BUILDING THE TRAINED MODEL

DATA PREPROCESSING

In [1]:
```
import pandas as pd
```

In [2]:
```
dataset = pd.read_csv('../dataset/train_dataset.csv', index_col = 0)
```

In [3]:
```
dataset.head()
```

Out[3]:

	Age	Gender	Polyuria	Polydipsia	Sudden weight loss	Weakness	Polyphagia	Genital thrush	Visual blurring	Itching	Irritability	Delayed healing	Partial paresis	Muscle stiffness	Alope
0	40	1	0	1	0	1	0	0	0	1	0	1	0	1	
1	58	1	0	0	0	1	0	0	1	0	0	0	1	0	
2	41	1	1	0	0	1	1	0	0	1	0	1	0	1	
3	45	1	0	0	1	1	1	1	0	1	0	1	0	0	
4	60	1	1	1	1	1	1	0	1	1	1	1	1	1	

In [4]:
```
import numpy as np
```

In [5]:
```
x = dataset.iloc[ : , : 16].values
y = dataset.iloc[ : , 16].values
```

In [6]:
```
from sklearn.model_selection import train_test_split
```

In [7]:
```
x_train, x_test, y_train, y_test = train_test_split(x, y, test_size = 0.15, random_state = 0)
```

In [8]:
```
x_train.shape
```

Out[8]:
```
(544, 16)
```

In [9]:
```
x_test.shape
```

Out[9]:
```
(96, 16)
```

In [10]:
```
class_1 = np.count_nonzero(y_train == 1)
class_0 = np.count_nonzero(y_train == 0)
```

In [11]:
```
print('Positive outcomes in training data =', class_1)
print('Negative outcomes in training data =', class_0)
```

```
Positive outcomes in training data = 271
Negative outcomes in training data = 273
```

In [12]:
```
from sklearn.preprocessing import StandardScaler
scaler = StandardScaler()
```

In [13]:
```
x_train = scaler.fit_transform(x_train)
x_test = scaler.transform(x_test)
```

In [14]:
```
x_train[ : 5]
```

Out[14]:
```
array([[-0.60659035,  0.66268653, -0.83666003, -0.78679579,  1.29099445,
        -1.12127669, -0.80218734, -0.52345457, -0.80218734, -0.94629297,
        -0.50917508, -0.8753478 , -0.7685332 , -0.74450367, -0.73557901,
         2.26105275],
       [-0.94322402,  0.66268653, -0.83666003, -0.78679579, -0.77459667,
        -1.12127669, -0.80218734, -0.52345457, -0.80218734, -0.94629297,
        -0.50917508, -0.8753478 , -0.7685332 , -0.74450367, -0.73557901,
        -0.44227186],
       [ 1.41321165,  0.66268653, -0.83666003, -0.78679579, -0.77459667,
         0.89184053,  1.2465916 , -0.52345457,  1.2465916 ,  1.05675518,
         1.96396101,  1.14240306, -0.7685332 ,  1.34317672,  1.35947326,
        -0.44227186],
       [-0.60659035,  0.66268653, -0.83666003, -0.78679579, -0.77459667,
```

```
        -1.12127669, -0.80218734, -0.52345457, -0.80218734,  1.05675518,
        -0.50917508, -0.8753478 , -0.7685332 , -0.74450367,  1.35947326,
        -0.44227186],
       [-0.01748144,  0.66268653, -0.83666003, -0.78679579, -0.77459667,
        -1.12127669, -0.80218734, -0.52345457, -0.80218734,  1.05675518,
        -0.50917508, -0.8753478 , -0.7685332 , -0.74450367,  1.35947326,
        -0.44227186]])
```

USING ARTIFICIAL NEURAL NETWORK (ANN)

In [15]:
```
import tensorflow as tf
```

In [16]:
```
model = tf.keras.models.Sequential()
```

In [17]:
```
model.add(tf.keras.layers.Dense(16, input_dim = 16, activation = 'relu'))
model.add(tf.keras.layers.Dense(32, activation = 'relu'))
model.add(tf.keras.layers.Dense(64, activation = 'relu'))
model.add(tf.keras.layers.Dense(1, activation = 'sigmoid'))
```

In [18]:
```
model.compile(optimizer = 'adam', loss = 'binary_crossentropy', metrics = ['accuracy'])
```

