prediction of diabates on medical record data

May 9, 2018

Import required models and layers and libraries

```
In [1]: from keras.models import Sequential
        from keras.layers import Dense
        import numpy
        # fix random seed for reproducibility
        numpy.random.seed(7)
```

```
/home/nikhil/anaconda3/lib/python3.6/site-packages/h5py/__init__.py:36: FutureWarning: Conversio
  from ._conv import register_converters as _register_converters
Using TensorFlow backend.
```

Load the data

```
In [9]: dataset = numpy.loadtxt("data/datapima.csv", delimiter=",")
```

split the dataset into input variables (X) and the output class variable (Y).

```
In [10]: X = dataset[:,0:8]
         Y = dataset[:,8]
```

Define the model with required number of layers, activation functions using dense layer and give the shape and dimentions of input data to the first layer

```
In [11]: # create model
         model = Sequential()
         model.add(Dense(12, input_dim=8, activation='relu'))
         model.add(Dense(8, activation='relu'))
         model.add(Dense(1, activation='sigmoid'))
```

Compile the model by defining the loss function , optimizer and metric

```
In [12]: # Compile model
         model.compile(loss='binary_crossentropy', optimizer='adam', metrics=['accuracy'])
```

fit our model on our loaded data by calling the fit() function on the model by giving the required number of epochs and batch size.

```
In [13]: # Fit the model
         model.fit(X, Y, epochs=150, batch_size=10)
```

```
Epoch 1/150
768/768 [==============================] - 0s 280us/step - loss: 3.6828 - acc: 0.5964
Epoch 2/150
768/768 [==============================] - 0s 150us/step - loss: 0.9279 - acc: 0.6003
Epoch 3/150
768/768 [==============================] - 0s 155us/step - loss: 0.7413 - acc: 0.6380
Epoch 4/150
768/768 [==============================] - 0s 152us/step - loss: 0.7080 - acc: 0.6589
Epoch 5/150
768/768 [==============================] - 0s 157us/step - loss: 0.6812 - acc: 0.6758
Epoch 6/150
768/768 [==============================] - 0s 155us/step - loss: 0.6512 - acc: 0.6836
Epoch 7/150
768/768 [==============================] - 0s 150us/step - loss: 0.6492 - acc: 0.6771
Epoch 8/150
768/768 [==============================] - 0s 152us/step - loss: 0.6353 - acc: 0.6875
Epoch 9/150
768/768 [==============================] - 0s 154us/step - loss: 0.6236 - acc: 0.6901
Epoch 10/150
768/768 [==============================] - 0s 150us/step - loss: 0.6287 - acc: 0.6784
Epoch 11/150
768/768 [==============================] - 0s 154us/step - loss: 0.6470 - acc: 0.6719
Epoch 12/150
768/768 [==============================] - 0s 152us/step - loss: 0.6393 - acc: 0.6732
Epoch 13/150
768/768 [==============================] - 0s 155us/step - loss: 0.6246 - acc: 0.6745
Epoch 14/150
768/768 [==============================] - 0s 160us/step - loss: 0.6166 - acc: 0.7018
Epoch 15/150
768/768 [==============================] - 0s 159us/step - loss: 0.6015 - acc: 0.7005
Epoch 16/150
768/768 [==============================] - 0s 161us/step - loss: 0.5870 - acc: 0.7018
Epoch 17/150
768/768 [==============================] - 0s 150us/step - loss: 0.5839 - acc: 0.7005
Epoch 18/150
768/768 [==============================] - 0s 153us/step - loss: 0.5984 - acc: 0.6901
Epoch 19/150
768/768 [==============================] - 0s 147us/step - loss: 0.5797 - acc: 0.7148
Epoch 20/150
768/768 [==============================] - 0s 149us/step - loss: 0.5790 - acc: 0.7266
Epoch 21/150
768/768 [==============================] - 0s 153us/step - loss: 0.5697 - acc: 0.7083
Epoch 22/150
768/768 [==============================] - 0s 157us/step - loss: 0.5818 - acc: 0.7005
Epoch 23/150
```

```
768/768 [==============================] - 0s 158us/step - loss: 0.5739 - acc: 0.7135
Epoch 24/150
768/768 [==============================] - 0s 152us/step - loss: 0.5689 - acc: 0.7305
Epoch 25/150
768/768 [==============================] - 0s 150us/step - loss: 0.5572 - acc: 0.7396
Epoch 26/150
768/768 [==============================] - 0s 142us/step - loss: 0.5700 - acc: 0.7083
Epoch 27/150
768/768 [==============================] - 0s 153us/step - loss: 0.5551 - acc: 0.7188
Epoch 28/150
768/768 [==============================] - 0s 156us/step - loss: 0.5549 - acc: 0.7318
Epoch 29/150
768/768 [==============================] - 0s 152us/step - loss: 0.5734 - acc: 0.7161
Epoch 30/150
768/768 [==============================] - 0s 150us/step - loss: 0.5615 - acc: 0.7227
Epoch 31/150
768/768 [==============================] - 0s 154us/step - loss: 0.5680 - acc: 0.7174
Epoch 32/150
768/768 [==============================] - 0s 156us/step - loss: 0.5641 - acc: 0.7161
Epoch 33/150
768/768 [==============================] - 0s 155us/step - loss: 0.5529 - acc: 0.7214
Epoch 34/150
768/768 [==============================] - 0s 153us/step - loss: 0.5507 - acc: 0.7292
Epoch 35/150
768/768 [==============================] - 0s 149us/step - loss: 0.5517 - acc: 0.7188
Epoch 36/150
768/768 [==============================] - 0s 147us/step - loss: 0.5651 - acc: 0.7031
Epoch 37/150
768/768 [==============================] - 0s 155us/step - loss: 0.5337 - acc: 0.7370
Epoch 38/150
768/768 [==============================] - 0s 166us/step - loss: 0.5402 - acc: 0.7214
Epoch 39/150
768/768 [==============================] - 0s 150us/step - loss: 0.5464 - acc: 0.7201
Epoch 40/150
768/768 [==============================] - 0s 161us/step - loss: 0.5455 - acc: 0.7266
Epoch 41/150
768/768 [==============================] - 0s 165us/step - loss: 0.5440 - acc: 0.7318
