diabetes

July 19, 2023

[1]:
```python
import numpy as np # linear algebra
import pandas as pd # data processing, CSV file I/O (e.g. pd.read_csv)
import matplotlib.pyplot as plt
import seaborn as sns

from sklearn.model_selection import train_test_split
from sklearn.linear_model import LogisticRegression
from sklearn.metrics import accuracy_score

from sklearn.tree import DecisionTreeClassifier
```

[2]:
```python
df = pd.read_csv("diabetes.csv")
```

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

[3]:
```
   Pregnancies  Glucose  BloodPressure  SkinThickness  Insulin   BMI  \
0            6      148             72             35        0  33.6
1            1       85             66             29        0  26.6
2            8      183             64              0        0  23.3
3            1       89             66             23       94  28.1
4            0      137             40             35      168  43.1

   DiabetesPedigreeFunction  Age  Outcome
0                     0.627   50        1
1                     0.351   31        0
2                     0.672   32        1
3                     0.167   21        0
4                     2.288   33        1
```

[4]:
```python
df.head(10)
```

[4]:
```
   Pregnancies  Glucose  BloodPressure  SkinThickness  Insulin   BMI  \
0            6      148             72             35        0  33.6
1            1       85             66             29        0  26.6
2            8      183             64              0        0  23.3
3            1       89             66             23       94  28.1
4            0      137             40             35      168  43.1
```

5	5	116	74	0	0	25.6
6	3	78	50	32	88	31.0
7	10	115	0	0	0	35.3
8	2	197	70	45	543	30.5
9	8	125	96	0	0	0.0

	DiabetesPedigreeFunction	Age	Outcome
0	0.627	50	1
1	0.351	31	0
2	0.672	32	1
3	0.167	21	0
4	2.288	33	1
5	0.201	30	0
6	0.248	26	1
7	0.134	29	0
8	0.158	53	1
9	0.232	54	1

[5]:
```
df.tail(10)
```

[5]:

	Pregnancies	Glucose	BloodPressure	SkinThickness	Insulin	BMI \
758	1	106	76	0	0	37.5
759	6	190	92	0	0	35.5
760	2	88	58	26	16	28.4
761	9	170	74	31	0	44.0
762	9	89	62	0	0	22.5
763	10	101	76	48	180	32.9
764	2	122	70	27	0	36.8
765	5	121	72	23	112	26.2
766	1	126	60	0	0	30.1
767	1	93	70	31	0	30.4

	DiabetesPedigreeFunction	Age	Outcome
758	0.197	26	0
759	0.278	66	1
760	0.766	22	0
761	0.403	43	1
762	0.142	33	0
763	0.171	63	0
764	0.340	27	0
765	0.245	30	0
766	0.349	47	1
767	0.315	23	0

[6]:
```
df.groupby('Outcome').size()
```

[6]:
```
Outcome
0    500
1    268
dtype: int64
```

[7]:
```python
df.describe()
```

[7]:
```
       Pregnancies     Glucose  BloodPressure  SkinThickness     Insulin  \
count   768.000000  768.000000     768.000000     768.000000  768.000000
mean      3.845052  120.894531      69.105469      20.536458   79.799479
std       3.369578   31.972618      19.355807      15.952218  115.244002
min       0.000000    0.000000       0.000000       0.000000    0.000000
25%       1.000000   99.000000      62.000000       0.000000    0.000000
50%       3.000000  117.000000      72.000000      23.000000   30.500000
75%       6.000000  140.250000      80.000000      32.000000  127.250000
max      17.000000  199.000000     122.000000      99.000000  846.000000

              BMI  DiabetesPedigreeFunction         Age     Outcome
count  768.000000                768.000000  768.000000  768.000000
mean    31.992578                  0.471876   33.240885    0.348958
std      7.884160                  0.331329   11.760232    0.476951
min      0.000000                  0.078000   21.000000    0.000000
25%     27.300000                  0.243750   24.000000    0.000000
50%     32.000000                  0.372500   29.000000    0.000000
75%     36.600000                  0.626250   41.000000    1.000000
max     67.100000                  2.420000   81.000000    1.000000
```