In [19]:
```
model.fit(x_train, y_train, batch_size = 10, epochs = 100)
```

```
Epoch 1/100
55/55 [==============================] - 1s 908us/step - loss: 0.7088 - accuracy: 0.5256
Epoch 2/100
55/55 [==============================] - 0s 1ms/step - loss: 0.3858 - accuracy: 0.8653
Epoch 3/100
55/55 [==============================] - 0s 1ms/step - loss: 0.2677 - accuracy: 0.8758
Epoch 4/100
55/55 [==============================] - 0s 1ms/step - loss: 0.1814 - accuracy: 0.9384
Epoch 5/100
55/55 [==============================] - 0s 1ms/step - loss: 0.1547 - accuracy: 0.9496
Epoch 6/100
55/55 [==============================] - 0s 1ms/step - loss: 0.1089 - accuracy: 0.9640
Epoch 7/100
55/55 [==============================] - 0s 1ms/step - loss: 0.0921 - accuracy: 0.9763
Epoch 8/100
55/55 [==============================] - 0s 997us/step - loss: 0.0613 - accuracy: 0.9838
```



```
] - 0s 923us/step - loss: 0.0655 - accuracy: 0.9737
```

```
Epoch 10/100
55/55 [==============================] - 0s 960us/step - loss: 0.0474 - accuracy: 0.9802
Epoch 11/100
55/55 [==============================] - 0s 997us/step - loss: 0.0406 - accuracy: 0.9860
Epoch 12/100
55/55 [==============================] - 0s 886us/step - loss: 0.0372 - accuracy: 0.9873
Epoch 13/100
55/55 [==============================] - 0s 859us/step - loss: 0.0238 - accuracy: 0.9929
Epoch 14/100
55/55 [==============================] - 0s 852us/step - loss: 0.0238 - accuracy: 0.9957
Epoch 15/100
55/55 [==============================] - 0s 852us/step - loss: 0.0154 - accuracy: 0.9961
Epoch 16/100
55/55 [==============================] - 0s 852us/step - loss: 0.0187 - accuracy: 0.9940
Epoch 17/100
55/55 [==============================] - 0s 852us/step - loss: 0.0113 - accuracy: 0.9942
Epoch 18/100
55/55 [==============================] - 0s 889us/step - loss: 0.0123 - accuracy: 0.9938
Epoch 19/100
55/55 [==============================] - 0s 850us/step - loss: 0.0192 - accuracy: 0.9934
Epoch 20/100
55/55 [==============================] - 0s 850us/step - loss: 0.0129 - accuracy: 0.9903
Epoch 21/100
55/55 [==============================] - 0s 856us/step - loss: 0.0264 - accuracy: 0.9790
Epoch 22/100
55/55 [==============================] - 0s 868us/step - loss: 0.0099 - accuracy: 0.9968
Epoch 23/100
55/55 [==============================] - 0s 855us/step - loss: 0.0113 - accuracy: 0.9952
Epoch 24/100
55/55 [==============================] - 0s 870us/step - loss: 0.0073 - accuracy: 0.9947
Epoch 25/100
55/55 [==============================] - 0s 868us/step - loss: 0.0113 - accuracy: 0.9951
Epoch 26/100
55/55 [==============================] - 0s 854us/step - loss: 0.0123 - accuracy: 0.9946
Epoch 27/100
55/55 [==============================] - 0s 852us/step - loss: 0.0059 - accuracy: 0.9979
Epoch 28/100
55/55 [==============================] - 0s 857us/step - loss: 0.0101 - accuracy: 0.9936
Epoch 29/100
55/55 [==============================] - 0s 847us/step - loss: 0.0137 - accuracy: 0.9913
Epoch 30/100
55/55 [==============================] - 0s 852us/step - loss: 0.0092 - accuracy: 0.9957
Epoch 31/100
55/55 [==============================] - 0s 852us/step - loss: 0.0077 - accuracy: 0.9964
Epoch 32/100
55/55 [==============================] - 0s 852us/step - loss: 0.0095 - accuracy: 0.9955
Epoch 33/100
55/55 [==============================] - 0s 889us/step - loss: 0.0094 - accuracy: 0.9948
Epoch 34/100
```

```
55/55 [==============================] - 0s 905us/step - loss: 0.0201 - accuracy: 0.9875
Epoch 35/100
55/55 [==============================] - 0s 867us/step - loss: 0.0091 - accuracy: 0.9969
Epoch 36/100
55/55 [==============================] - 0s 852us/step - loss: 0.0084 - accuracy: 0.9951
Epoch 37/100
55/55 [==============================] - 0s 870us/step - loss: 0.0071 - accuracy: 0.9968
Epoch 38/100
55/55 [==============================] - 0s 889us/step - loss: 0.0062 - accuracy: 0.9982
Epoch 39/100
55/55 [==============================] - 0s 870us/step - loss: 0.0313 - accuracy: 0.9829
Epoch 40/100
55/55 [==============================] - 0s 850us/step - loss: 0.0154 - accuracy: 0.9946
Epoch 41/100
55/55 [==============================] - 0s 854us/step - loss: 0.0074 - accuracy: 0.9965
Epoch 42/100
55/55 [==============================] - 0s 870us/step - loss: 0.0083 - accuracy: 0.9956
Epoch 43/100
55/55 [==============================] - 0s 871us/step - loss: 0.0128 - accuracy: 0.9902
Epoch 44/100
55/55 [==============================] - 0s 871us/step - loss: 0.0044 - accuracy: 0.9982
Epoch 45/100
55/55 [==============================] - 0s 889us/step - loss: 0.0096 - accuracy: 0.9953
Epoch 46/100
55/55 [==============================] - 0s 870us/step - loss: 0.0098 - accuracy: 0.9917
Epoch 47/100
55/55 [==============================] - 0s 870us/step - loss: 0.0060 - accuracy: 0.9971
Epoch 48/100
55/55 [==============================] - 0s 852us/step - loss: 0.0174 - accuracy: 0.9860
Epoch 49/100
55/55 [==============================] - 0s 870us/step - loss: 0.0097 - accuracy: 0.9930
Epoch 50/100
55/55 [==============================] - 0s 850us/step - loss: 0.0122 - accuracy: 0.9960