Epoch 42/150
768/768 [==============================] - 0s 157us/step - loss: 0.5380 - acc: 0.7435
Epoch 43/150
768/768 [==============================] - 0s 146us/step - loss: 0.5305 - acc: 0.7435
Epoch 44/150
768/768 [==============================] - 0s 152us/step - loss: 0.5332 - acc: 0.7500
Epoch 45/150
768/768 [==============================] - 0s 152us/step - loss: 0.5318 - acc: 0.7539
Epoch 46/150
768/768 [==============================] - 0s 158us/step - loss: 0.5311 - acc: 0.7487
Epoch 47/150
```

```
768/768 [==============================] - 0s 155us/step - loss: 0.5341 - acc: 0.7448
Epoch 48/150
768/768 [==============================] - 0s 144us/step - loss: 0.5335 - acc: 0.7396
Epoch 49/150
768/768 [==============================] - 0s 156us/step - loss: 0.5332 - acc: 0.7487
Epoch 50/150
768/768 [==============================] - 0s 159us/step - loss: 0.5277 - acc: 0.7318
Epoch 51/150
768/768 [==============================] - 0s 157us/step - loss: 0.5270 - acc: 0.7500
Epoch 52/150
768/768 [==============================] - 0s 141us/step - loss: 0.5320 - acc: 0.7435
Epoch 53/150
768/768 [==============================] - 0s 150us/step - loss: 0.5430 - acc: 0.7396
Epoch 54/150
768/768 [==============================] - 0s 151us/step - loss: 0.5387 - acc: 0.7240
Epoch 55/150
768/768 [==============================] - 0s 151us/step - loss: 0.5217 - acc: 0.7552
Epoch 56/150
768/768 [==============================] - 0s 153us/step - loss: 0.5290 - acc: 0.7435
Epoch 57/150
768/768 [==============================] - 0s 152us/step - loss: 0.5322 - acc: 0.7383
Epoch 58/150
768/768 [==============================] - 0s 147us/step - loss: 0.5217 - acc: 0.7539
Epoch 59/150
768/768 [==============================] - 0s 152us/step - loss: 0.5137 - acc: 0.7695
Epoch 60/150
768/768 [==============================] - 0s 152us/step - loss: 0.5360 - acc: 0.7357
Epoch 61/150
768/768 [==============================] - 0s 150us/step - loss: 0.5266 - acc: 0.7422
Epoch 62/150
768/768 [==============================] - 0s 150us/step - loss: 0.5161 - acc: 0.7578
Epoch 63/150
768/768 [==============================] - 0s 146us/step - loss: 0.5430 - acc: 0.7344
Epoch 64/150
768/768 [==============================] - 0s 150us/step - loss: 0.5307 - acc: 0.7461
Epoch 65/150
768/768 [==============================] - 0s 153us/step - loss: 0.5200 - acc: 0.7539
Epoch 66/150
768/768 [==============================] - 0s 149us/step - loss: 0.5064 - acc: 0.7578
Epoch 67/150
768/768 [==============================] - 0s 161us/step - loss: 0.5168 - acc: 0.7370
Epoch 68/150
768/768 [==============================] - 0s 155us/step - loss: 0.5125 - acc: 0.7565
Epoch 69/150
768/768 [==============================] - 0s 148us/step - loss: 0.5112 - acc: 0.7461
Epoch 70/150
768/768 [==============================] - 0s 153us/step - loss: 0.5339 - acc: 0.7201
Epoch 71/150
```

```
768/768 [==============================] - 0s 158us/step - loss: 0.5156 - acc: 0.7500
Epoch 72/150
768/768 [==============================] - 0s 151us/step - loss: 0.5139 - acc: 0.7578
Epoch 73/150
768/768 [==============================] - 0s 151us/step - loss: 0.5155 - acc: 0.7500
Epoch 74/150
768/768 [==============================] - 0s 152us/step - loss: 0.5083 - acc: 0.7656
Epoch 75/150
768/768 [==============================] - 0s 141us/step - loss: 0.5092 - acc: 0.7591
Epoch 76/150
768/768 [==============================] - 0s 154us/step - loss: 0.5113 - acc: 0.7565
Epoch 77/150
768/768 [==============================] - 0s 144us/step - loss: 0.5132 - acc: 0.7643
Epoch 78/150
768/768 [==============================] - 0s 142us/step - loss: 0.5102 - acc: 0.7526
Epoch 79/150
768/768 [==============================] - 0s 143us/step - loss: 0.5107 - acc: 0.7422
Epoch 80/150
768/768 [==============================] - 0s 143us/step - loss: 0.5075 - acc: 0.7643
Epoch 81/150
768/768 [==============================] - 0s 152us/step - loss: 0.5011 - acc: 0.7734
Epoch 82/150
768/768 [==============================] - 0s 150us/step - loss: 0.5000 - acc: 0.7591
Epoch 83/150
768/768 [==============================] - 0s 156us/step - loss: 0.4968 - acc: 0.7656
Epoch 84/150
768/768 [==============================] - 0s 154us/step - loss: 0.4944 - acc: 0.7656
Epoch 85/150
768/768 [==============================] - 0s 155us/step - loss: 0.5040 - acc: 0.7617
Epoch 86/150
768/768 [==============================] - 0s 153us/step - loss: 0.5053 - acc: 0.7539
Epoch 87/150
768/768 [==============================] - 0s 156us/step - loss: 0.4961 - acc: 0.7617
Epoch 88/150
768/768 [==============================] - 0s 150us/step - loss: 0.4977 - acc: 0.7656
Epoch 89/150
768/768 [==============================] - 0s 154us/step - loss: 0.5019 - acc: 0.7747
Epoch 90/150
768/768 [==============================] - 0s 148us/step - loss: 0.5081 - acc: 0.7513
Epoch 91/150
768/768 [==============================] - 0s 155us/step - loss: 0.4972 - acc: 0.7656
Epoch 92/150
768/768 [==============================] - 0s 153us/step - loss: 0.5031 - acc: 0.7526
Epoch 93/150
768/768 [==============================] - 0s 158us/step - loss: 0.4970 - acc: 0.7630
Epoch 94/150
768/768 [==============================] - 0s 157us/step - loss: 0.4954 - acc: 0.7708
Epoch 95/150
```

```
768/768 [==============================] - 0s 153us/step - loss: 0.5015 - acc: 0.7513
Epoch 96/150
768/768 [==============================] - 0s 152us/step - loss: 0.4885 - acc: 0.7708
Epoch 97/150
