

k_nearest_neighbors

November 7, 2024

1 K-Nearest Neighbors (K-NN)

1.1 Importing the libraries

```
[ ]: import numpy as np
import matplotlib.pyplot as plt
import pandas as pd
```

1.2 Importing the dataset

```
[ ]: dataset = pd.read_csv('Social_Network_Ads.csv')
X = dataset.iloc[:, :-1].values
y = dataset.iloc[:, -1].values
```

1.3 Splitting the dataset into the Training set and Test set

```
[ ]: from sklearn.model_selection import train_test_split
X_train, X_test, y_train, y_test = train_test_split(X, y, test_size = 0.25,
↳ random_state = 0)
```

```
[4]: print(X_train)
```

```
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 [ 38 50000]
 [ 32 135000]
 [ 52 21000]
 [ 53 104000]
 [ 39 42000]
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[ 34 43000]
[ 37 52000]
[ 48 30000]
[ 29 43000]
[ 36 52000]
[ 27 54000]
[ 26 118000]]

```

```
[5]: print(y_train)
```

```
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```

```

0 0 1 0 0 0 0 0 1 1 1 1 0 0 0 1 0 1 0 1 0 0 1 0 0 0 1 0 0 0 1 1 0 0 1 0 1
1 1 0 0 1 1 0 0 1 1 0 1 0 0 1 1 0 1 1 1 0 0 0 0 1 0 0 1 1 1 1 1 0 1 1 0
1 0 0 0 0 0 0 0 1 1 0 0 1 0 0 1 0 0 0 1 0 1 1 0 1 0 0 0 0 1 0 0 0 1 1 0 0
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0 1 1 0 0 0 0 1 0 0 0 0 1 0 1 0 1 0 0 0 1 0 0 0 1 0 1 0 0 0 0 0 1 1 0 0 0
0 0 1 0 1 1 0 0 0 0 1 0 1 0 0 1 0 0 1 0 1 0 0 0 0 0 0 1 1 1 1 0 0 0 0 1
0 0 0 0]

```

```
[6]: print(X_test)
```

```

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 [ 35 75000]
 [ 30 79000]
 [ 35 50000]
 [ 27 20000]
 [ 31 15000]
 [ 36 144000]
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```


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```
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[ 25 33000]
[ 24 84000]
[ 27 96000]
[ 23 63000]
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[ 48 90000]
[ 42 104000]]
```

```
[7]: print(y_test)
```

```
[0 0 0 0 0 0 0 1 0 0 0 0 0 0 0 0 0 0 0 1 0 0 1 0 1 0 1 0 0 0 0 0 1 1 0 0 0 0
 0 0 1 0 0 0 0 1 0 0 1 0 1 1 0 0 0 1 1 0 0 1 0 0 1 0 1 0 1 0 0 0 0 1 0 0 1
 0 0 0 0 1 1 1 0 0 0 1 1 0 1 1 0 0 1 0 0 0 1 0 1 1 1]
```

1.4 Feature Scaling

```
[ ]: from sklearn.preprocessing import StandardScaler
sc = StandardScaler()
X_train = sc.fit_transform(X_train)
X_test = sc.transform(X_test)
```

```
[9]: print(X_train)
```

```
[[ 0.58164944 -0.88670699]
 [-0.60673761  1.46173768]
 [-0.01254409 -0.5677824 ]
 [-0.60673761  1.89663484]
 [ 1.37390747 -1.40858358]
 [ 1.47293972  0.99784738]
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```

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```

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[-0.30964085 -0.13288524]
[ 0.38358493 -0.45180983]
[-0.4086731  -0.77073441]
[-0.11157634 -0.50979612]
[ 0.97777845 -1.14764529]
[-0.90383437 -0.77073441]
[-0.21060859 -0.50979612]
[-1.10189888 -0.45180983]
[-1.20093113  1.40375139]]

```

