model

January 16, 2023

1 Solution (using KNN classification)

[1]:
```
# importing the libraries
import numpy as np
import pandas as pd
import matplotlib.pyplot as plt
import seaborn as sns
```

[2]:
```
df = pd.read_excel('robot.xlsx')
```

[3]:
```
df.head()
```

[3]:

	r_number	speed (m/s)	weight (kg)	qualified
0	1	2.50	600	No
1	2	3.75	800	No
2	3	2.25	550	No
3	4	3.25	825	No
4	5	2.75	750	No

[4]:
```
# since the model only interprets numerical data, we replace the qualified␣
↪column with numerical values
df['qualified'] = df['qualified'].replace(['No', 'Yes'], [0,1])
df.head()
```

[4]:

	r_number	speed (m/s)	weight (kg)	qualified
0	1	2.50	600	0
1	2	3.75	800	0
2	3	2.25	550	0
3	4	3.25	825	0
4	5	2.75	750	0

[5]:
```
# taking the X and y values
X = df.iloc[:, [1,2]].values
print(X)
```

```
[[  2.5  600.  ]
 [  3.75 800.  ]
 [  2.25 550.  ]
```

```
 [  3.25 825.   ]
 [  2.75 750.   ]
 [  4.5  500.   ]
 [  3.5  525.   ]
 [  3.   325.   ]
 [  4.   400.   ]
 [  4.25 375.   ]
 [  2.   200.   ]
 [  5.   250.   ]
 [  8.25 850.   ]
 [  5.75 875.   ]
 [  4.75 625.   ]
 [  5.5  675.   ]
 [  5.25 950.   ]
 [  7.   425.   ]
 [  7.5  800.   ]
 [  7.25 575.   ]]
```

[6]:
```python
y = df.iloc[:,-1].values
y
```

[6]:
```
array([0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 1, 1, 1, 1, 1, 1, 1],
      dtype=int64)
```

[7]:
```python
# import the needed sklearn libraries
from sklearn.neighbors import KNeighborsClassifier  # importing the classifier
from sklearn import metrics  # import the needed metrics to calculate the␣
 ↪confusion matrix and accuracy
from sklearn.preprocessing import StandardScaler  # to scale the X values
from sklearn.model_selection import train_test_split  # splitting the data into␣
 ↪training and testing sets
```

[22]:
```python
# splitting X and y data
X_train, X_test, y_train, y_test = train_test_split(X, y, test_size=0.2,␣
 ↪random_state=0)
```

[26]:
```python
# scaling the X values
scaler = StandardScaler()
X_train = scaler.fit_transform(X_train)
X_test = scaler.fit_transform(X_test)
```

[27]:
```python
print(X_train)
```

```
[[-1.37320266 -1.71372656]
 [ 1.55629635 -0.70234695]
 [-0.49435296 -0.2528449 ]
 [ 0.8239216   1.32041227]
 [-0.93377781  0.75853471]
```

```
[-1.22672771 -0.14046939]
 [ 0.09154684 -0.36522041]
 [ 0.23802179  0.19665715]
 [-0.05492811 -0.92709797]
 [-0.78730286 -1.151849  ]
 [ 0.5309717   1.6575388 ]
 [ 0.38449675 -1.48897554]
 [-0.64082791  1.09566124]
 [-1.08025276  0.08428163]
 [ 0.67744665  0.42140817]
 [ 2.2886711   1.20803676]]
```

[28]:

```python
print(X_test)
```

```
[[ 1.06870575  0.92976   ]
 [-1.06870575  0.92976   ]
 [ 0.92621165 -0.4090944 ]
 [-0.92621165 -1.45042561]]
```

[37]:

```python
# create, train and test the model
K = []
train = []
test = []
score = {}
accuracy = []
for k in range(1,16):
    K.append(k)                                            # fill the list␣
 ↪with the k values (1-10)
    clf = KNeighborsClassifier(n_neighbors=k)              # create the model
    clf.fit(X_train, y_train)                              # train the model

    y_pred = clf.predict(X_test)                           # testing the␣
 ↪model

    train_score = clf.score(X_train, y_train)              # get the␣
 ↪training score
    test_score = clf.score(X_test, y_test)                 # get the test␣
 ↪score
    acc = metrics.accuracy_score(y_test, y_pred)           # get the␣
 ↪accuracy (which is same as test score)

    train.append(train_score)                              # put the train␣
 ↪scores in the train list
    test.append(test_score)                                # put the test␣
 ↪scores in the test list
    score[k] = [train_score, test_score]                   # placing it in␣
 ↪the scores dictionary
```

```
    accuracy.append(acc)                                        # placing it in
↪the accuracy list
```