768/768 [==============================] - 0s 162us/step - loss: 0.4954 - acc: 0.7721
Epoch 98/150
768/768 [==============================] - 0s 152us/step - loss: 0.4880 - acc: 0.7656
Epoch 99/150
768/768 [==============================] - 0s 155us/step - loss: 0.4887 - acc: 0.7682
Epoch 100/150
768/768 [==============================] - 0s 157us/step - loss: 0.4842 - acc: 0.7839
Epoch 101/150
768/768 [==============================] - 0s 152us/step - loss: 0.4873 - acc: 0.7826
Epoch 102/150
768/768 [==============================] - 0s 153us/step - loss: 0.4960 - acc: 0.7630
Epoch 103/150
768/768 [==============================] - 0s 157us/step - loss: 0.4956 - acc: 0.7604
Epoch 104/150
768/768 [==============================] - 0s 155us/step - loss: 0.4906 - acc: 0.7865
Epoch 105/150
768/768 [==============================] - 0s 157us/step - loss: 0.5293 - acc: 0.7513
Epoch 106/150
768/768 [==============================] - 0s 159us/step - loss: 0.4891 - acc: 0.7773
Epoch 107/150
768/768 [==============================] - 0s 155us/step - loss: 0.4877 - acc: 0.7747
Epoch 108/150
768/768 [==============================] - 0s 151us/step - loss: 0.5013 - acc: 0.7656
Epoch 109/150
768/768 [==============================] - 0s 156us/step - loss: 0.4850 - acc: 0.7604
Epoch 110/150
768/768 [==============================] - 0s 156us/step - loss: 0.4847 - acc: 0.7721
Epoch 111/150
768/768 [==============================] - 0s 151us/step - loss: 0.4821 - acc: 0.7839
Epoch 112/150
768/768 [==============================] - 0s 160us/step - loss: 0.4864 - acc: 0.7747
Epoch 113/150
768/768 [==============================] - 0s 148us/step - loss: 0.4979 - acc: 0.7565
Epoch 114/150
768/768 [==============================] - 0s 158us/step - loss: 0.4847 - acc: 0.7630
Epoch 115/150
768/768 [==============================] - 0s 154us/step - loss: 0.4908 - acc: 0.7721
Epoch 116/150
768/768 [==============================] - 0s 146us/step - loss: 0.4889 - acc: 0.7721
Epoch 117/150
768/768 [==============================] - 0s 155us/step - loss: 0.4877 - acc: 0.7656
Epoch 118/150
768/768 [==============================] - 0s 154us/step - loss: 0.4844 - acc: 0.7799
Epoch 119/150
```

```
768/768 [==============================] - 0s 161us/step - loss: 0.4813 - acc: 0.7669
Epoch 120/150
768/768 [==============================] - 0s 153us/step - loss: 0.4918 - acc: 0.7760
Epoch 121/150
768/768 [==============================] - 0s 148us/step - loss: 0.4900 - acc: 0.7773
Epoch 122/150
768/768 [==============================] - 0s 148us/step - loss: 0.4788 - acc: 0.7865
Epoch 123/150
768/768 [==============================] - 0s 152us/step - loss: 0.4833 - acc: 0.7682
Epoch 124/150
768/768 [==============================] - 0s 147us/step - loss: 0.4822 - acc: 0.7760
Epoch 125/150
768/768 [==============================] - 0s 152us/step - loss: 0.4818 - acc: 0.7799
Epoch 126/150
768/768 [==============================] - 0s 147us/step - loss: 0.4770 - acc: 0.7721
Epoch 127/150
768/768 [==============================] - 0s 147us/step - loss: 0.4837 - acc: 0.7760
Epoch 128/150
768/768 [==============================] - 0s 143us/step - loss: 0.4692 - acc: 0.7799
Epoch 129/150
768/768 [==============================] - 0s 143us/step - loss: 0.4782 - acc: 0.7760
Epoch 130/150
768/768 [==============================] - 0s 146us/step - loss: 0.4679 - acc: 0.7878
Epoch 131/150
768/768 [==============================] - 0s 142us/step - loss: 0.4802 - acc: 0.7669
Epoch 132/150
768/768 [==============================] - 0s 152us/step - loss: 0.4786 - acc: 0.7799
Epoch 133/150
768/768 [==============================] - 0s 139us/step - loss: 0.4804 - acc: 0.7695
Epoch 134/150
768/768 [==============================] - 0s 150us/step - loss: 0.4804 - acc: 0.7760
Epoch 135/150
768/768 [==============================] - 0s 139us/step - loss: 0.4716 - acc: 0.7813
Epoch 136/150
768/768 [==============================] - 0s 150us/step - loss: 0.4691 - acc: 0.7799
Epoch 137/150
768/768 [==============================] - 0s 142us/step - loss: 0.4655 - acc: 0.7917
Epoch 138/150
768/768 [==============================] - 0s 146us/step - loss: 0.4757 - acc: 0.7917
Epoch 139/150
768/768 [==============================] - 0s 147us/step - loss: 0.4638 - acc: 0.7839
Epoch 140/150
768/768 [==============================] - 0s 144us/step - loss: 0.4773 - acc: 0.7826
Epoch 141/150
768/768 [==============================] - 0s 143us/step - loss: 0.4691 - acc: 0.7878
Epoch 142/150
768/768 [==============================] - 0s 148us/step - loss: 0.4804 - acc: 0.7721
Epoch 143/150
```

```
768/768 [==============================] - 0s 143us/step - loss: 0.4705 - acc: 0.7839
Epoch 144/150
768/768 [==============================] - 0s 144us/step - loss: 0.4728 - acc: 0.7839
Epoch 145/150
768/768 [==============================] - 0s 149us/step - loss: 0.4857 - acc: 0.7682
Epoch 146/150
768/768 [==============================] - 0s 147us/step - loss: 0.4944 - acc: 0.7630
Epoch 147/150
768/768 [==============================] - 0s 147us/step - loss: 0.4799 - acc: 0.7852
Epoch 148/150
768/768 [==============================] - 0s 139us/step - loss: 0.4682 - acc: 0.7799
Epoch 149/150
768/768 [==============================] - 0s 145us/step - loss: 0.4723 - acc: 0.7669
Epoch 150/150
768/768 [==============================] - 0s 146us/step - loss: 0.4763 - acc: 0.7839
```

```
Out[13]: <keras.callbacks.History at 0x7fb7d6066518>
```

Evaluate the model and print the accuracy

```
In [14]: # evaluate the model
         scores = model.evaluate(X, Y)
