

K-Nearest Neighbors (K-NN)

Importing the libraries

```
In [0]: import numpy as np
import matplotlib.pyplot as plt
import pandas as pd
```

Importing the dataset

```
In [0]: dataset = pd.read_csv('Social_Network_Ads.csv')
X = dataset.iloc[:, :-1].values
y = dataset.iloc[:, -1].values
```

Splitting the dataset into the Training set and Test set

```
In [0]: from sklearn.model_selection import train_test_split
X_train, X_test, y_train, y_test = train_test_split(X, y, test_size = 0.2
5, random_state = 0)
```

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

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[ [ 44 39000]
[ 32 120000]
[ 38 50000]
[ 32 135000]
[ 52 21000]
[ 53 104000]
[ 39 42000]
[ 38 61000]
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[ 42 54000]
[ 34 43000]
[ 37 52000]
[ 48 30000]
[ 29 43000]
[ 36 52000]
[ 27 54000]
[ 26 118000]]
```

In [5]: `print(y_train)`

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



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

```
[ [ 30 87000]
[ 38 50000]
[ 35 75000]
[ 30 79000]
[ 35 50000]
[ 27 20000]
[ 31 15000]
[ 36 144000]
[ 18 68000]
[ 47 43000]
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[ 32 117000]
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[ 29 83000]
```

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[ 23 48000]
[ 25 33000]
[ 24 84000]
[ 27 96000]
[ 23 63000]
[ 48 33000]
[ 48 90000]
[ 42 104000]]
```

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

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

Feature Scaling

```
In [0]: from sklearn.preprocessing import StandardScaler  
        sc = StandardScaler()  
        X_train = sc.fit_transform(X_train)  
        X_test = sc.transform(X_test)
```

```
In [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]
  [ 0.08648817 -0.79972756]
  [-0.01254409 -0.24885782]
  [-0.21060859 -0.5677824 ]
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  [ 0.8787462  -0.59677555]
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  [ 1.07681071 -0.13288524]
  [ 0.68068169  1.78066227]
  [-0.70576986  0.56295021]
  [ 0.77971394  0.35999821]
  [ 0.8787462  -0.53878926]
  [-1.20093113 -1.58254245]
  [ 2.1661655  0.93986109]
  [-0.01254409  1.22979253]
  [ 0.18552042  1.08482681]
  [ 0.38358493 -0.48080297]
  [-0.30964085 -0.30684411]
  [ 0.97777845 -0.8287207 ]
  [ 0.97777845  1.8676417 ]
  [-0.01254409  1.25878567]
  [-0.90383437  2.27354572]
  [-1.20093113 -1.58254245]
  [ 2.1661655  -0.79972756]
  [-1.39899564 -1.46656987]
  [ 0.38358493  2.30253886]
  [ 0.77971394  0.76590222]
  [-1.00286662 -0.30684411]
  [ 0.08648817  0.76590222]
  [-1.00286662  0.56295021]
  [ 0.28455268  0.07006676]
  [ 0.68068169 -1.26361786]
  [-0.50770535 -0.01691267]
  [-1.79512465  0.35999821]
  [-0.70576986  0.12805305]
  [ 0.38358493  0.30201192]
  [-0.30964085  0.07006676]
  [-0.50770535  2.30253886]
  [ 0.18552042  0.04107362]
  [ 1.27487521  2.21555943]
  [ 0.77971394  0.27301877]
  [-0.30964085  0.1570462 ]
  [-0.01254409 -0.53878926]
  [-0.21060859  0.1570462 ]
  [-0.11157634  0.24402563]
  [-0.01254409 -0.24885782]
  [ 2.1661655  1.11381995]
  [-1.79512465  0.35999821]
  [ 1.86906873  0.12805305]
```

```
[ 0.38358493 -0.13288524]
[-1.20093113  0.30201192]
[ 0.77971394  1.37475825]
[-0.30964085 -0.24885782]
[-1.6960924  -0.04590581]
[-1.00286662 -0.74174127]
[ 0.28455268  0.50496393]
[-0.11157634 -1.06066585]
[-1.10189888  0.59194336]
[ 0.08648817 -0.79972756]
[-1.00286662  1.54871711]
[-0.70576986  1.40375139]
[-1.29996338  0.50496393]
[-0.30964085  0.04107362]
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[-0.01254409  0.04107362]
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[-1.20093113 -1.089659 ]
[-0.70576986 -0.1038921 ]
[ 0.08648817  0.09905991]
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[ 0.8787462  -0.5677824 ]
[ 0.28455268 -1.14764529]
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[-1.99318916  0.47597078]
[-0.30964085  0.27301877]
[ 1.86906873 -1.06066585]
[-0.4086731  0.07006676]
[ 1.07681071 -0.88670699]
[-1.10189888 -1.11865214]
[-1.89415691  0.01208048]
[ 0.08648817  0.27301877]
[-1.20093113  0.33100506]
```

```
[ -1.29996338  0.30201192]  
[ -1.00286662  0.44697764]  
[  1.67100423 -0.88670699]  
[  1.17584296  0.53395707]  
[  1.07681071  0.53395707]  
[  1.37390747  2.331532  ]  
[ -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] ]
```

```
In [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] ]

```

Training the K-NN model on the Training set

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

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

Predicting a new result

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

[0]
```

Predicting the Test set results

```
In [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]
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[1 1]]
```

Making the Confusion Matrix

```
In [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]]
```

```
Out[14]: 0.93
```

Visualising the Training set results

```
In [0]: 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_s
et[:, 0].max() + 10, step = 0.25),
                     np.arange(start = X_set[:, 1].min() - 1000, stop = X
_set[:, 1].max() + 1000, step = 0.25))
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 = ListedCol
ormap(('red', 'green'))(i), label = j)
plt.title('K-NN (Training set)')
plt.xlabel('Age')
plt.ylabel('Estimated Salary')
plt.legend()
plt.show()
```

Visualising the Test set results

```
In [0]: 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_s
et[:, 0].max() + 10, step = 0.25),
                     np.arange(start = X_set[:, 1].min() - 1000, stop = X
_set[:, 1].max() + 1000, step = 0.25))
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 = ListedCol
ormap(['red', 'green'])(i), label = j)
plt.title('K-NN (Test set)')
plt.xlabel('Age')
plt.ylabel('Estimated Salary')
plt.legend()
plt.show()
```