[8]:
```python
X=df.iloc[:,0:7].values
Y=df.iloc[:,8].values
```

[9]:
```python
print(X[:,1])
```

```
[148.  85. 183.  89. 137. 116.  78. 115. 197. 125. 110. 168. 139. 189.
 166. 100. 118. 107. 103. 115. 126.  99. 196. 119. 143. 125. 147.  97.
 145. 117. 109. 158.  88.  92. 122. 103. 138. 102.  90. 111. 180. 133.
 106. 171. 159. 180. 146.  71. 103. 105. 103. 101.  88. 176. 150.  73.
 187. 100. 146. 105.  84. 133.  44. 141. 114.  99. 109. 109.  95. 146.
 100. 139. 126. 129.  79.   0.  62.  95. 131. 112. 113.  74.  83. 101.
 137. 110. 106. 100. 136. 107.  80. 123.  81. 134. 142. 144.  92.  71.
  93. 122. 163. 151. 125.  81.  85. 126.  96. 144.  83.  95. 171. 155.
  89.  76. 160. 146. 124.  78.  97.  99. 162. 111. 107. 132. 113.  88.
 120. 118. 117. 105. 173. 122. 170.  84.  96. 125. 100.  93. 129. 105.
 128. 106. 108. 108. 154. 102.  57. 106. 147.  90. 136. 114. 156. 153.
 188. 152.  99. 109.  88. 163. 151. 102. 114. 100. 131. 104. 148. 120.
 110. 111. 102. 134.  87.  79.  75. 179.  85. 129. 143. 130.  87. 119.
   0.  73. 141. 194. 181. 128. 109. 139. 111. 123. 159. 135.  85. 158.
 105. 107. 109. 148. 113. 138. 108.  99. 103. 111. 196. 162.  96. 184.
```

```
  81. 147. 179. 140. 112. 151. 109. 125.  85. 112. 177. 158. 119. 142.
 100.  87. 101. 162. 197. 117. 142. 134.  79. 122.  74. 171. 181. 179.
 164. 104.  91.  91. 139. 119. 146. 184. 122. 165. 124. 111. 106. 129.
  90.  86.  92. 113. 111. 114. 193. 155. 191. 141.  95. 142. 123.  96.
 138. 128. 102. 146. 101. 108. 122.  71. 106. 100. 106. 104. 114. 108.
 146. 129. 133. 161. 108. 136. 155. 119.  96. 108.  78. 107. 128. 128.
 161. 151. 146. 126. 100. 112. 167. 144.  77. 115. 150. 120. 161. 137.
 128. 124.  80. 106. 155. 113. 109. 112.  99. 182. 115. 194. 129. 112.
 124. 152. 112. 157. 122. 179. 102. 105. 118.  87. 180. 106.  95. 165.
 117. 115. 152. 178. 130.  95.   0. 122.  95. 126. 139. 116.  99.   0.
  92. 137.  61.  90.  90. 165. 125. 129.  88. 196. 189. 158. 103. 146.
 147.  99. 124. 101.  81. 133. 173. 118.  84. 105. 122. 140.  98.  87.
 156.  93. 107. 105. 109.  90. 125. 119. 116. 105. 144. 100. 100. 166.
 131. 116. 158. 127.  96. 131.  82. 193.  95. 137. 136.  72. 168. 123.
 115. 101. 197. 172. 102. 112. 143. 143. 138. 173.  97. 144.  83. 129.
 119.  94. 102. 115. 151. 184.  94. 181. 135.  95.  99.  89.  80. 139.
  90. 141. 140. 147.  97. 107. 189.  83. 117. 108. 117. 180. 100.  95.
 104. 120.  82. 134.  91. 119. 100. 175. 135.  86. 148. 134. 120.  71.
  74.  88. 115. 124.  74.  97. 120. 154. 144. 137. 119. 136. 114. 137.
 105. 114. 126. 132. 158. 123.  85.  84. 145. 135. 139. 173.  99. 194.
  83.  89.  99. 125.  80. 166. 110.  81. 195. 154. 117.  84.   0.  94.
  96.  75. 180. 130.  84. 120.  84. 139.  91.  91.  99. 163. 145. 125.
  76. 129.  68. 124. 114. 130. 125.  87.  97. 116. 117. 111. 122. 107.
  86.  91.  77. 132. 105.  57. 127. 129. 100. 128.  90.  84.  88. 186.
 187. 131. 164. 189. 116.  84. 114.  88.  84. 124.  97. 110. 103.  85.
 125. 198.  87.  99.  91.  95.  99.  92. 154. 121.  78. 130. 111.  98.
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 176.  73. 111. 112. 132.  82. 123. 188.  67.  89. 173. 109. 108.  96.
 124. 150. 183. 124. 181.  92. 152. 111. 106. 174. 168. 105. 138. 106.
 117.  68. 112. 119. 112.  92. 183.  94. 108.  90. 125. 132. 128.  94.
 114. 102. 111. 128.  92. 104. 104.  94.  97. 100. 102. 128. 147.  90.
 103. 157. 167. 179. 136. 107.  91. 117. 123. 120. 106. 155. 101. 120.
 127.  80. 162. 199. 167. 145. 115. 112. 145. 111.  98. 154. 165.  99.
  68. 123.  91. 195. 156.  93. 121. 101.  56. 162.  95. 125. 136. 129.
 130. 107. 140. 144. 107. 158. 121. 129.  90. 142. 169.  99. 127. 118.
 122. 125. 168. 129. 110.  80. 115. 127. 164.  93. 158. 126. 129. 134.
 102. 187. 173.  94. 108.  97.  83. 114. 149. 117. 111. 112. 116. 141.
 175.  92. 130. 120. 174. 106. 105.  95. 126.  65.  99. 102. 120. 102.
 109. 140. 153. 100. 147.  81. 187. 162. 136. 121. 108. 181. 154. 128.
 137. 123. 106. 190.  88. 170.  89. 101. 122. 121. 126.  93.]
```