         print("\n%s: %.2f%%" % (model.metrics_names[1], scores[1]*100))
```

```
768/768 [==============================] - 0s 56us/step

acc: 78.91%
```

Now put all the code i.e tie together the code and run it

```
In [17]: # Create your first MLP in Keras
         from keras.models import Sequential
         from keras.layers import Dense
         import numpy
         # fix random seed for reproducibility
         numpy.random.seed(7)
         # load pima indians dataset
         dataset = numpy.loadtxt("data/datapima.csv", delimiter=",")
         # split into input (X) and output (Y) variables
         X = dataset[:,0:8]
         Y = dataset[:,8]
         # create model
         model = Sequential()
         model.add(Dense(12, input_dim=8, activation='relu'))
         model.add(Dense(8, activation='relu'))
         model.add(Dense(1, activation='sigmoid'))
         # Compile model
```

```
model.compile(loss='binary_crossentropy', optimizer='adam', metrics=['accuracy'])
# Fit the model
model.fit(X, Y, epochs=150, batch_size=10)
# evaluate the model
scores = model.evaluate(X, Y)
print("\n%s: %.2f%%" % (model.metrics_names[1], scores[1]*100))
```

```
Epoch 1/150
768/768 [==============================] - 0s 305us/step - loss: 3.7106 - acc: 0.5977
Epoch 2/150
768/768 [==============================] - 0s 147us/step - loss: 0.9377 - acc: 0.5924
Epoch 3/150
768/768 [==============================] - 0s 149us/step - loss: 0.7478 - acc: 0.6445
Epoch 4/150
768/768 [==============================] - 0s 150us/step - loss: 0.7120 - acc: 0.6549
Epoch 5/150
768/768 [==============================] - 0s 150us/step - loss: 0.6841 - acc: 0.6667
Epoch 6/150
768/768 [==============================] - 0s 146us/step - loss: 0.6521 - acc: 0.6784
Epoch 7/150
768/768 [==============================] - 0s 133us/step - loss: 0.6505 - acc: 0.6810
Epoch 8/150
768/768 [==============================] - 0s 145us/step - loss: 0.6388 - acc: 0.6823
Epoch 9/150
768/768 [==============================] - 0s 152us/step - loss: 0.6250 - acc: 0.6966
Epoch 10/150
768/768 [==============================] - 0s 157us/step - loss: 0.6315 - acc: 0.6771
Epoch 11/150
768/768 [==============================] - 0s 150us/step - loss: 0.6500 - acc: 0.6719
Epoch 12/150
768/768 [==============================] - 0s 161us/step - loss: 0.6408 - acc: 0.6680
Epoch 13/150
768/768 [==============================] - 0s 155us/step - loss: 0.6262 - acc: 0.6758
Epoch 14/150
768/768 [==============================] - 0s 157us/step - loss: 0.6184 - acc: 0.6979
Epoch 15/150
768/768 [==============================] - 0s 164us/step - loss: 0.6028 - acc: 0.6927
Epoch 16/150
768/768 [==============================] - 0s 165us/step - loss: 0.5881 - acc: 0.6979
Epoch 17/150
768/768 [==============================] - 0s 142us/step - loss: 0.5853 - acc: 0.7005
Epoch 18/150
768/768 [==============================] - 0s 151us/step - loss: 0.6004 - acc: 0.6875
Epoch 19/150
768/768 [==============================] - 0s 142us/step - loss: 0.5801 - acc: 0.7070
Epoch 20/150
768/768 [==============================] - 0s 139us/step - loss: 0.5800 - acc: 0.7187
Epoch 21/150
```

```
768/768 [==============================] - 0s 145us/step - loss: 0.5674 - acc: 0.7148
Epoch 22/150
768/768 [==============================] - 0s 143us/step - loss: 0.5811 - acc: 0.6953
Epoch 23/150
768/768 [==============================] - 0s 142us/step - loss: 0.5731 - acc: 0.7148
Epoch 24/150
768/768 [==============================] - 0s 142us/step - loss: 0.5672 - acc: 0.7305
Epoch 25/150
768/768 [==============================] - 0s 146us/step - loss: 0.5572 - acc: 0.7370
Epoch 26/150
768/768 [==============================] - 0s 147us/step - loss: 0.5700 - acc: 0.7005
Epoch 27/150
768/768 [==============================] - 0s 146us/step - loss: 0.5554 - acc: 0.7214
Epoch 28/150
768/768 [==============================] - 0s 146us/step - loss: 0.5553 - acc: 0.7318
Epoch 29/150
768/768 [==============================] - 0s 147us/step - loss: 0.5734 - acc: 0.7135
Epoch 30/150
768/768 [==============================] - 0s 134us/step - loss: 0.5613 - acc: 0.7214
Epoch 31/150
768/768 [==============================] - 0s 139us/step - loss: 0.5688 - acc: 0.7174
Epoch 32/150
768/768 [==============================] - 0s 144us/step - loss: 0.5635 - acc: 0.7148
Epoch 33/150
768/768 [==============================] - 0s 158us/step - loss: 0.5517 - acc: 0.7214
Epoch 34/150
768/768 [==============================] - 0s 149us/step - loss: 0.5493 - acc: 0.7318
Epoch 35/150
768/768 [==============================] - 0s 149us/step - loss: 0.5509 - acc: 0.7161
Epoch 36/150
768/768 [==============================] - 0s 157us/step - loss: 0.5635 - acc: 0.7070
Epoch 37/150
768/768 [==============================] - 0s 152us/step - loss: 0.5343 - acc: 0.7370
Epoch 38/150
768/768 [==============================] - 0s 160us/step - loss: 0.5403 - acc: 0.7266
Epoch 39/150
768/768 [==============================] - 0s 160us/step - loss: 0.5445 - acc: 0.7227
Epoch 40/150
768/768 [==============================] - 0s 149us/step - loss: 0.5432 - acc: 0.7240
Epoch 41/150
768/768 [==============================] - 0s 155us/step - loss: 0.5426 - acc: 0.7370
Epoch 42/150
768/768 [==============================] - 0s 159us/step - loss: 0.5355 - acc: 0.7461
Epoch 43/150
768/768 [==============================] - 0s 151us/step - loss: 0.5322 - acc: 0.7461
Epoch 44/150
768/768 [==============================] - 0s 160us/step - loss: 0.5317 - acc: 0.7435
Epoch 45/150