[38]:
```
train
```

[38]:
```
[1.0,
 0.9375,
 0.9375,
 0.8125,
 0.875,
 0.8125,
 0.8125,
 0.6875,
 0.6875,
 0.6875,
 0.6875,
 0.6875,
 0.6875,
 0.6875,
 0.6875]
```

[39]:
```
test
```

[39]:
```
[1.0,
 0.75,
 1.0,
 1.0,
 1.0,
 0.75,
 0.75,
 0.75,
 0.75,
 0.5,
 0.5,
 0.5,
 0.5,
 0.5,
 0.5]
```

[40]:
```
accuracy
```

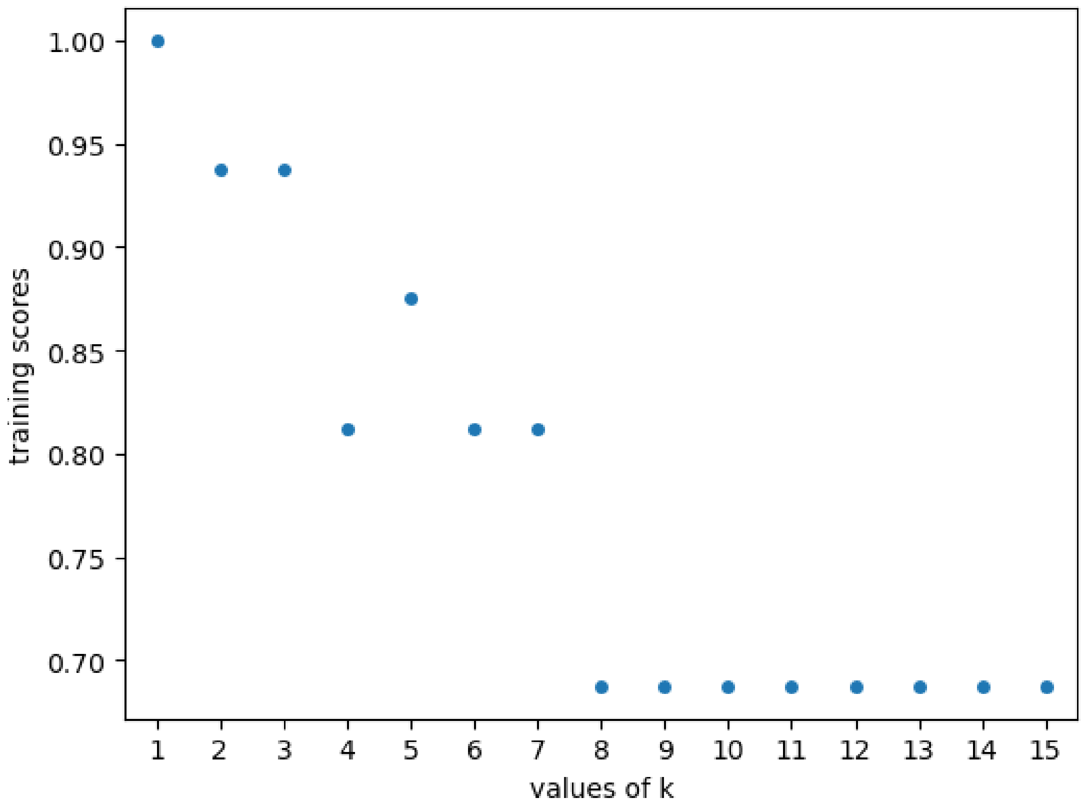
[40]:
```
[1.0,
 0.75,
 1.0,
 1.0,
 1.0,
 0.75,
```

```
 0.75,
 0.75,
 0.75,
 0.5,
 0.5,
 0.5,
 0.5,
 0.5,
 0.5]
```

