k-NN

March 3, 2020

[1]:
```
%matplotlib inline
```

[7]:
```
import numpy as np
from sklearn import neighbors, datasets
from sklearn.model_selection import train_test_split
from matplotlib import pyplot as plt
from matplotlib.colors import ListedColormap

cmap_bold = ListedColormap(['darkorange', 'c'])


# The Iris flower data set consists of 50 samples from each of three species of␣
 ↪Iris
# (1) Iris setosa,
# (2) Iris virginica,
# (3) Iris versicolor.
#
# Four features were measured from each sample:
# (1) length of the sepals (cm)
# (2) length of the petals (cm)
# (3) width of the sepals  (cm)
# (4) width of the petals  (cm)
#
# We will use on two features because it is easy to visualize 2-dimensional␣
 ↪data.
# Problem Statement:
# Based on the combination of these four features, we need to build k-nn␣
 ↪classifier
iris = datasets.load_iris()
X = iris.data[:, 0:2]
Y = iris.target
```

[8]:
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indices = Y!=2
X,Y = X[indices,:], Y[indices]

# Lets visualize the data
plt.figure()
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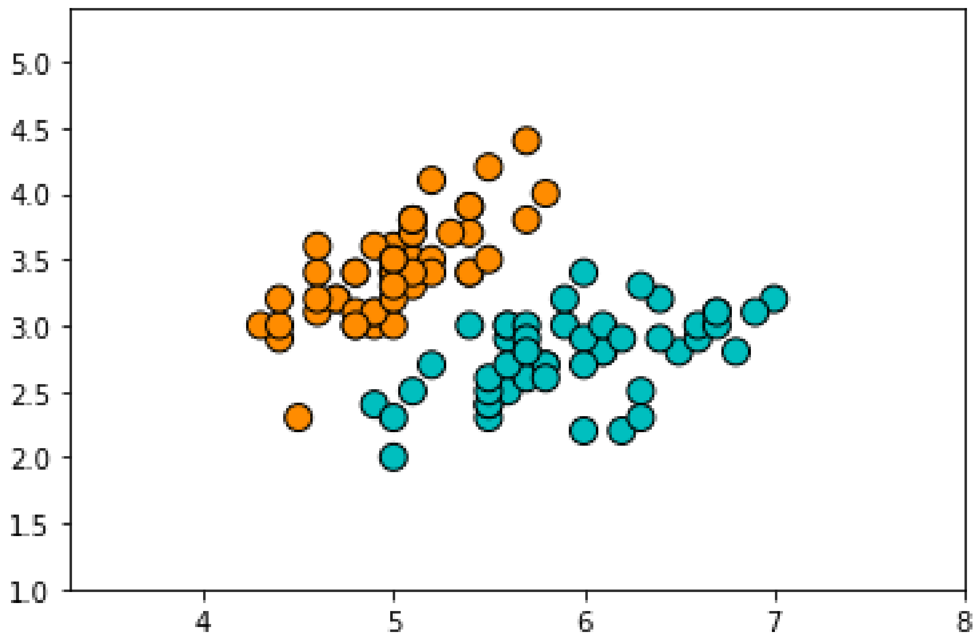
plt.scatter(X[:, 0], X[:, 1], c=Y, cmap=cmap_bold, edgecolor='k', s=100)
plt.xlim(X[:,0].min() - 1, X[:,0].max() + 1)
plt.ylim(X[:,1].min() - 1, X[:,1].max() + 1)
plt.show()
```



[9]:
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# split data into training (80%) and testing (20%)
X_train, X_test, Y_train, Y_test = train_test_split(X, Y, test_size=0.20,␣
↪random_state=42)
```

[10]:
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# First we will manually work through the algorithm and later use sklearn to␣
↪check our
# results

# Define our parameters
k = 1 # neighbors
acc = 0

# loop through all my test points
for i in range(X_test.shape[0]):
    i_star = None
    d_star = float('inf')

    # loop over all training points
    for j in range(X_train.shape[0]):
        # compute the distance between train point and test points
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        d = np.linalg.norm(X_train[j,:] - X_test[i,:])
        if d < d_star:
            i_star = j # set i_star to the train index
            d_star = d # distance to the closes training point

    y_pred = Y_train[i_star] # asssigning the train point label to the test
    if y_pred == Y_test[i]:
        acc += 1

print(f"Accuracy:{acc/X_test.shape[0]}")
```

```
Accuracy:1.0
```

[12]:

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# define sklearn model
clf = neighbors.KNeighborsClassifier(1)
# call fit function
# is there any training here?
# No!
#
clf.fit(X_train, Y_train)
# call score function
clf.score(X_test, Y_test)
```

[12]: 1.0

[13]:

```
# Plot the decision boundary. For that, we will assign a color to each
# point in the mesh [x_min, x_max]x[y_min, y_max].
h = 0.1
cmap_light = ListedColormap(['orange', 'cyan'])
cmap_bold = ListedColormap(['darkorange', 'c'])

x_min, x_max = X[:, 0].min() - 1, X[:, 0].max() + 1
y_min, y_max = X[:, 1].min() - 1, X[:, 1].max() + 1
xx, yy = np.meshgrid(np.arange(x_min, x_max, h),
                     np.arange(y_min, y_max, h))
Z = clf.predict(np.c_[xx.ravel(), yy.ravel()])

# Put the result into a color plot
Z = Z.reshape(xx.shape)

plt.figure()
plt.pcolormesh(xx, yy, Z, cmap=cmap_light)

# Plot also the training points
plt.scatter(X[:, 0], X[:, 1], c=Y, cmap=cmap_bold, edgecolor='k', s=100)
plt.xlim(xx.min(), xx.max())
plt.ylim(yy.min(), yy.max())
```

```
plt.show()
```