```

```
768/768 [==============================] - 0s 149us/step - loss: 0.5308 - acc: 0.7500
Epoch 46/150
768/768 [==============================] - 0s 146us/step - loss: 0.5295 - acc: 0.7500
Epoch 47/150
768/768 [==============================] - 0s 144us/step - loss: 0.5299 - acc: 0.7370
Epoch 48/150
768/768 [==============================] - 0s 157us/step - loss: 0.5327 - acc: 0.7370
Epoch 49/150
768/768 [==============================] - 0s 160us/step - loss: 0.5321 - acc: 0.7487
Epoch 50/150
768/768 [==============================] - 0s 148us/step - loss: 0.5265 - acc: 0.7357
Epoch 51/150
768/768 [==============================] - 0s 172us/step - loss: 0.5278 - acc: 0.7474
Epoch 52/150
768/768 [==============================] - 0s 163us/step - loss: 0.5304 - acc: 0.7487
Epoch 53/150
768/768 [==============================] - 0s 144us/step - loss: 0.5376 - acc: 0.7435
Epoch 54/150
768/768 [==============================] - 0s 150us/step - loss: 0.5379 - acc: 0.7279
Epoch 55/150
768/768 [==============================] - 0s 152us/step - loss: 0.5218 - acc: 0.7513
Epoch 56/150
768/768 [==============================] - 0s 149us/step - loss: 0.5280 - acc: 0.7435
Epoch 57/150
768/768 [==============================] - 0s 160us/step - loss: 0.5310 - acc: 0.7383
Epoch 58/150
768/768 [==============================] - 0s 149us/step - loss: 0.5217 - acc: 0.7526
Epoch 59/150
768/768 [==============================] - 0s 149us/step - loss: 0.5122 - acc: 0.7630
Epoch 60/150
768/768 [==============================] - 0s 148us/step - loss: 0.5336 - acc: 0.7331
Epoch 61/150
768/768 [==============================] - 0s 145us/step - loss: 0.5285 - acc: 0.7422
Epoch 62/150
768/768 [==============================] - 0s 148us/step - loss: 0.5170 - acc: 0.7539
Epoch 63/150
768/768 [==============================] - 0s 148us/step - loss: 0.5437 - acc: 0.7357
Epoch 64/150
768/768 [==============================] - 0s 147us/step - loss: 0.5303 - acc: 0.7409
Epoch 65/150
768/768 [==============================] - 0s 160us/step - loss: 0.5203 - acc: 0.7487
Epoch 66/150
768/768 [==============================] - 0s 151us/step - loss: 0.5072 - acc: 0.7474
Epoch 67/150
768/768 [==============================] - 0s 144us/step - loss: 0.5165 - acc: 0.7396
Epoch 68/150
768/768 [==============================] - 0s 153us/step - loss: 0.5132 - acc: 0.7539
Epoch 69/150
```

```
768/768 [==============================] - 0s 154us/step - loss: 0.5128 - acc: 0.7539
Epoch 70/150
768/768 [==============================] - 0s 154us/step - loss: 0.5368 - acc: 0.7227
Epoch 71/150
768/768 [==============================] - 0s 169us/step - loss: 0.5166 - acc: 0.7435
Epoch 72/150
768/768 [==============================] - 0s 141us/step - loss: 0.5157 - acc: 0.7513
Epoch 73/150
768/768 [==============================] - 0s 148us/step - loss: 0.5158 - acc: 0.7500
Epoch 74/150
768/768 [==============================] - 0s 145us/step - loss: 0.5091 - acc: 0.7604
Epoch 75/150
768/768 [==============================] - 0s 157us/step - loss: 0.5087 - acc: 0.7617
Epoch 76/150
768/768 [==============================] - 0s 148us/step - loss: 0.5096 - acc: 0.7526
Epoch 77/150
768/768 [==============================] - 0s 146us/step - loss: 0.5162 - acc: 0.7656
Epoch 78/150
768/768 [==============================] - 0s 141us/step - loss: 0.5111 - acc: 0.7474
Epoch 79/150
768/768 [==============================] - 0s 148us/step - loss: 0.5125 - acc: 0.7500
Epoch 80/150
768/768 [==============================] - 0s 143us/step - loss: 0.5119 - acc: 0.7604
Epoch 81/150
768/768 [==============================] - 0s 149us/step - loss: 0.5050 - acc: 0.7695
Epoch 82/150
768/768 [==============================] - 0s 151us/step - loss: 0.5020 - acc: 0.7552
Epoch 83/150
768/768 [==============================] - 0s 152us/step - loss: 0.4979 - acc: 0.7604
Epoch 84/150
768/768 [==============================] - 0s 157us/step - loss: 0.4985 - acc: 0.7617
Epoch 85/150
768/768 [==============================] - 0s 153us/step - loss: 0.5040 - acc: 0.7513
Epoch 86/150
768/768 [==============================] - 0s 150us/step - loss: 0.5054 - acc: 0.7513
Epoch 87/150
768/768 [==============================] - 0s 154us/step - loss: 0.4986 - acc: 0.7487
Epoch 88/150
768/768 [==============================] - 0s 154us/step - loss: 0.5011 - acc: 0.7630
Epoch 89/150
768/768 [==============================] - 0s 150us/step - loss: 0.5035 - acc: 0.7721
Epoch 90/150
768/768 [==============================] - 0s 151us/step - loss: 0.5084 - acc: 0.7552
Epoch 91/150
768/768 [==============================] - 0s 150us/step - loss: 0.5029 - acc: 0.7513
Epoch 92/150
768/768 [==============================] - 0s 157us/step - loss: 0.5037 - acc: 0.7448
Epoch 93/150
```

```
768/768 [==============================] - 0s 154us/step - loss: 0.4959 - acc: 0.7721
Epoch 94/150
768/768 [==============================] - 0s 156us/step - loss: 0.4976 - acc: 0.7669
Epoch 95/150
768/768 [==============================] - 0s 150us/step - loss: 0.5017 - acc: 0.7487
Epoch 96/150
768/768 [==============================] - 0s 147us/step - loss: 0.4899 - acc: 0.7695
Epoch 97/150
768/768 [==============================] - 0s 143us/step - loss: 0.4961 - acc: 0.7786
Epoch 98/150
768/768 [==============================] - 0s 146us/step - loss: 0.4886 - acc: 0.7721
Epoch 99/150
768/768 [==============================] - 0s 165us/step - loss: 0.4887 - acc: 0.7643
Epoch 100/150
768/768 [==============================] - 0s 162us/step - loss: 0.4833 - acc: 0.7760