```
[10]: print(X_test)
```

```

[[-0.80480212  0.50496393]
 [-0.01254409 -0.5677824 ]
 [-0.30964085  0.1570462 ]]

```


[-0.80480212 0.27301877]
[-0.30964085 -0.5677824]
[-1.10189888 -1.43757673]
[-0.70576986 -1.58254245]
[-0.21060859 2.15757314]
[-1.99318916 -0.04590581]
[0.8787462 -0.77073441]
[-0.80480212 -0.59677555]
[-1.00286662 -0.42281668]
[-0.11157634 -0.42281668]
[0.08648817 0.21503249]
[-1.79512465 0.47597078]
[-0.60673761 1.37475825]
[-0.11157634 0.21503249]
[-1.89415691 0.44697764]
[1.67100423 1.75166912]
[-0.30964085 -1.37959044]
[-0.30964085 -0.65476184]
[0.8787462 2.15757314]
[0.28455268 -0.53878926]
[0.8787462 1.02684052]
[-1.49802789 -1.20563157]
[1.07681071 2.07059371]
[-1.00286662 0.50496393]
[-0.90383437 0.30201192]
[-0.11157634 -0.21986468]
[-0.60673761 0.47597078]
[-1.6960924 0.53395707]
[-0.11157634 0.27301877]
[1.86906873 -0.27785096]
[-0.11157634 -0.48080297]
[-1.39899564 -0.33583725]
[-1.99318916 -0.50979612]
[-1.59706014 0.33100506]
[-0.4086731 -0.77073441]
[-0.70576986 -1.03167271]
[1.07681071 -0.97368642]
[-1.10189888 0.53395707]
[0.28455268 -0.50979612]
[-1.10189888 0.41798449]
[-0.30964085 -1.43757673]
[0.48261718 1.22979253]
[-1.10189888 -0.33583725]
[-0.11157634 0.30201192]
[1.37390747 0.59194336]
[-1.20093113 -1.14764529]
[1.07681071 0.47597078]
[1.86906873 1.51972397]

[-0.4086731 -1.29261101]
[-0.30964085 -0.3648304]
[-0.4086731 1.31677196]
[2.06713324 0.53395707]
[0.68068169 -1.089659]
[-0.90383437 0.38899135]
[-1.20093113 0.30201192]
[1.07681071 -1.20563157]
[-1.49802789 -1.43757673]
[-0.60673761 -1.49556302]
[2.1661655 -0.79972756]
[-1.89415691 0.18603934]
[-0.21060859 0.85288166]
[-1.89415691 -1.26361786]
[2.1661655 0.38899135]
[-1.39899564 0.56295021]
[-1.10189888 -0.33583725]
[0.18552042 -0.65476184]
[0.38358493 0.01208048]
[-0.60673761 2.331532]
[-0.30964085 0.21503249]
[-1.59706014 -0.19087153]
[0.68068169 -1.37959044]
[-1.10189888 0.56295021]
[-1.99318916 0.35999821]
[0.38358493 0.27301877]
[0.18552042 -0.27785096]
[1.47293972 -1.03167271]
[0.8787462 1.08482681]
[1.96810099 2.15757314]
[2.06713324 0.38899135]
[-1.39899564 -0.42281668]
[-1.20093113 -1.00267957]
[1.96810099 -0.91570013]
[0.38358493 0.30201192]
[0.18552042 0.1570462]
[2.06713324 1.75166912]
[0.77971394 -0.8287207]
[0.28455268 -0.27785096]
[0.38358493 -0.16187839]
[-0.11157634 2.21555943]
[-1.49802789 -0.62576869]
[-1.29996338 -1.06066585]
[-1.39899564 0.41798449]
[-1.10189888 0.76590222]
[-1.49802789 -0.19087153]
[0.97777845 -1.06066585]
[0.97777845 0.59194336]

```
[ 0.38358493  0.99784738]]
```

1.5 Training the K-NN model on the Training set

```
[11]: from sklearn.neighbors import KNeighborsClassifier
classifier = KNeighborsClassifier(n_neighbors = 5, metric = 'minkowski', p = 2)
classifier.fit(X_train, y_train)
```

```
[11]: KNeighborsClassifier(algorithm='auto', leaf_size=30, metric='minkowski',
metric_params=None, n_jobs=None, n_neighbors=5, p=2,
weights='uniform')
```

1.6 Predicting a new result

```
[12]: print(classifier.predict(sc.transform([[30,87000]])))
```

```
[0]
```

1.7 Predicting the Test set results

```
[13]: y_pred = classifier.predict(X_test)
print(np.concatenate((y_pred.reshape(len(y_pred),1), y_test.
↪reshape(len(y_test),1)),1))
```

```
[[0 0]
 [0 0]
 [0 0]
 [0 0]
 [0 0]
 [0 0]
 [0 0]
 [1 1]
 [0 0]
 [1 0]
 [0 0]
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 [0 0]
 [1 1]
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[0 0]
[1 1]
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[0 0]
[0 1]
[0 0]
[1 1]
[1 1]
[1 1]]

```

1.8 Making the Confusion Matrix

```

[14]: from sklearn.metrics import confusion_matrix, accuracy_score
      cm = confusion_matrix(y_test, y_pred)
      print(cm)
      accuracy_score(y_test, y_pred)

```

