1st experiment

October 12, 2022

1 Diabetes Prediction

[1]:
```
from keras.models import Sequential
from keras.layers import Dense
import pandas as pd
```

[2]:
```
data1 = pd.read_csv("pima-indians-diabetes.data.csv")
```

[3]:
```
data1.columns =␣
↪["pregnency","glucose","bp","triceps","insuline","bmi","pdeigree","age","class"]
```

[4]:
```
data1.head(2)
```

[4]:

	pregnency	glucose	bp	triceps	insuline	bmi	pdeigree	age	class
0	1	85	66	29	0	26.6	0.351	31	0
1	8	183	64	0	0	23.3	0.672	32	1

[5]:
```
model = Sequential()
```

[6]:
```
model.add(Dense(12,activation="relu"))
```

[7]:
```
model.add(Dense(8,activation="relu"))
```

[8]:
```
model.add(Dense(1,activation="sigmoid"))
```

[9]:
```
model.compile(loss="binary_crossentropy",optimizer="adam",metrics=["accuracy"])
```

[10]:
```
x = data1.drop(columns="class")
```

[11]:
```
y=data1["class"]
```

[12]:
```
model.fit(x,y,epochs=150,batch_size=5)
```

```
Epoch 1/150
154/154 [==============================] - 1s 1ms/step - loss: 2.4762 -
accuracy: 0.6037
Epoch 2/150
154/154 [==============================] - 0s 1ms/step - loss: 0.8302 -
accuracy: 0.6180
```

```
Epoch 3/150
154/154 [==============================] - 0s 1ms/step - loss: 0.7586 -
accuracy: 0.6415
Epoch 4/150
154/154 [==============================] - 0s 1ms/step - loss: 0.7244 -
accuracy: 0.6532
Epoch 5/150
154/154 [==============================] - 0s 1ms/step - loss: 0.7136 -
accuracy: 0.6519
Epoch 6/150
154/154 [==============================] - 0s 1ms/step - loss: 0.7159 -
accuracy: 0.6467
Epoch 7/150
154/154 [==============================] - 0s 1ms/step - loss: 0.6956 -
accuracy: 0.6584
Epoch 8/150
154/154 [==============================] - 0s 1ms/step - loss: 0.6845 -
accuracy: 0.6519
Epoch 9/150
154/154 [==============================] - 0s 1ms/step - loss: 0.6888 -
accuracy: 0.6389
Epoch 10/150
154/154 [==============================] - 0s 1ms/step - loss: 0.6672 -
accuracy: 0.6506
Epoch 11/150
154/154 [==============================] - 0s 1ms/step - loss: 0.6675 -
accuracy: 0.6506
Epoch 12/150
154/154 [==============================] - 0s 1ms/step - loss: 0.6522 -
accuracy: 0.6649
Epoch 13/150
154/154 [==============================] - 0s 1ms/step - loss: 0.6461 -
accuracy: 0.6688
Epoch 14/150
154/154 [==============================] - 0s 1ms/step - loss: 0.6431 -
accuracy: 0.6493
Epoch 15/150
154/154 [==============================] - 0s 1ms/step - loss: 0.6360 -
accuracy: 0.6675
Epoch 16/150
154/154 [==============================] - 0s 1ms/step - loss: 0.6304 -
accuracy: 0.6728
Epoch 17/150
154/154 [==============================] - 0s 1ms/step - loss: 0.6474 -
accuracy: 0.6662
Epoch 18/150
154/154 [==============================] - 0s 1ms/step - loss: 0.6383 -
accuracy: 0.6636
```

```
Epoch 19/150
154/154 [==============================] - 0s 1ms/step - loss: 0.6324 -
accuracy: 0.6714
Epoch 20/150
154/154 [==============================] - 0s 1ms/step - loss: 0.6269 -
accuracy: 0.6649
Epoch 21/150
154/154 [==============================] - 0s 1ms/step - loss: 0.6144 -
accuracy: 0.6780
Epoch 22/150
154/154 [==============================] - 0s 1ms/step - loss: 0.6273 -
accuracy: 0.6623
Epoch 23/150
154/154 [==============================] - 0s 1ms/step - loss: 0.6148 -
accuracy: 0.6662
Epoch 24/150
154/154 [==============================] - 0s 1ms/step - loss: 0.6111 -
accuracy: 0.6714
Epoch 25/150
154/154 [==============================] - 0s 1ms/step - loss: 0.6143 -
accuracy: 0.6754
Epoch 26/150
154/154 [==============================] - 0s 1ms/step - loss: 0.6154 -
accuracy: 0.6741
Epoch 27/150
154/154 [==============================] - 0s 2ms/step - loss: 0.6188 -
accuracy: 0.6832
Epoch 28/150
154/154 [==============================] - 0s 2ms/step - loss: 0.6240 -
accuracy: 0.6793
Epoch 29/150
154/154 [==============================] - 0s 1ms/step - loss: 0.6080 -
accuracy: 0.6806
Epoch 30/150
154/154 [==============================] - 0s 1ms/step - loss: 0.6013 -
accuracy: 0.6793
Epoch 31/150
154/154 [==============================] - 0s 2ms/step - loss: 0.6048 -
accuracy: 0.6754