Epoch 101/150
768/768 [==============================] - 0s 162us/step - loss: 0.4873 - acc: 0.7721
Epoch 102/150
768/768 [==============================] - 0s 142us/step - loss: 0.4977 - acc: 0.7591
Epoch 103/150
768/768 [==============================] - 0s 150us/step - loss: 0.4973 - acc: 0.7643
Epoch 104/150
768/768 [==============================] - 0s 150us/step - loss: 0.4883 - acc: 0.7904
Epoch 105/150
768/768 [==============================] - 0s 161us/step - loss: 0.5279 - acc: 0.7487
Epoch 106/150
768/768 [==============================] - 0s 171us/step - loss: 0.4945 - acc: 0.7708
Epoch 107/150
768/768 [==============================] - 0s 149us/step - loss: 0.4914 - acc: 0.7734
Epoch 108/150
768/768 [==============================] - 0s 156us/step - loss: 0.4978 - acc: 0.7708
Epoch 109/150
768/768 [==============================] - 0s 166us/step - loss: 0.4850 - acc: 0.7708
Epoch 110/150
768/768 [==============================] - 0s 156us/step - loss: 0.4895 - acc: 0.7682
Epoch 111/150
768/768 [==============================] - 0s 149us/step - loss: 0.4826 - acc: 0.7812
Epoch 112/150
768/768 [==============================] - 0s 150us/step - loss: 0.4933 - acc: 0.7773
Epoch 113/150
768/768 [==============================] - 0s 159us/step - loss: 0.4941 - acc: 0.7565
Epoch 114/150
768/768 [==============================] - 0s 164us/step - loss: 0.4903 - acc: 0.7604
Epoch 115/150
768/768 [==============================] - 0s 155us/step - loss: 0.4885 - acc: 0.7812
Epoch 116/150
768/768 [==============================] - 0s 151us/step - loss: 0.4919 - acc: 0.7669
Epoch 117/150
```

```
768/768 [==============================] - 0s 138us/step - loss: 0.4892 - acc: 0.7708
Epoch 118/150
768/768 [==============================] - 0s 151us/step - loss: 0.4886 - acc: 0.7826
Epoch 119/150
768/768 [==============================] - 0s 151us/step - loss: 0.4829 - acc: 0.7708
Epoch 120/150
768/768 [==============================] - 0s 152us/step - loss: 0.4928 - acc: 0.7773
Epoch 121/150
768/768 [==============================] - 0s 149us/step - loss: 0.4919 - acc: 0.7721
Epoch 122/150
768/768 [==============================] - 0s 150us/step - loss: 0.4865 - acc: 0.7773
Epoch 123/150
768/768 [==============================] - 0s 151us/step - loss: 0.4798 - acc: 0.7669
Epoch 124/150
768/768 [==============================] - 0s 151us/step - loss: 0.4835 - acc: 0.7747
Epoch 125/150
768/768 [==============================] - 0s 147us/step - loss: 0.4870 - acc: 0.7812
Epoch 126/150
768/768 [==============================] - 0s 150us/step - loss: 0.4805 - acc: 0.7812
Epoch 127/150
768/768 [==============================] - 0s 147us/step - loss: 0.4904 - acc: 0.7656
Epoch 128/150
768/768 [==============================] - 0s 153us/step - loss: 0.4728 - acc: 0.7747
Epoch 129/150
768/768 [==============================] - 0s 149us/step - loss: 0.4820 - acc: 0.7760
Epoch 130/150
768/768 [==============================] - 0s 148us/step - loss: 0.4753 - acc: 0.7878
Epoch 131/150
768/768 [==============================] - 0s 154us/step - loss: 0.4796 - acc: 0.7734
Epoch 132/150
768/768 [==============================] - 0s 152us/step - loss: 0.4802 - acc: 0.7826
Epoch 133/150
768/768 [==============================] - 0s 153us/step - loss: 0.4836 - acc: 0.7695
Epoch 134/150
768/768 [==============================] - 0s 150us/step - loss: 0.4839 - acc: 0.7734
Epoch 135/150
768/768 [==============================] - 0s 150us/step - loss: 0.4783 - acc: 0.7786
Epoch 136/150
768/768 [==============================] - 0s 151us/step - loss: 0.4736 - acc: 0.7812
Epoch 137/150
768/768 [==============================] - 0s 152us/step - loss: 0.4677 - acc: 0.7826
Epoch 138/150
768/768 [==============================] - 0s 141us/step - loss: 0.4811 - acc: 0.7773
Epoch 139/150
768/768 [==============================] - 0s 146us/step - loss: 0.4652 - acc: 0.7943
Epoch 140/150
768/768 [==============================] - 0s 147us/step - loss: 0.4832 - acc: 0.7786
Epoch 141/150
```

```
768/768 [==============================] - 0s 151us/step - loss: 0.4721 - acc: 0.7839
Epoch 142/150
768/768 [==============================] - 0s 145us/step - loss: 0.4816 - acc: 0.7734
Epoch 143/150
768/768 [==============================] - 0s 155us/step - loss: 0.4755 - acc: 0.7747
Epoch 144/150
768/768 [==============================] - 0s 151us/step - loss: 0.4758 - acc: 0.7734
Epoch 145/150
768/768 [==============================] - 0s 154us/step - loss: 0.4896 - acc: 0.7643
Epoch 146/150
768/768 [==============================] - 0s 155us/step - loss: 0.4928 - acc: 0.7669
Epoch 147/150
768/768 [==============================] - 0s 157us/step - loss: 0.4825 - acc: 0.7760
Epoch 148/150
768/768 [==============================] - 0s 153us/step - loss: 0.4718 - acc: 0.7734
Epoch 149/150
768/768 [==============================] - 0s 155us/step - loss: 0.4755 - acc: 0.7682
Epoch 150/150
768/768 [==============================] - 0s 152us/step - loss: 0.4773 - acc: 0.7734
768/768 [==============================] - 0s 71us/step

acc: 80.08%
```

PREDICTION

We can adapt the above example and use it to generate predictions on the training dataset, pretending it is a new dataset we have not seen before.

Making predictions is as easy as calling model.predict(). We are using a sigmoid activation function on the output layer, so the predictions will be in the range between 0 and 1. We can easily convert them into a crisp binary prediction for this classification task by rounding them.