Epoch 51/100
55/55 [==============================] - 0s 873us/step - loss: 0.0108 - accuracy: 0.9940
Epoch 52/100
55/55 [==============================] - 0s 887us/step - loss: 0.0088 - accuracy: 0.9930
Epoch 53/100
55/55 [==============================] - 0s 836us/step - loss: 0.0168 - accuracy: 0.9904
Epoch 54/100
55/55 [==============================] - 0s 926us/step - loss: 0.0104 - accuracy: 0.9960
Epoch 55/100
55/55 [==============================] - 0s 865us/step - loss: 0.0124 - accuracy: 0.9886
Epoch 56/100
55/55 [==============================] - 0s 853us/step - loss: 0.0072 - accuracy: 0.9976
Epoch 57/100
55/55 [==============================] - 0s 999us/step - loss: 0.0125 - accuracy: 0.9933
```



```
55/55 [==============================] - 0s 871us/step - loss: 0.0097 - accuracy: 0.9953
```

```
Epoch 59/100
55/55 [==============================] - 0s 887us/step - loss: 0.0199 - accuracy: 0.9866
Epoch 60/100
55/55 [==============================] - 0s 868us/step - loss: 0.0093 - accuracy: 0.9938
Epoch 61/100
55/55 [==============================] - 0s 856us/step - loss: 0.0103 - accuracy: 0.9911
Epoch 62/100
55/55 [==============================] - 0s 868us/step - loss: 0.0126 - accuracy: 0.9905
Epoch 63/100
55/55 [==============================] - 0s 868us/step - loss: 0.0124 - accuracy: 0.9927
Epoch 64/100
55/55 [==============================] - 0s 968us/step - loss: 0.0056 - accuracy: 0.9970
Epoch 65/100
55/55 [==============================] - 0s 865us/step - loss: 0.0123 - accuracy: 0.9911
Epoch 66/100
55/55 [==============================] - 0s 870us/step - loss: 0.0094 - accuracy: 0.9952
Epoch 67/100
55/55 [==============================] - 0s 870us/step - loss: 0.0044 - accuracy: 0.9975
Epoch 68/100
55/55 [==============================] - 0s 889us/step - loss: 0.0074 - accuracy: 0.9951
Epoch 69/100
55/55 [==============================] - 0s 870us/step - loss: 0.0096 - accuracy: 0.9961
Epoch 70/100
55/55 [==============================] - 0s 870us/step - loss: 0.0085 - accuracy: 0.9908
Epoch 71/100
55/55 [==============================] - 0s 870us/step - loss: 0.0154 - accuracy: 0.9993
Epoch 72/100
55/55 [==============================] - 0s 870us/step - loss: 0.0098 - accuracy: 0.9941
Epoch 73/100
55/55 [==============================] - 0s 871us/step - loss: 0.0110 - accuracy: 0.9929
Epoch 74/100
55/55 [==============================] - 0s 870us/step - loss: 0.0116 - accuracy: 0.9957
Epoch 75/100
55/55 [==============================] - 0s 887us/step - loss: 0.0052 - accuracy: 0.9963
Epoch 76/100
55/55 [==============================] - 0s 1ms/step - loss: 0.0051 - accuracy: 0.9967
Epoch 77/100
55/55 [==============================] - 0s 905us/step - loss: 0.0046 - accuracy: 0.9974
Epoch 78/100
55/55 [==============================] - 0s 872us/step - loss: 0.0130 - accuracy: 0.9928
Epoch 79/100
55/55 [==============================] - 0s 887us/step - loss: 0.0136 - accuracy: 0.9881
Epoch 80/100
55/55 [==============================] - 0s 891us/step - loss: 0.0145 - accuracy: 0.9893
Epoch 81/100
55/55 [==============================] - 0s 889us/step - loss: 0.0066 - accuracy: 0.9975
Epoch 82/100
55/55 [==============================] - 0s 905us/step - loss: 0.0080 - accuracy: 0.9967
Epoch 83/100
```

```
55/55 [==============================] - 0s 850us/step - loss: 0.0087 - accuracy: 0.9961
Epoch 84/100
55/55 [==============================] - 0s 899us/step - loss: 0.0104 - accuracy: 0.9933
Epoch 85/100
55/55 [==============================] - 0s 841us/step - loss: 0.0119 - accuracy: 0.9904
Epoch 86/100
55/55 [==============================] - 0s 833us/step - loss: 0.0049 - accuracy: 0.9966
Epoch 87/100
55/55 [==============================] - 0s 833us/step - loss: 0.0097 - accuracy: 0.9960
Epoch 88/100
55/55 [==============================] - 0s 852us/step - loss: 0.0084 - accuracy: 0.9982
Epoch 89/100
55/55 [==============================] - 0s 834us/step - loss: 0.0160 - accuracy: 0.9885
Epoch 90/100
55/55 [==============================] - 0s 886us/step - loss: 0.0084 - accuracy: 0.9937
Epoch 91/100
55/55 [==============================] - 0s 854us/step - loss: 0.0116 - accuracy: 0.9925
Epoch 92/100
55/55 [==============================] - 0s 852us/step - loss: 0.0148 - accuracy: 0.9930
Epoch 93/100
55/55 [==============================] - 0s 889us/step - loss: 0.0083 - accuracy: 0.9948
Epoch 94/100
55/55 [==============================] - 0s 886us/step - loss: 0.0136 - accuracy: 0.9979
Epoch 95/100
55/55 [==============================] - 0s 836us/step - loss: 0.0048 - accuracy: 0.9972
Epoch 96/100
55/55 [==============================] - 0s 1ms/step - loss: 0.0116 - accuracy: 0.9953
Epoch 97/100
55/55 [==============================] - 0s 868us/step - loss: 0.0121 - accuracy: 0.9974
Epoch 98/100
55/55 [==============================] - 0s 865us/step - loss: 0.0101 - accuracy: 0.9945
Epoch 99/100
55/55 [==============================] - 0s 871us/step - loss: 0.0076 - accuracy: 0.9965
Epoch 100/100
55/55 [==============================] - 0s 870us/step - loss: 0.0054 - accuracy: 0.9971
```