Epoch 32/150
154/154 [==============================] - 0s 2ms/step - loss: 0.5985 -
accuracy: 0.6806
Epoch 33/150
154/154 [==============================] - 0s 1ms/step - loss: 0.6021 -
accuracy: 0.6910
Epoch 34/150
154/154 [==============================] - 0s 1ms/step - loss: 0.5926 -
accuracy: 0.6884
```

```
Epoch 35/150
154/154 [==============================] - 0s 1ms/step - loss: 0.5955 -
accuracy: 0.6897
Epoch 36/150
154/154 [==============================] - 0s 1ms/step - loss: 0.5860 -
accuracy: 0.6871
Epoch 37/150
154/154 [==============================] - 0s 1ms/step - loss: 0.5936 -
accuracy: 0.6910
Epoch 38/150
154/154 [==============================] - 0s 1ms/step - loss: 0.5858 -
accuracy: 0.6871
Epoch 39/150
154/154 [==============================] - 0s 1ms/step - loss: 0.5866 -
accuracy: 0.6845
Epoch 40/150
154/154 [==============================] - 0s 1ms/step - loss: 0.5887 -
accuracy: 0.6884
Epoch 41/150
154/154 [==============================] - 0s 1ms/step - loss: 0.5829 -
accuracy: 0.6949
Epoch 42/150
154/154 [==============================] - 0s 1ms/step - loss: 0.5800 -
accuracy: 0.6949
Epoch 43/150
154/154 [==============================] - 0s 1ms/step - loss: 0.5859 -
accuracy: 0.7001
Epoch 44/150
154/154 [==============================] - 0s 1ms/step - loss: 0.5679 -
accuracy: 0.7001
Epoch 45/150
154/154 [==============================] - 0s 1ms/step - loss: 0.5803 -
accuracy: 0.6988
Epoch 46/150
154/154 [==============================] - 0s 1ms/step - loss: 0.5789 -
accuracy: 0.6923
Epoch 47/150
154/154 [==============================] - 0s 1ms/step - loss: 0.5769 -
accuracy: 0.7053
Epoch 48/150
154/154 [==============================] - 0s 1ms/step - loss: 0.5689 -
accuracy: 0.7197
Epoch 49/150
154/154 [==============================] - 0s 1ms/step - loss: 0.5658 -
accuracy: 0.7080
Epoch 50/150
154/154 [==============================] - 0s 1ms/step - loss: 0.5657 -
accuracy: 0.7066
```

```
Epoch 51/150
154/154 [==============================] - 0s 1ms/step - loss: 0.5783 -
accuracy: 0.7340
Epoch 52/150
154/154 [==============================] - 0s 1ms/step - loss: 0.5680 -
accuracy: 0.7210
Epoch 53/150
154/154 [==============================] - 0s 1ms/step - loss: 0.5645 -
accuracy: 0.7145
Epoch 54/150
154/154 [==============================] - 0s 1ms/step - loss: 0.5628 -
accuracy: 0.6988
Epoch 55/150
154/154 [==============================] - 0s 1ms/step - loss: 0.5534 -
accuracy: 0.7392
Epoch 56/150
154/154 [==============================] - 0s 1ms/step - loss: 0.5545 -
accuracy: 0.7327
Epoch 57/150
154/154 [==============================] - 0s 1ms/step - loss: 0.5561 -
accuracy: 0.7379
Epoch 58/150
154/154 [==============================] - 0s 1ms/step - loss: 0.5529 -
accuracy: 0.7392
Epoch 59/150
154/154 [==============================] - 0s 1ms/step - loss: 0.5548 -
accuracy: 0.7471
Epoch 60/150
154/154 [==============================] - 0s 1ms/step - loss: 0.5423 -
accuracy: 0.7432
Epoch 61/150
154/154 [==============================] - 0s 1ms/step - loss: 0.5403 -
accuracy: 0.7366
Epoch 62/150
154/154 [==============================] - 0s 1ms/step - loss: 0.5536 -
accuracy: 0.7275
Epoch 63/150
154/154 [==============================] - 0s 1ms/step - loss: 0.5515 -
accuracy: 0.7249
Epoch 64/150
154/154 [==============================] - 0s 1ms/step - loss: 0.5462 -
accuracy: 0.7445
Epoch 65/150
154/154 [==============================] - 0s 1ms/step - loss: 0.5354 -
accuracy: 0.7445
Epoch 66/150
154/154 [==============================] - 0s 1ms/step - loss: 0.5498 -
accuracy: 0.7366
```

```
Epoch 67/150
154/154 [==============================] - 0s 1ms/step - loss: 0.5372 -
accuracy: 0.7575
Epoch 68/150
154/154 [==============================] - 0s 1ms/step - loss: 0.5375 -
accuracy: 0.7523
Epoch 69/150
154/154 [==============================] - 0s 1ms/step - loss: 0.5392 -
accuracy: 0.7405
Epoch 70/150
154/154 [==============================] - 0s 1ms/step - loss: 0.5259 -
accuracy: 0.7392
Epoch 71/150
154/154 [==============================] - 0s 1ms/step - loss: 0.5277 -