The complete example that makes predictions for each record in the training data is listed below

```
In [18]: # Create first network with Keras
         from keras.models import Sequential
         from keras.layers import Dense
         import numpy
         # fix random seed for reproducibility
         seed = 7
         numpy.random.seed(seed)
         # load pima indians dataset
         dataset = numpy.loadtxt("data/datapima.csv", delimiter=",")
         # split into input (X) and output (Y) variables
         X = dataset[:,0:8]
         Y = dataset[:,8]
         # create model
         model = Sequential()
         model.add(Dense(12, input_dim=8, init='uniform', activation='relu'))
```

```python
model.add(Dense(8, init='uniform', activation='relu'))
model.add(Dense(1, init='uniform', activation='sigmoid'))
# Compile model
model.compile(loss='binary_crossentropy', optimizer='adam', metrics=['accuracy'])
# Fit the model
model.fit(X, Y, epochs=150, batch_size=10,  verbose=2)
# calculate predictions
predictions = model.predict(X)
# round predictions
rounded = [round(x[0]) for x in predictions]
print(rounded)
```

```
/home/nikhil/anaconda3/lib/python3.6/site-packages/ipykernel_launcher.py:15: UserWarning: Update
  from ipykernel import kernelapp as app
/home/nikhil/anaconda3/lib/python3.6/site-packages/ipykernel_launcher.py:16: UserWarning: Update
  app.launch_new_instance()
/home/nikhil/anaconda3/lib/python3.6/site-packages/ipykernel_launcher.py:17: UserWarning: Update


Epoch 1/150
 - 0s - loss: 0.6773 - acc: 0.6510
Epoch 2/150
 - 0s - loss: 0.6594 - acc: 0.6510
Epoch 3/150
 - 0s - loss: 0.6476 - acc: 0.6510
Epoch 4/150
 - 0s - loss: 0.6389 - acc: 0.6510
Epoch 5/150
 - 0s - loss: 0.6296 - acc: 0.6510
Epoch 6/150
 - 0s - loss: 0.6150 - acc: 0.6628
Epoch 7/150
 - 0s - loss: 0.6117 - acc: 0.6875
Epoch 8/150
 - 0s - loss: 0.6039 - acc: 0.6953
Epoch 9/150
 - 0s - loss: 0.5974 - acc: 0.6888
Epoch 10/150
 - 0s - loss: 0.5985 - acc: 0.6940
Epoch 11/150
 - 0s - loss: 0.5931 - acc: 0.6823
Epoch 12/150
 - 0s - loss: 0.5905 - acc: 0.6914
Epoch 13/150
 - 0s - loss: 0.5878 - acc: 0.6849
Epoch 14/150
 - 0s - loss: 0.5858 - acc: 0.6940
Epoch 15/150
```

```
 - 0s - loss: 0.5812 - acc: 0.6979
Epoch 16/150
 - 0s - loss: 0.5808 - acc: 0.6797
Epoch 17/150
 - 0s - loss: 0.5790 - acc: 0.7083
Epoch 18/150
 - 0s - loss: 0.5833 - acc: 0.7044
Epoch 19/150
 - 0s - loss: 0.5756 - acc: 0.7044
Epoch 20/150
 - 0s - loss: 0.5770 - acc: 0.6966
Epoch 21/150
 - 0s - loss: 0.5730 - acc: 0.7122
Epoch 22/150
 - 0s - loss: 0.5765 - acc: 0.6979
Epoch 23/150
 - 0s - loss: 0.5701 - acc: 0.7174
Epoch 24/150
 - 0s - loss: 0.5781 - acc: 0.7005
Epoch 25/150
 - 0s - loss: 0.5656 - acc: 0.7070
Epoch 26/150
 - 0s - loss: 0.5781 - acc: 0.6927
Epoch 27/150
 - 0s - loss: 0.5715 - acc: 0.7057
Epoch 28/150
 - 0s - loss: 0.5636 - acc: 0.7122
Epoch 29/150
 - 0s - loss: 0.5682 - acc: 0.7148
Epoch 30/150
 - 0s - loss: 0.5641 - acc: 0.7122
Epoch 31/150
 - 0s - loss: 0.5631 - acc: 0.7044
Epoch 32/150
 - 0s - loss: 0.5594 - acc: 0.7057
Epoch 33/150
 - 0s - loss: 0.5565 - acc: 0.7188
Epoch 34/150
 - 0s - loss: 0.5599 - acc: 0.7122
Epoch 35/150
 - 0s - loss: 0.5551 - acc: 0.7135
Epoch 36/150
 - 0s - loss: 0.5529 - acc: 0.7044
Epoch 37/150
 - 0s - loss: 0.5524 - acc: 0.7253
Epoch 38/150
 - 0s - loss: 0.5590 - acc: 0.7148
Epoch 39/150
```

```
 - 0s - loss: 0.5540 - acc: 0.7188
Epoch 40/150
 - 0s - loss: 0.5558 - acc: 0.7201
Epoch 41/150
 - 0s - loss: 0.5496 - acc: 0.7214
Epoch 42/150
 - 0s - loss: 0.5501 - acc: 0.7201
Epoch 43/150
 - 0s - loss: 0.5442 - acc: 0.7266
Epoch 44/150
 - 0s - loss: 0.5490 - acc: 0.7318
Epoch 45/150
 - 0s - loss: 0.5457 - acc: 0.7370
Epoch 46/150
 - 0s - loss: 0.5418 - acc: 0.7174
Epoch 47/150
 - 0s - loss: 0.5424 - acc: 0.7266
Epoch 48/150
 - 0s - loss: 0.5401 - acc: 0.7383
Epoch 49/150
 - 0s - loss: 0.5363 - acc: 0.7357
Epoch 50/150
 - 0s - loss: 0.5376 - acc: 0.7435
Epoch 51/150
 - 0s - loss: 0.5376 - acc: 0.7266
Epoch 52/150
 - 0s - loss: 0.5389 - acc: 0.7318
Epoch 53/150
 - 0s - loss: 0.5364 - acc: 0.7292
Epoch 54/150
 - 0s - loss: 0.5348 - acc: 0.7292
Epoch 55/150
 - 0s - loss: 0.5348 - acc: 0.7331
Epoch 56/150
 - 0s - loss: 0.5358 - acc: 0.7422
Epoch 57/150
 - 0s - loss: 0.5284 - acc: 0.7357
Epoch 58/150
 - 0s - loss: 0.5305 - acc: 0.7240
Epoch 59/150
 - 0s - loss: 0.5266 - acc: 0.7474
Epoch 60/150
 - 0s - loss: 0.5278 - acc: 0.7409
Epoch 61/150
 - 0s - loss: 0.5218 - acc: 0.7396
Epoch 62/150
 - 0s - loss: 0.5255 - acc: 0.7461
Epoch 63/150
```

```
