In [16]:
```
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
```

In [17]:
```
y_train
```

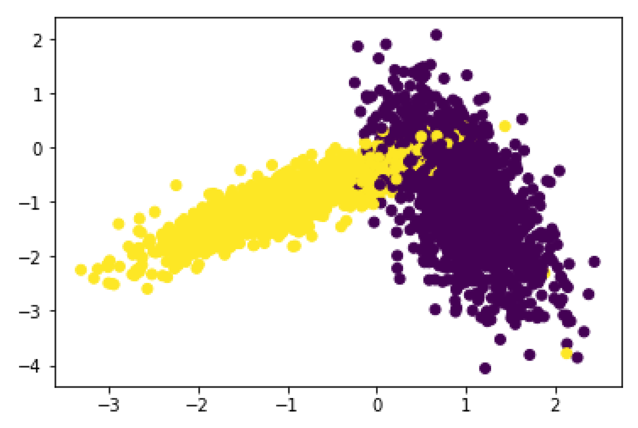
Out[17]:
```
array([0, 0, 1, ..., 0, 1, 0])
```

In [77]:
```
len(X_train)
```

Out[77]:
```
7500
```

In [ ]:

In [18]:
```
%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()
```



In [19]:
```
#Generating 10 unique values using the given param_range
param_range=(1,50)
folds = 3
```

In [20]:
```
import random
```

In [63]:
```
def random_pick_in_1to50(param_range):

    new_values=random.sample(range(param_range[0],param_range[1]),10) # Sampling & picking 1
0 random numbers in range of 1 to 50
    new_values.sort()
    return new_values

#Followed the same way we sample data in Grid search in function
#'randomly_select_60_percent_indices_in_range_from_1_to_len'
```

In [ ]:

In [ ]:

In [64]:
```
random_pick_in_1to50(param_range) # This will pick 10 random numbers in range o 1-50 everyti
me we run it
```

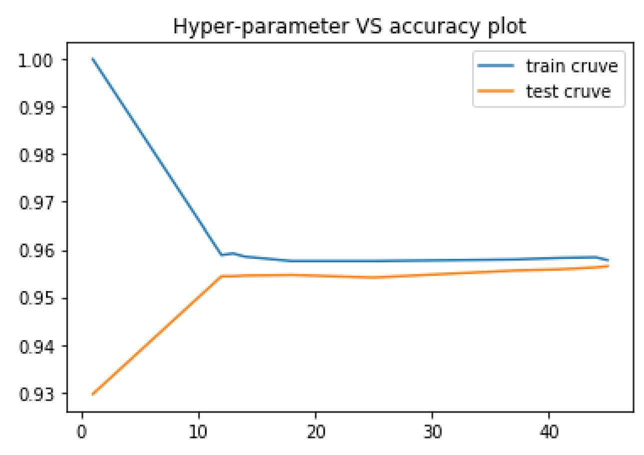
Out[64]:
```
[5, 9, 18, 24, 29, 39, 44, 45, 48, 49]
```

In [65]:
```
from sklearn.metrics import accuracy_score
```

In [70]:
```
def RandomCV(x_train,y_train,classifier, param_range, folds):
    trainscores=[]
    testscores=[]
    random_values=random_pick_in_1to50(param_range)
    random_val={'n_neighbors':random_values}

    print(random_values)
    for i in tqdm(random_val['n_neighbors']):
        trainscores_folds=[]
        testscores_folds=[]
        for j in range(0,folds):

            dividing_value=(len(x_train)/folds)
            dval=int(dividing_value)
            # this will initialize the trigger value 2500

            test_indices=list(set(list(range((dval*j), (dval*(j+1))))))

            # The first iteration the test indices will be from 0 to 2499 , 2nd iteration 25
00-4999
            #3rd iteration 5000-7499

            train_indices=list(set(list(range(0, len(x_train)))) - set(test_indices))

               # In the first Iteration the train_indices will be 2500-7499 , 2nd: 0-2499 a
nd 5000-7499 3rd: 0-4999

            X_train = x_train[train_indices] # Will pick up 2500-7499 indices values as trai
ning in first iteration and so on

            Y_train = y_train[train_indices]

            X_test  = x_train[test_indices] # will pick first 2500 values as test in 1st ite
ration and so on

            Y_test  = y_train[test_indices]

            classifier.n_neighbors = i  # Each iteration the number of neighbors will be cha
nged
            classifier.fit(X_train,Y_train)

            Y_predicted = classifier.predict(X_test)
            testscores_folds.append(accuracy_score(Y_test, Y_predicted))

            Y_predicted = classifier.predict(X_train)
            trainscores_folds.append(accuracy_score(Y_train, Y_predicted)) # The rest of the
process is exactly same like Grid Search
        trainscores.append(np.mean(np.array(trainscores_folds)))
        testscores.append(np.mean(np.array(testscores_folds)))
    return trainscores,testscores,random_val
```