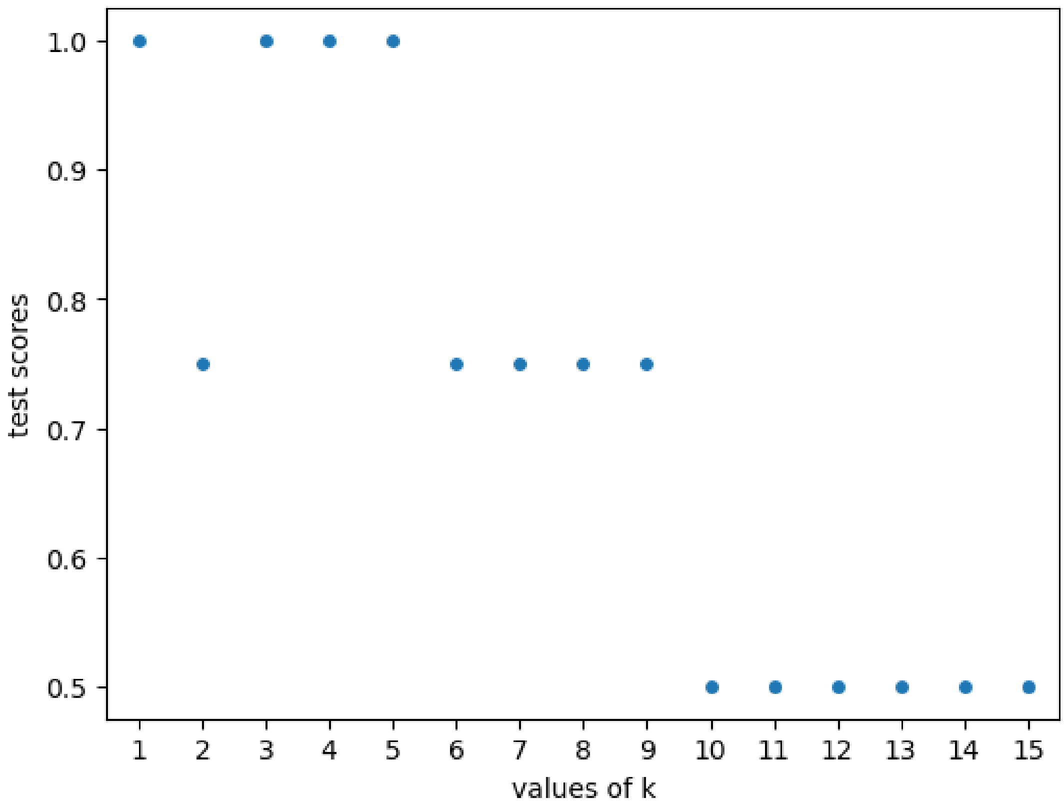
[41]:
```python
for keys, values in score.items():
    print(f'{keys}:{values}')
```

```
1:[1.0, 1.0]
2:[0.9375, 0.75]
3:[0.9375, 1.0]
4:[0.8125, 1.0]
5:[0.875, 1.0]
6:[0.8125, 0.75]
7:[0.8125, 0.75]
8:[0.6875, 0.75]
9:[0.6875, 0.75]
10:[0.6875, 0.5]
11:[0.6875, 0.5]
12:[0.6875, 0.5]
13:[0.6875, 0.5]
14:[0.6875, 0.5]
15:[0.6875, 0.5]
```

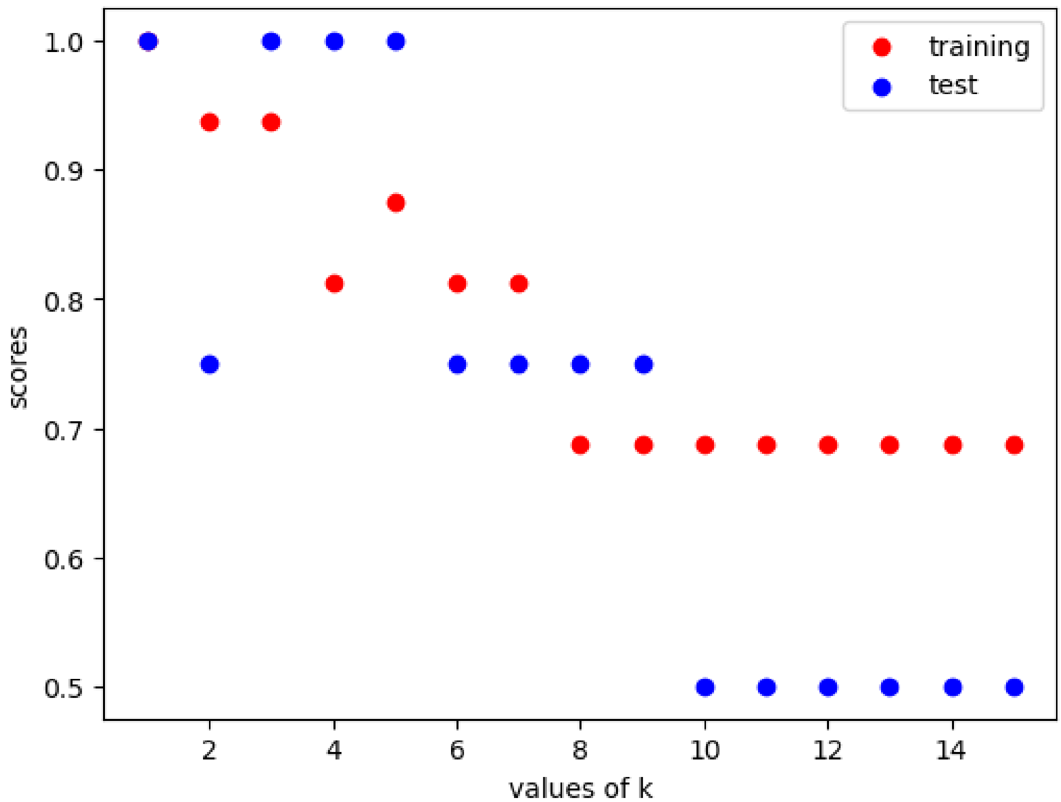
[42]:
```python
# plotting the strip plot for training values
sns.stripplot(x=K, y=train)
plt.xlabel('values of k')
plt.ylabel('training scores')
plt.show()
```