 - 0s - loss: 0.5273 - acc: 0.7565
Epoch 64/150
 - 0s - loss: 0.5256 - acc: 0.7409
Epoch 65/150
 - 0s - loss: 0.5198 - acc: 0.7565
Epoch 66/150
 - 0s - loss: 0.5174 - acc: 0.7500
Epoch 67/150
 - 0s - loss: 0.5138 - acc: 0.7409
Epoch 68/150
 - 0s - loss: 0.5163 - acc: 0.7474
Epoch 69/150
 - 0s - loss: 0.5119 - acc: 0.7526
Epoch 70/150
 - 0s - loss: 0.5198 - acc: 0.7383
Epoch 71/150
 - 0s - loss: 0.5118 - acc: 0.7526
Epoch 72/150
 - 0s - loss: 0.5111 - acc: 0.7526
Epoch 73/150
 - 0s - loss: 0.5066 - acc: 0.7526
Epoch 74/150
 - 0s - loss: 0.5110 - acc: 0.7539
Epoch 75/150
 - 0s - loss: 0.5046 - acc: 0.7604
Epoch 76/150
 - 0s - loss: 0.5050 - acc: 0.7617
Epoch 77/150
 - 0s - loss: 0.5033 - acc: 0.7604
Epoch 78/150
 - 0s - loss: 0.4993 - acc: 0.7643
Epoch 79/150
 - 0s - loss: 0.5084 - acc: 0.7565
Epoch 80/150
 - 0s - loss: 0.5000 - acc: 0.7643
Epoch 81/150
 - 0s - loss: 0.4941 - acc: 0.7578
Epoch 82/150
 - 0s - loss: 0.5010 - acc: 0.7617
Epoch 83/150
 - 0s - loss: 0.4921 - acc: 0.7565
Epoch 84/150
 - 0s - loss: 0.4916 - acc: 0.7734
Epoch 85/150
 - 0s - loss: 0.4941 - acc: 0.7643
Epoch 86/150
 - 0s - loss: 0.5014 - acc: 0.7500
Epoch 87/150
```

```
 - 0s - loss: 0.4960 - acc: 0.7695
Epoch 88/150
 - 0s - loss: 0.4855 - acc: 0.7604
Epoch 89/150
 - 0s - loss: 0.4930 - acc: 0.7643
Epoch 90/150
 - 0s - loss: 0.4878 - acc: 0.7643
Epoch 91/150
 - 0s - loss: 0.4823 - acc: 0.7552
Epoch 92/150
 - 0s - loss: 0.4859 - acc: 0.7669
Epoch 93/150
 - 0s - loss: 0.4818 - acc: 0.7617
Epoch 94/150
 - 0s - loss: 0.4865 - acc: 0.7565
Epoch 95/150
 - 0s - loss: 0.4771 - acc: 0.7617
Epoch 96/150
 - 0s - loss: 0.4788 - acc: 0.7721
Epoch 97/150
 - 0s - loss: 0.4798 - acc: 0.7734
Epoch 98/150
 - 0s - loss: 0.4776 - acc: 0.7747
Epoch 99/150
 - 0s - loss: 0.4721 - acc: 0.7826
Epoch 100/150
 - 0s - loss: 0.4744 - acc: 0.7734
Epoch 101/150
 - 0s - loss: 0.4755 - acc: 0.7760
Epoch 102/150
 - 0s - loss: 0.4754 - acc: 0.7669
Epoch 103/150
 - 0s - loss: 0.4783 - acc: 0.7708
Epoch 104/150
 - 0s - loss: 0.4779 - acc: 0.7721
Epoch 105/150
 - 0s - loss: 0.4854 - acc: 0.7630
Epoch 106/150
 - 0s - loss: 0.4700 - acc: 0.7865
Epoch 107/150
 - 0s - loss: 0.4738 - acc: 0.7760
Epoch 108/150
 - 0s - loss: 0.4759 - acc: 0.7839
Epoch 109/150
 - 0s - loss: 0.4680 - acc: 0.7786
Epoch 110/150
 - 0s - loss: 0.4678 - acc: 0.7799
Epoch 111/150
```

```
 - 0s - loss: 0.4713 - acc: 0.7930
Epoch 112/150
 - 0s - loss: 0.4660 - acc: 0.7682
Epoch 113/150
 - 0s - loss: 0.4727 - acc: 0.7669
Epoch 114/150
 - 0s - loss: 0.4739 - acc: 0.7630
Epoch 115/150
 - 0s - loss: 0.4650 - acc: 0.7773
Epoch 116/150
 - 0s - loss: 0.4714 - acc: 0.7760
Epoch 117/150
 - 0s - loss: 0.4643 - acc: 0.7747
Epoch 118/150
 - 0s - loss: 0.4702 - acc: 0.7826
Epoch 119/150
 - 0s - loss: 0.4635 - acc: 0.7747
Epoch 120/150
 - 0s - loss: 0.4645 - acc: 0.7721
Epoch 121/150
 - 0s - loss: 0.4693 - acc: 0.7982
Epoch 122/150
 - 0s - loss: 0.4657 - acc: 0.7891
Epoch 123/150
 - 0s - loss: 0.4629 - acc: 0.7708
Epoch 124/150
 - 0s - loss: 0.4564 - acc: 0.7812
Epoch 125/150
 - 0s - loss: 0.4608 - acc: 0.7786
Epoch 126/150
 - 0s - loss: 0.4584 - acc: 0.7760
Epoch 127/150
 - 0s - loss: 0.4656 - acc: 0.7891
Epoch 128/150
 - 0s - loss: 0.4504 - acc: 0.7852
Epoch 129/150
 - 0s - loss: 0.4617 - acc: 0.7878
Epoch 130/150
 - 0s - loss: 0.4518 - acc: 0.7826
Epoch 131/150
 - 0s - loss: 0.4582 - acc: 0.7826
Epoch 132/150
 - 0s - loss: 0.4539 - acc: 0.7812
Epoch 133/150
 - 0s - loss: 0.4643 - acc: 0.7786
Epoch 134/150
 - 0s - loss: 0.4573 - acc: 0.7773
Epoch 135/150
```

```
 - 0s - loss: 0.4545 - acc: 0.7812
Epoch 136/150
 - 0s - loss: 0.4534 - acc: 0.7865
Epoch 137/150
 - 0s - loss: 0.4600 - acc: 0.7917
Epoch 138/150
 - 0s - loss: 0.4583 - acc: 0.7878
Epoch 139/150
 - 0s - loss: 0.4452 - acc: 0.7812
Epoch 140/150
 - 0s - loss: 0.4575 - acc: 0.7826
Epoch 141/150
 - 0s - loss: 0.4488 - acc: 0.7839
Epoch 142/150
 - 0s - loss: 0.4604 - acc: 0.7786
Epoch 143/150
 - 0s - loss: 0.4548 - acc: 0.7760
Epoch 144/150
 - 0s - loss: 0.4560 - acc: 0.7891
Epoch 145/150
 - 0s - loss: 0.4598 - acc: 0.7773
Epoch 146/150
 - 0s - loss: 0.4505 - acc: 0.7839
Epoch 147/150
 - 0s - loss: 0.4536 - acc: 0.7839
Epoch 148/150
 - 0s - loss: 0.4523 - acc: 0.7865
Epoch 149/150
 - 0s - loss: 0.4507 - acc: 0.7760
Epoch 150/150
 - 0s - loss: 0.4462 - acc: 0.7878
[1.0, 0.0, 1.0, 0.0, 1.0, 0.0, 0.0, 1.0, 1.0, 0.0, 0.0, 1.0, 0.0, 1.0, 1.0, 0.0, 1.0, 0.0, 0.0,
```

Running this modified example now prints the predictions for each input pattern. We could use these predictions directly in our application if needed