[10]:
```
from sklearn.preprocessing import LabelEncoder
LEncoder =LabelEncoder()
y=LEncoder.fit_transform(Y)
```

[11]:
```
#splitting dataset
from sklearn.model_selection import train_test_split
```

```python
X_train, X_test, y_train, y_test = train_test_split(X, y, test_size=0.25,␣
 ↪random_state=42)
```

[12]:
```python
#feature scalling for classification
from sklearn.preprocessing import StandardScaler

scaler = StandardScaler()
scaler.fit(X_train)

X_train = scaler.transform(X_train)
X_test = scaler.transform(X_test)
```

[13]:
```python
#Training & predicting for classification
from sklearn.neighbors import KNeighborsClassifier

classifier = KNeighborsClassifier(n_neighbors =7)
#Fitting the model to the training data
classifier.fit(X_train, y_train)
y_pred=classifier.predict(X_test)
print(y_pred)
```

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

```
C:\ProgramData\Anaconda3\lib\site-
packages\sklearn\neighbors\_classification.py:228: FutureWarning: Unlike other
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accepted. Set `keepdims` to True or False to avoid this warning.
  mode, _ = stats.mode(_y[neigh_ind, k], axis=1)
```

[14]:
```python
#Evaluating the accuracy
acc = classifier.score(X_test, y_test)
print(acc)
```

```
0.703125
```

```
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```
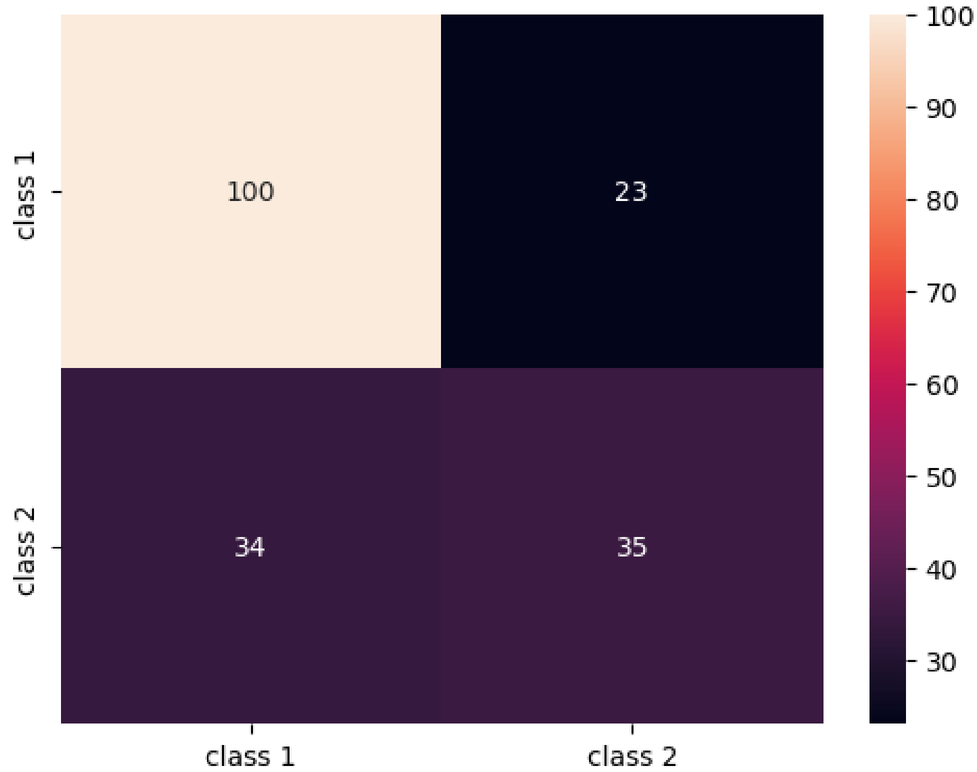

[15]:
```python
from sklearn.metrics import classification_report, confusion_matrix
#importing Seaborn's to use the heatmap
import seaborn as sns