Out[19]: `<tensorflow.python.keras.callbacks.History at 0x17a8b46c040>`

In [20]:
```
model.summary()
```

```
Model: "sequential"
_________________________________________________________________
Layer (type)                 Output Shape              Param #
=================================================================
dense (Dense)                (None, 16)                272
_________________________________________________________________
                             2)                        544
_________________________________________________________________
```

```
dense_2 (Dense)              (None, 64)                2112
_________________________________________________________________
dense_3 (Dense)              (None, 1)                 65
=================================================================
Total params: 2,993
Trainable params: 2,993
Non-trainable params: 0
_________________________________________________________________
```

In [21]:
```
loss, accuracy = model.evaluate(x_test, y_test, verbose = 0)
```

In [22]:
```
print("Model accuracy:", round(accuracy * 100, 2), "%")
```

```
Model accuracy: 96.88 %
```

In [23]:
```
y_pred = model.predict(x_test)
y_pred = y_pred >= 0.5
```

In [24]:
```
from sklearn.metrics import accuracy_score
print("Accuracy =", accuracy_score(y_test, y_pred))
```

```
Accuracy = 0.96875
```

SAVING THE TRAINED MODEL

In [25]:
```
import os.path
```

In [26]:
```
if os.path.isfile('../model/project_model.h5') is False:
    model.save('../model/project_model.h5')
```

In [ ]:
```

```