```

[[64  4]
 [ 3 29]]

```

```

[14]: 0.93

```

1.9 Visualising the Training set results

```

[15]: from matplotlib.colors import ListedColormap
      X_set, y_set = sc.inverse_transform(X_train), y_train
      X1, X2 = np.meshgrid(np.arange(start = X_set[:, 0].min() - 10, stop = X_set[:, 0].max() + 10, step = 1),

```

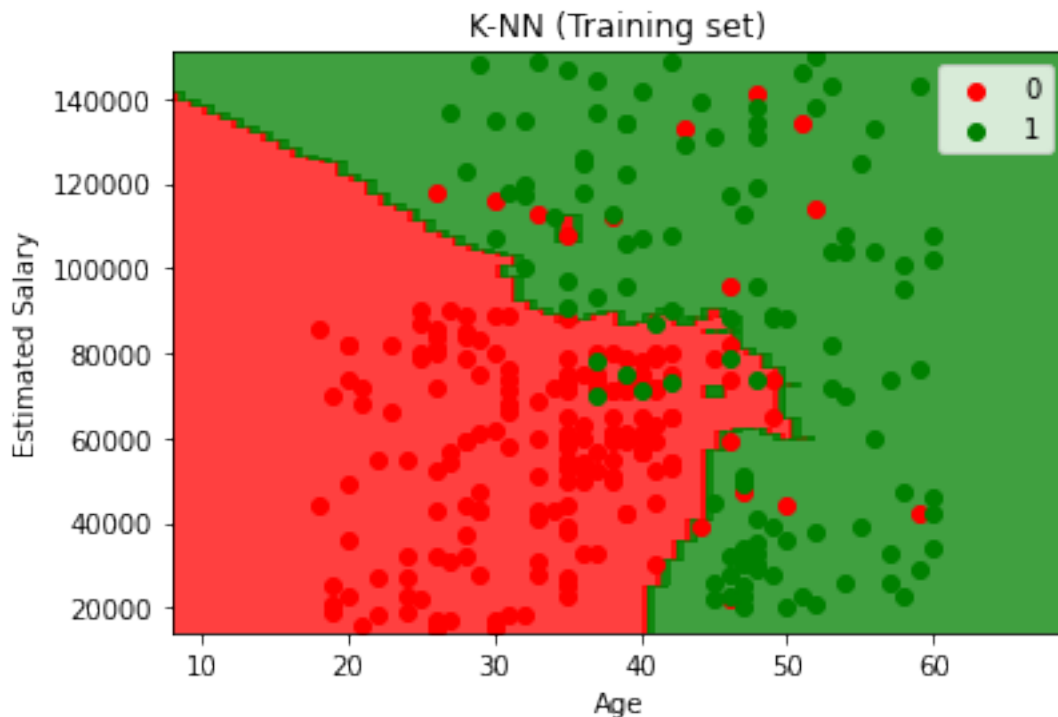
```

        np.arange(start = X_set[:, 1].min() - 1000, stop = X_set[:, 1].max() + 1000, step = 1))
plt.contourf(X1, X2, classifier.predict(sc.transform(np.array([X1.ravel(), X2.
    ravel()])).T).reshape(X1.shape),
            alpha = 0.75, cmap = ListedColormap(('red', 'green')))
plt.xlim(X1.min(), X1.max())
plt.ylim(X2.min(), X2.max())
for i, j in enumerate(np.unique(y_set)):
    plt.scatter(X_set[y_set == j, 0], X_set[y_set == j, 1], c =
    ListedColormap(('red', 'green'))(i), label = j)
plt.title('K-NN (Training set)')
plt.xlabel('Age')
plt.ylabel('Estimated Salary')
plt.legend()
plt.show()

```

'c' argument looks like a single numeric RGB or RGBA sequence, which should be avoided as value-mapping will have precedence in case its length matches with 'x' & 'y'. Please use a 2-D array with a single row if you really want to specify the same RGB or RGBA value for all points.

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1.10 Visualising the Test set results

```
[16]: from matplotlib.colors import ListedColormap
X_set, y_set = sc.inverse_transform(X_test), y_test
X1, X2 = np.meshgrid(np.arange(start = X_set[:, 0].min() - 10, stop = X_set[:, 0].max() + 10, step = 1),
                     np.arange(start = X_set[:, 1].min() - 1000, stop = X_set[:, 1].max() + 1000, step = 1))
plt.contourf(X1, X2, classifier.predict(sc.transform(np.array([X1.ravel(), X2.ravel()])).T).reshape(X1.shape),
             alpha = 0.75, cmap = ListedColormap(('red', 'green')))
plt.xlim(X1.min(), X1.max())
plt.ylim(X2.min(), X2.max())
for i, j in enumerate(np.unique(y_set)):
    plt.scatter(X_set[y_set == j, 0], X_set[y_set == j, 1], c = ListedColormap(('red', 'green'))(i), label = j)
plt.title('K-NN (Test set)')
plt.xlabel('Age')
plt.ylabel('Estimated Salary')
plt.legend()
plt.show()
```

'c' argument looks like a single numeric RGB or RGBA sequence, which should be avoided as value-mapping will have precedence in case its length matches with 'x' & 'y'. Please use a 2-D array with a single row if you really want to specify the same RGB or RGBA value for all points.

'c' argument looks like a single numeric RGB or RGBA sequence, which should be avoided as value-mapping will have precedence in case its length matches with 'x' & 'y'. Please use a 2-D array with a single row if you really want to specify the same RGB or RGBA value for all points.