In [71]:
```
from sklearn.metrics import accuracy_score
from sklearn.neighbors import KNeighborsClassifier
import matplotlib.pyplot as plt
import random
import warnings
warnings.filterwarnings("ignore")

neigh = KNeighborsClassifier()
trainscores,testscores,params = RandomCV(X_train, y_train, neigh, param_range, folds)

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

```
  0%|          | 0/10 [00:00<?, ?it/s]
[1, 12, 13, 14, 18, 25, 37, 41, 44, 45]
100%|██████████| 10/10 [00:08<00:00,  1.08it/s]
```



In [ ]:
```
#Observation :it is observed that The gap between the Train n CV curve is smallest at 41,44,
45
```

In [39]:
```
print(trainscores)
print('-'*50)
print(testscores)
```

```
[0.9624666666666667, 0.9611333333333333, 0.9596666666666667, 0.9571999999999999, 0.9568, 0.95
75333333333332, 0.9574666666666666, 0.9582, 0.9584, 0.9578000000000001]
--------------------------------------------------
[0.9495999999999999, 0.9510666666666667, 0.9540000000000001, 0.9533333333333333, 0.9535999999
999999, 0.9546666666666667, 0.9553333333333334, 0.956, 0.9562666666666667, 0.956533333333333
3]
```

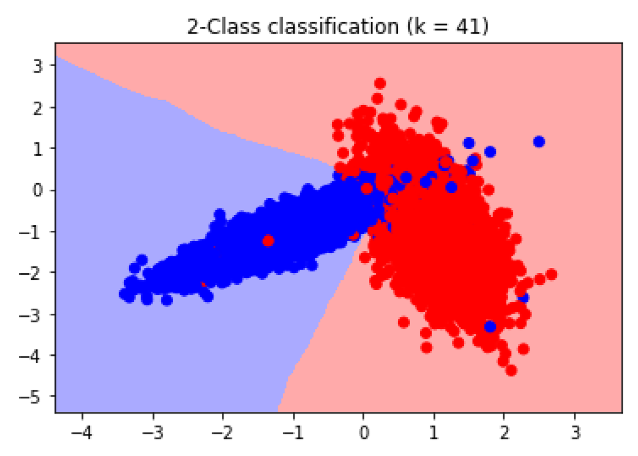
In [ ]:
```
#Have taken the plot decision Boundary from Reference
```

In [43]:
```
# 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()
```

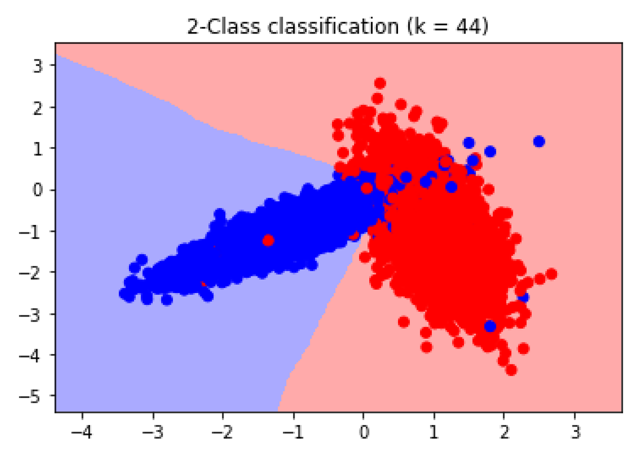
In [ ]:

In [44]:
```
# is getting the highest accuracy
```

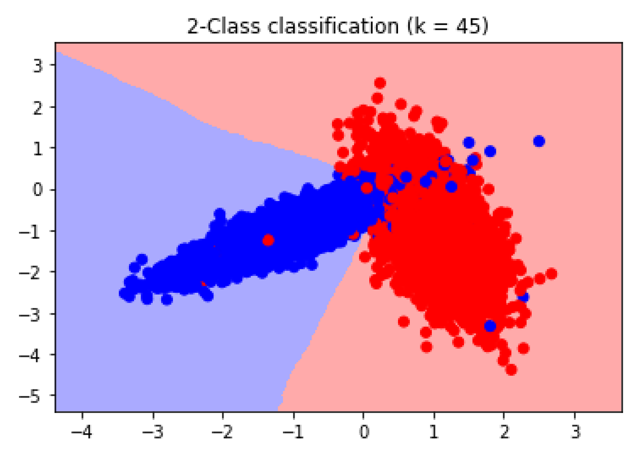
In [72]:
```
from matplotlib.colors import ListedColormap
neigh = KNeighborsClassifier(n_neighbors = 41)
neigh.fit(X_train, y_train)
plot_decision_boundary(X_train[:, 0], X_train[:, 1], y_train, neigh)
```



In [73]:
```
from matplotlib.colors import ListedColormap
neigh = KNeighborsClassifier(n_neighbors = 44)
neigh.fit(X_train, y_train)
plot_decision_boundary(X_train[:, 0], X_train[:, 1], y_train, neigh)
```



In [74]:
```
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)
```



In [ ]: