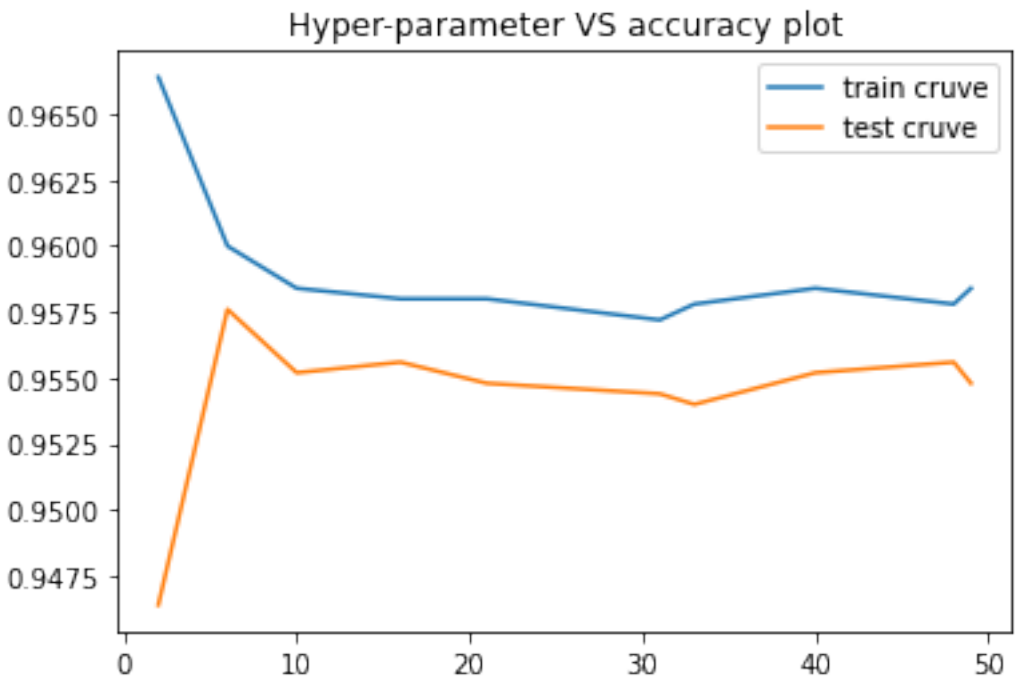
[4]:
```
knn = KNeighborsClassifier()
folds = 3 # this is like k in k-fold CV
param_range = 50
trainscores, testscores, n_neighbors = RandomSearchCV(X_train, y_train,knn,␣
 ↪param_range, folds)
```

```
100%|
    | 10/10 [00:04<00:00,  2.45it/s]
```

[5]:
```
print(trainscores,"\n",testscores,"\n",n_neighbors)
```

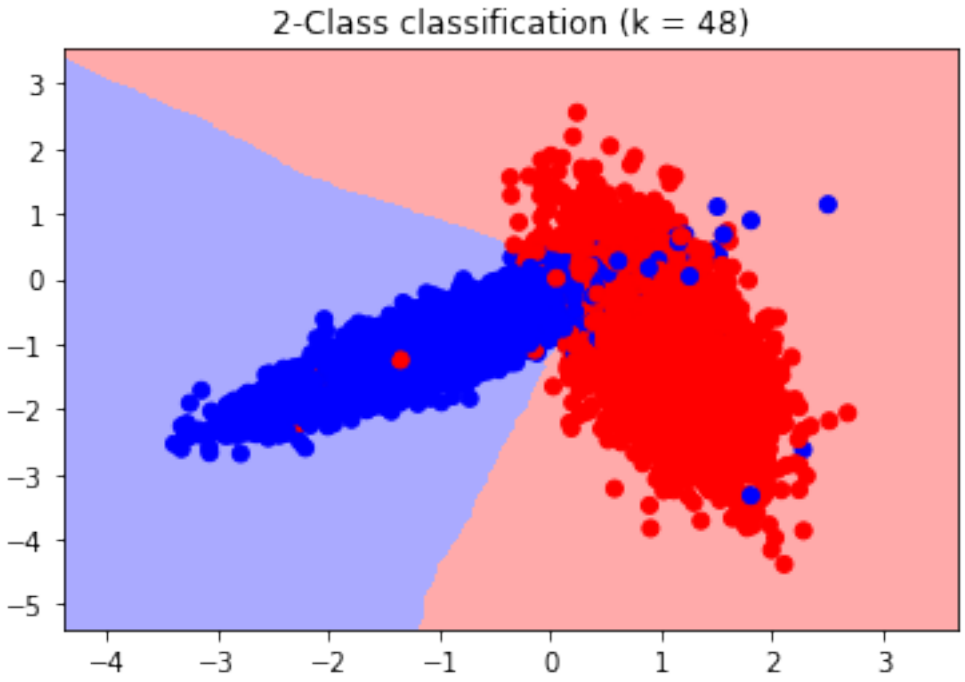
```
[0.9664, 0.96, 0.9584, 0.958, 0.958, 0.9572, 0.9578, 0.9584, 0.9578, 0.9584]
 [0.9464, 0.9576, 0.9552, 0.9556, 0.9548, 0.9544, 0.954, 0.9552, 0.9556, 0.9548]
 [2, 6, 10, 16, 21, 31, 33, 40, 48, 49]
```

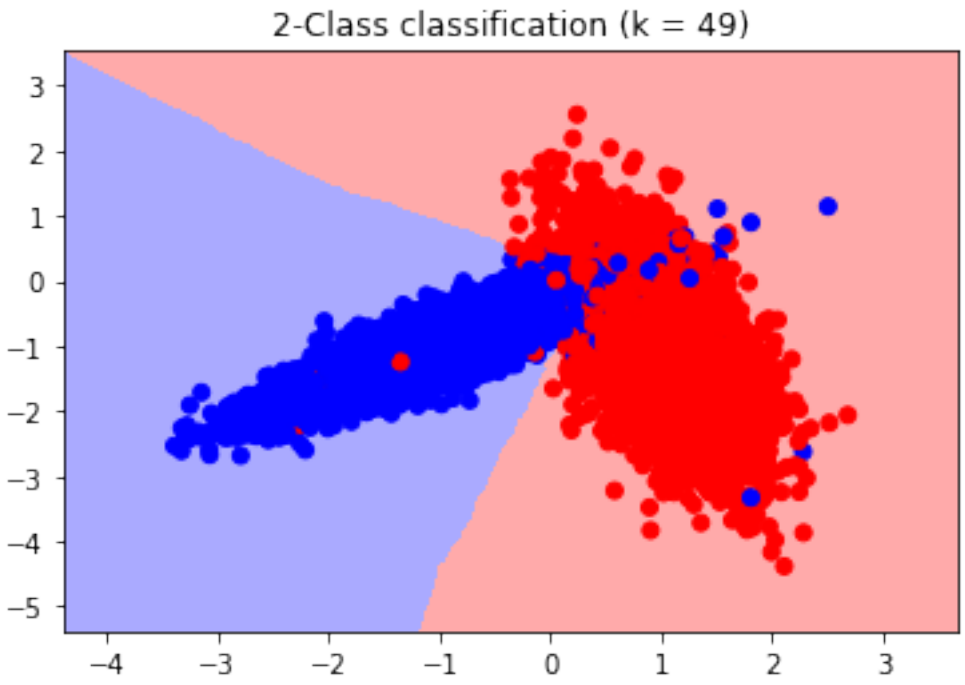
[6]:
```
import matplotlib.pyplot as plt
import warnings
warnings.filterwarnings("ignore")

plt.plot(n_neighbors,trainscores, label='train cruve')
plt.plot(n_neighbors,testscores, label='test cruve')
plt.title('Hyper-parameter VS accuracy plot')
plt.legend()
plt.show()
```



[7]:
```
# 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()
    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()
```

[8]:
```
from matplotlib.colors import ListedColormap
for i in n_neighbors[-2:]:
    neigh = KNeighborsClassifier(n_neighbors = i)
    neigh.fit(X_train, y_train)
    plot_decision_boundary(X_train[:, 0], X_train[:, 1], y_train, neigh)
```




2-Class classification (k = 49)
3
2
1
0
−1
−2
−3
−4
−5
−4
−3
−2
−1
0
1
2
3