accuracy: 0.7392
Epoch 72/150
154/154 [==============================] - 0s 1ms/step - loss: 0.5351 -
accuracy: 0.7445
Epoch 73/150
154/154 [==============================] - 0s 1ms/step - loss: 0.5433 -
accuracy: 0.7497
Epoch 74/150
154/154 [==============================] - 0s 1ms/step - loss: 0.5233 -
accuracy: 0.7497
Epoch 75/150
154/154 [==============================] - 0s 1ms/step - loss: 0.5285 -
accuracy: 0.7523
Epoch 76/150
154/154 [==============================] - 0s 1ms/step - loss: 0.5336 -
accuracy: 0.7458
Epoch 77/150
154/154 [==============================] - 0s 1ms/step - loss: 0.5192 -
accuracy: 0.7471
Epoch 78/150
154/154 [==============================] - 0s 1ms/step - loss: 0.5230 -
accuracy: 0.7510
Epoch 79/150
154/154 [==============================] - 0s 1ms/step - loss: 0.5200 -
accuracy: 0.7405
Epoch 80/150
154/154 [==============================] - 0s 1ms/step - loss: 0.5228 -
accuracy: 0.7575
Epoch 81/150
154/154 [==============================] - 0s 1ms/step - loss: 0.5234 -
accuracy: 0.7392
Epoch 82/150
154/154 [==============================] - 0s 1ms/step - loss: 0.5250 -
accuracy: 0.7419
```

```
Epoch 83/150
154/154 [==============================] - 0s 1ms/step - loss: 0.5159 -
accuracy: 0.7419
Epoch 84/150
154/154 [==============================] - 0s 1ms/step - loss: 0.5238 -
accuracy: 0.7458
Epoch 85/150
154/154 [==============================] - 0s 1ms/step - loss: 0.5269 -
accuracy: 0.7471
Epoch 86/150
154/154 [==============================] - 0s 1ms/step - loss: 0.5285 -
accuracy: 0.7327
Epoch 87/150
154/154 [==============================] - 0s 1ms/step - loss: 0.5215 -
accuracy: 0.7458
Epoch 88/150
154/154 [==============================] - 0s 1ms/step - loss: 0.5151 -
accuracy: 0.7471
Epoch 89/150
154/154 [==============================] - 0s 1ms/step - loss: 0.5151 -
accuracy: 0.7419
Epoch 90/150
154/154 [==============================] - 0s 1ms/step - loss: 0.5154 -
accuracy: 0.7510
Epoch 91/150
154/154 [==============================] - 0s 1ms/step - loss: 0.5112 -
accuracy: 0.7536
Epoch 92/150
154/154 [==============================] - 0s 1ms/step - loss: 0.5068 -
accuracy: 0.7549
Epoch 93/150
154/154 [==============================] - 0s 1ms/step - loss: 0.5092 -
accuracy: 0.7419
Epoch 94/150
154/154 [==============================] - 0s 1ms/step - loss: 0.5132 -
accuracy: 0.7497
Epoch 95/150
154/154 [==============================] - 0s 1ms/step - loss: 0.5170 -
accuracy: 0.7471
Epoch 96/150
154/154 [==============================] - 0s 1ms/step - loss: 0.5140 -
accuracy: 0.7432
Epoch 97/150
154/154 [==============================] - 0s 1ms/step - loss: 0.5025 -
accuracy: 0.7575
Epoch 98/150
154/154 [==============================] - 0s 1ms/step - loss: 0.5070 -
accuracy: 0.7588
```

```
Epoch 99/150
154/154 [==============================] - 0s 1ms/step - loss: 0.5097 -
accuracy: 0.7601
Epoch 100/150
154/154 [==============================] - 0s 1ms/step - loss: 0.5041 -
accuracy: 0.7549
Epoch 101/150
154/154 [==============================] - 0s 1ms/step - loss: 0.4986 -
accuracy: 0.7614
Epoch 102/150
154/154 [==============================] - 0s 1ms/step - loss: 0.4978 -
accuracy: 0.7536
Epoch 103/150
154/154 [==============================] - 0s 1ms/step - loss: 0.4992 -
accuracy: 0.7640
Epoch 104/150
154/154 [==============================] - 0s 1ms/step - loss: 0.5015 -
accuracy: 0.7640
Epoch 105/150
154/154 [==============================] - 0s 1ms/step - loss: 0.4975 -
accuracy: 0.7562
Epoch 106/150
154/154 [==============================] - 0s 1ms/step - loss: 0.4998 -
accuracy: 0.7653
Epoch 107/150
154/154 [==============================] - 0s 1ms/step - loss: 0.4961 -
accuracy: 0.7484
Epoch 108/150
154/154 [==============================] - 0s 1ms/step - loss: 0.4921 -
accuracy: 0.7562
Epoch 109/150
154/154 [==============================] - 0s 1ms/step - loss: 0.4966 -
accuracy: 0.7458
Epoch 110/150
154/154 [==============================] - 0s 1ms/step - loss: 0.4961 -
accuracy: 0.7614
Epoch 111/150
154/154 [==============================] - 0s 1ms/step - loss: 0.4882 -