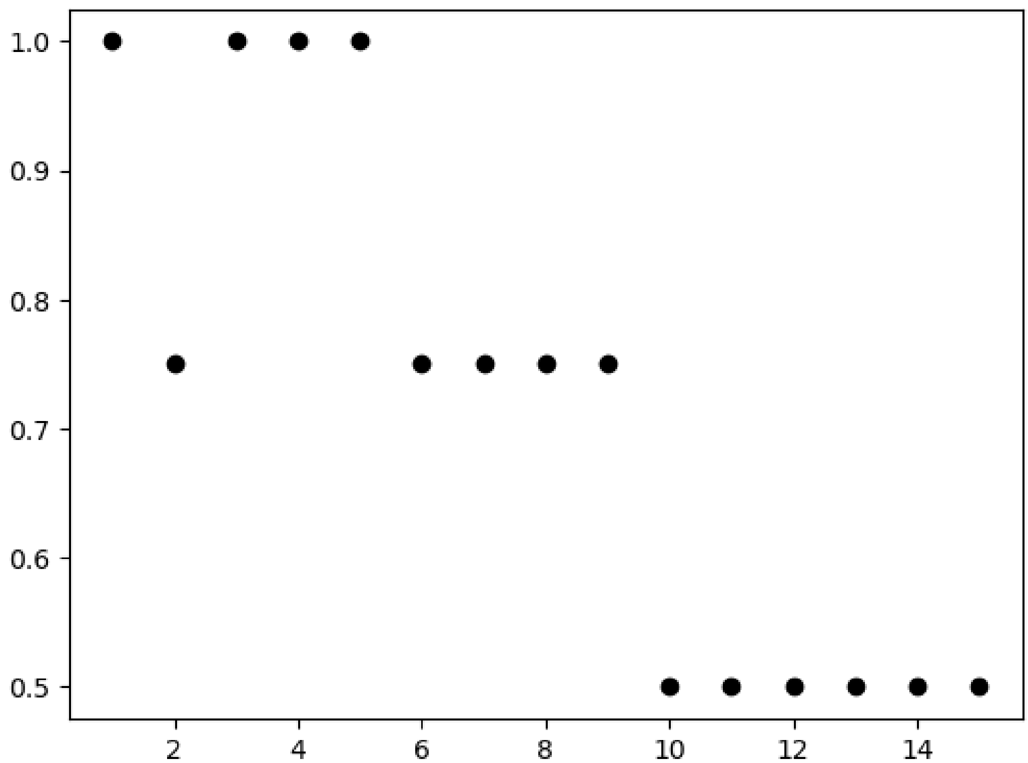
[43]:
```
# plotting the strip plot for test values
sns.stripplot(x=K, y=test)
plt.xlabel('values of k')
plt.ylabel('test scores')
plt.show()
```



[44]:
```
# overlapping plot of training and test values
plt.scatter(K, train, color='r')
plt.scatter(K, test, color='b')
plt.xlabel('values of k')
plt.ylabel('scores')
plt.legend(['training', 'test'])
plt.show()
```



[45]:
```
plt.scatter(K,accuracy, color='k')
plt.show()
```



2 from the graph above, the optimum k values are 1, 3, 4, and 5

[48]:
```
new_k = [1,3,5]     # k values going to be used
x_new = [[5.20, 500]]
y_new = []
for k in new_k:
    clf_2 = KNeighborsClassifier(n_neighbors=k)
    clf_2.fit(X_train, y_train)
    pred_y = clf_2.predict(x_new)
    y_new.append(pred_y)
print(y_new)
```

```
[array([1], dtype=int64), array([1], dtype=int64), array([0], dtype=int64)]
```