#Adding classes names for better interpretation
classes_names = ['class 1', 'class 2']
cm = pd.DataFrame(confusion_matrix(y_test, y_pred),
                columns=classes_names, index = classes_names)

#Seaborn's heatmap to better visualize the confusion matrix
sns.heatmap(cm, annot=True, fmt= 'd');

print(classification_report(y_test, y_pred))
```

```
              precision    recall  f1-score   support

           0       0.75      0.81      0.78       123
           1       0.60      0.51      0.55        69

    accuracy                           0.70       192
   macro avg       0.67      0.66      0.66       192
weighted avg       0.69      0.70      0.70       192
```



[16]:
```
from sklearn.metrics import f1_score

f1s = []

# Calculating f1 score for k values between 1 and 40
for i in range(1, 40):
    knn = KNeighborsClassifier(n_neighbors=i)
    knn.fit(X_train, y_train)
    pred_i = knn.predict(X_test)
    # using average= 'weighted' to calculate a weighted average for the 2␣
↪classes
    f1s.append(f1_score(y_test, pred_i, average='weighted'))
```

```
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```
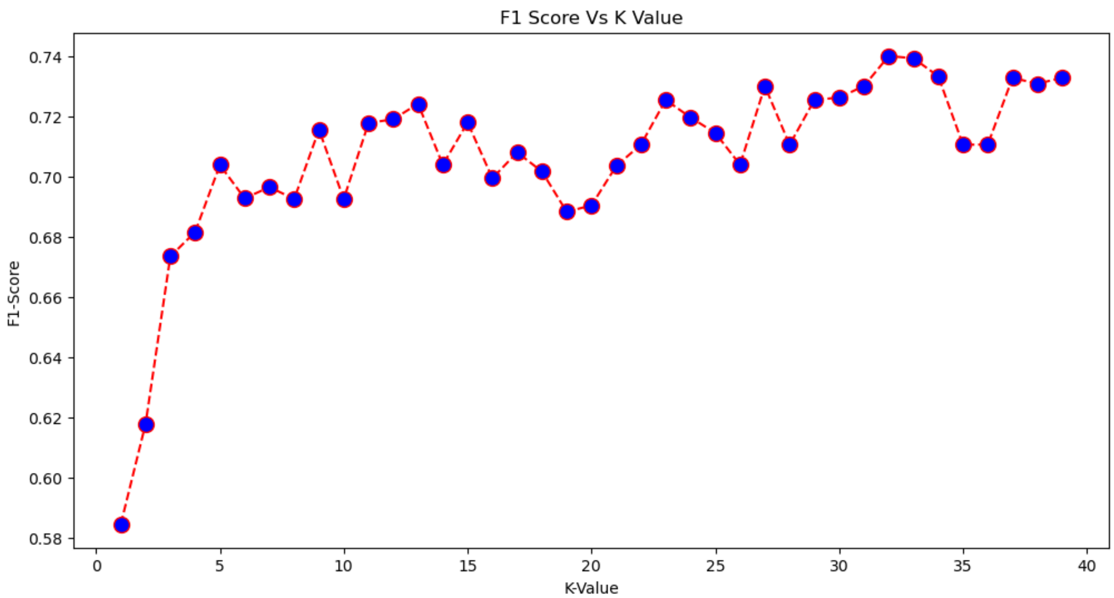

[17]:
```python
import matplotlib.pyplot as plt

plt.figure(figsize=(12, 6))
plt.plot(range(1, 40), f1s, color='red', linestyle='dashed', marker='o',
         markerfacecolor='blue', markersize=10)
plt.title('F1 Score Vs K Value')
plt.xlabel('K-Value')
plt.ylabel('F1-Score')
```

[17]: Text(0, 0.5, 'F1-Score')



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