accuracy: 0.7692
Epoch 112/150
154/154 [==============================] - 0s 1ms/step - loss: 0.4859 -
accuracy: 0.7731
Epoch 113/150
154/154 [==============================] - 0s 1ms/step - loss: 0.4920 -
accuracy: 0.7640
Epoch 114/150
154/154 [==============================] - 0s 1ms/step - loss: 0.4893 -
accuracy: 0.7614
```

```
Epoch 115/150
154/154 [==============================] - 0s 1ms/step - loss: 0.4953 -
accuracy: 0.7510
Epoch 116/150
154/154 [==============================] - 0s 1ms/step - loss: 0.4900 -
accuracy: 0.7692
Epoch 117/150
154/154 [==============================] - 0s 1ms/step - loss: 0.4889 -
accuracy: 0.7588
Epoch 118/150
154/154 [==============================] - 0s 1ms/step - loss: 0.4826 -
accuracy: 0.7666
Epoch 119/150
154/154 [==============================] - 0s 1ms/step - loss: 0.4855 -
accuracy: 0.7640
Epoch 120/150
154/154 [==============================] - 0s 1ms/step - loss: 0.4886 -
accuracy: 0.7705
Epoch 121/150
154/154 [==============================] - 0s 1ms/step - loss: 0.4908 -
accuracy: 0.7575
Epoch 122/150
154/154 [==============================] - 0s 1ms/step - loss: 0.4862 -
accuracy: 0.7705
Epoch 123/150
154/154 [==============================] - 0s 1ms/step - loss: 0.4871 -
accuracy: 0.7640
Epoch 124/150
154/154 [==============================] - 0s 1ms/step - loss: 0.4924 -
accuracy: 0.7588
Epoch 125/150
154/154 [==============================] - 0s 1ms/step - loss: 0.4812 -
accuracy: 0.7718
Epoch 126/150
154/154 [==============================] - 0s 1ms/step - loss: 0.4856 -
accuracy: 0.7549
Epoch 127/150
154/154 [==============================] - 0s 1ms/step - loss: 0.4875 -
accuracy: 0.7614
Epoch 128/150
154/154 [==============================] - 0s 1ms/step - loss: 0.4806 -
accuracy: 0.7666
Epoch 129/150
154/154 [==============================] - 0s 1ms/step - loss: 0.4874 -
accuracy: 0.7627
Epoch 130/150
154/154 [==============================] - 0s 1ms/step - loss: 0.5048 -
accuracy: 0.7562
```

```
Epoch 131/150
154/154 [==============================] - 0s 1ms/step - loss: 0.4917 -
accuracy: 0.7653
Epoch 132/150
154/154 [==============================] - 0s 1ms/step - loss: 0.4878 -
accuracy: 0.7731
Epoch 133/150
154/154 [==============================] - 0s 1ms/step - loss: 0.4893 -
accuracy: 0.7640
Epoch 134/150
154/154 [==============================] - 0s 1ms/step - loss: 0.4900 -
accuracy: 0.7731
Epoch 135/150
154/154 [==============================] - 0s 1ms/step - loss: 0.4911 -
accuracy: 0.7549
Epoch 136/150
154/154 [==============================] - 0s 1ms/step - loss: 0.4836 -
accuracy: 0.7549
Epoch 137/150
154/154 [==============================] - 0s 1ms/step - loss: 0.4758 -
accuracy: 0.7666
Epoch 138/150
154/154 [==============================] - 0s 1ms/step - loss: 0.4765 -
accuracy: 0.7771
Epoch 139/150
154/154 [==============================] - 0s 1ms/step - loss: 0.4748 -
accuracy: 0.7744
Epoch 140/150
154/154 [==============================] - 0s 1ms/step - loss: 0.4789 -
accuracy: 0.7718
Epoch 141/150
154/154 [==============================] - 0s 1ms/step - loss: 0.4782 -
accuracy: 0.7757
Epoch 142/150
154/154 [==============================] - 0s 1ms/step - loss: 0.4798 -
accuracy: 0.7862
Epoch 143/150
154/154 [==============================] - 0s 1ms/step - loss: 0.4776 -
accuracy: 0.7705
Epoch 144/150
154/154 [==============================] - 0s 1ms/step - loss: 0.4777 -
accuracy: 0.7666
Epoch 145/150
154/154 [==============================] - 0s 1ms/step - loss: 0.4726 -
accuracy: 0.7771
Epoch 146/150
154/154 [==============================] - 0s 1ms/step - loss: 0.4767 -
accuracy: 0.7771
```

```
Epoch 147/150
154/154 [==============================] - 0s 1ms/step - loss: 0.4778 -
accuracy: 0.7692
Epoch 148/150
154/154 [==============================] - 0s 1ms/step - loss: 0.4684 -
accuracy: 0.7810
Epoch 149/150
154/154 [==============================] - 0s 1ms/step - loss: 0.4793 -
accuracy: 0.7757
Epoch 150/150
154/154 [==============================] - 0s 1ms/step - loss: 0.4845 -
accuracy: 0.7718
```

[12]:
```
<keras.callbacks.History at 0x29756a02ef0>
```

[13]:
```
score = model.evaluate(x,y)
```

```
24/24 [==============================] - 0s 1ms/step - loss: 0.4609 - accuracy:
0.7810
```

[14]:
```
score
```

[14]:
```
[0.4609473943710327, 0.7809647917747498]
```

[15]:
```
print("%s : %.2f%%" %(model.metrics_names[1], score[1]*100 ))
```

```
accuracy : 78.10%
```

1.0.1 Accuracy by splitting

[16]:
```
from sklearn.model_selection import train_test_split
from sklearn.linear_model import LogisticRegression
from sklearn.metrics import accuracy_score
```

[17]:
```
x_train, x_test, y_train, y_test = train_test_split(x, y, test_size = 0.2,␣
 ↪stratify = y, random_state = 2)
```

[18]:
```
model = LogisticRegression(max_iter=1000)
```

[19]:
```
model.fit(x_train, y_train)
```

[19]:
```
LogisticRegression(max_iter=1000)
```

[20]:
```
x_train_pred = model.predict(x_train)
```

[21]:
```
training_data_accuracy = accuracy_score(y_train, x_train_pred)
```

[22]:
```
print(training_data_accuracy*100)
```

```
77.81402936378467
```

1.0.2 Confusion matrix

[23]:
```
from sklearn.metrics import confusion_matrix
```

[24]:
```
x_test_pred = model.predict(x_test)
```

[25]:
```
#cf_matrix = confusion_matrix(y_test, x_test_pred)
cf_matrix = confusion_matrix(y_train, x_train_pred)
```

[26]:
```
print(cf_matrix)
```

```
[[356  44]
 [ 92 121]]
```

1.0.3 Recall score

[27]:
```
from sklearn.metrics import precision_score, recall_score
```

[28]:
```
x = precision_score(y_train, x_train_pred)
```

[29]:
```
x*100
```

[29]:
```
73.33333333333333
```

[31]:
```
xx = recall_score(y_train, x_train_pred)
```

[32]:
```
xx * 100
```

[32]:
```
56.8075117370892
```

1.0.4 F1_Score

[33]:
```
from sklearn.metrics import f1_score
```

[35]:
```
y = f1_score(y_train, x_train_pred)
```

[36]:
```
y * 100
```

[36]:
```
64.02116402116401
```