```
#
import numpy as np
import pandas as pd
import matplotlib.pyplot as plt
from sklearn.model_selection import train_test_split
from sklearn.preprocessing import StandardScaler
from sklearn.metrics import accuracy_score, f1_score
from tensorflow.keras.models import Sequential
from tensorflow.keras.layers import Dense

data = pd.read_csv('cancer data (1).csv') # Importing the dataset

data
```

```
           id diagnosis  radius_mean  texture_mean  perimeter_mean
area_mean  \
0      842302         M        17.99         10.38          122.80
1001.0
1      842517         M        20.57         17.77          132.90
1326.0
2    84300903         M        19.69         21.25          130.00
1203.0
3    84348301         M        11.42         20.38           77.58
386.1
4    84358402         M        20.29         14.34          135.10
1297.0
..        ...       ...          ...           ...             ...
...
564    926424         M        21.56         22.39          142.00
1479.0
565    926682         M        20.13         28.25          131.20
1261.0
566    926954         M        16.60         28.08          108.30
858.1
567    927241         M        20.60         29.33          140.10
1265.0
568     92751         B         7.76         24.54           47.92
181.0

     smoothness_mean  compactness_mean  concavity_mean  concave
points_mean  \
0            0.11840           0.27760         0.30010
0.14710
1            0.08474           0.07864         0.08690
0.07017
2            0.10960           0.15990         0.19740
0.12790
3            0.14250           0.28390         0.24140
0.10520
4            0.10030           0.13280         0.19800
0.10430
```

```
..              ...               ...             ...
...
564          0.11100           0.11590         0.24390
0.13890
565          0.09780           0.10340         0.14400
0.09791
566          0.08455           0.10230         0.09251
0.05302
567          0.11780           0.27700         0.35140
0.15200
568          0.05263           0.04362         0.00000
0.00000

     ...  texture_worst  perimeter_worst  area_worst  smoothness_worst
\
0    ...          17.33           184.60      2019.0           0.16220

1    ...          23.41           158.80      1956.0           0.12380

2    ...          25.53           152.50      1709.0           0.14440

3    ...          26.50            98.87       567.7           0.20980

4    ...          16.67           152.20      1575.0           0.13740

..   ...            ...              ...         ...              ...

564  ...          26.40           166.10      2027.0           0.14100

565  ...          38.25           155.00      1731.0           0.11660

566  ...          34.12           126.70      1124.0           0.11390

567  ...          39.42           184.60      1821.0           0.16500

568  ...          30.37            59.16       268.6           0.08996


     compactness_worst  concavity_worst  concave points_worst
symmetry_worst  \
0              0.66560           0.7119               0.2654
0.4601
1              0.18660           0.2416               0.1860
0.2750
2              0.42450           0.4504               0.2430
0.3613
3              0.86630           0.6869               0.2575
0.6638
4              0.20500           0.4000               0.1625
```

```
0.2364
..                  ...              ...                   ...
...
564           0.21130          0.4107                0.2216
0.2060
565           0.19220          0.3215                0.1628
0.2572
566           0.30940          0.3403                0.1418
0.2218
567           0.86810          0.9387                0.2650
0.4087
568           0.06444          0.0000                0.0000
0.2871

     fractal_dimension_worst  Unnamed: 32
0                    0.11890          NaN
1                    0.08902          NaN
2                    0.08758          NaN
3                    0.17300          NaN
4                    0.07678          NaN
..                       ...          ...
564                  0.07115          NaN
565                  0.06637          NaN
566                  0.07820          NaN
567                  0.12400          NaN
568                  0.07039          NaN

[569 rows x 33 columns]

data.info()

<class 'pandas.core.frame.DataFrame'>
RangeIndex: 569 entries, 0 to 568
Data columns (total 33 columns):
 #   Column                   Non-Null Count  Dtype
---  ------                   --------------  -----
 0   id                       569 non-null    int64
 1   diagnosis                569 non-null    object
 2   radius_mean              569 non-null    float64
 3   texture_mean             569 non-null    float64
 4   perimeter_mean           569 non-null    float64
 5   area_mean                569 non-null    float64
 6   smoothness_mean          569 non-null    float64
 7   compactness_mean         569 non-null    float64
 8   concavity_mean           569 non-null    float64
 9   concave points_mean      569 non-null    float64
 10  symmetry_mean            569 non-null    float64
 11  fractal_dimension_mean   569 non-null    float64
 12  radius_se                569 non-null    float64
 13  texture_se               569 non-null    float64
```

```
 14  perimeter_se             569 non-null    float64
 15  area_se                  569 non-null    float64
 16  smoothness_se            569 non-null    float64
 17  compactness_se           569 non-null    float64
 18  concavity_se             569 non-null    float64
 19  concave points_se        569 non-null    float64
 20  symmetry_se              569 non-null    float64
 21  fractal_dimension_se     569 non-null    float64
 22  radius_worst             569 non-null    float64
 23  texture_worst            569 non-null    float64
 24  perimeter_worst          569 non-null    float64
 25  area_worst               569 non-null    float64
 26  smoothness_worst         569 non-null    float64
 27  compactness_worst        569 non-null    float64
 28  concavity_worst          569 non-null    float64
 29  concave points_worst     569 non-null    float64
 30  symmetry_worst           569 non-null    float64
 31  fractal_dimension_worst  569 non-null    float64
 32  Unnamed: 32              0 non-null      float64
dtypes: float64(31), int64(1), object(1)
memory usage: 146.8+ KB
```

```
data.isnull().sum()
```

```
id                           0
diagnosis                    0
radius_mean                  0
texture_mean                 0
perimeter_mean               0
area_mean                    0
smoothness_mean              0
compactness_mean             0
concavity_mean               0
concave points_mean          0
symmetry_mean                0
fractal_dimension_mean       0
radius_se                    0
texture_se                   0
perimeter_se                 0
area_se                      0
smoothness_se                0
compactness_se               0
concavity_se                 0
concave points_se            0
symmetry_se                  0
fractal_dimension_se         0
radius_worst                 0
texture_worst                0
perimeter_worst              0
area_worst                   0
smoothness_worst             0
```

```
compactness_worst            0
concavity_worst              0
concave points_worst         0
symmetry_worst               0
fractal_dimension_worst      0
Unnamed: 32                569
dtype: int64
```

```
data = data.drop(["id","Unnamed: 32"], axis="columns")   # removing
the unwanted columns
```

```
data
```

```
    diagnosis  radius_mean  texture_mean  perimeter_mean  area_mean  \
0           M        17.99         10.38          122.80     1001.0
1           M        20.57         17.77          132.90     1326.0
2           M        19.69         21.25          130.00     1203.0
3           M        11.42         20.38           77.58      386.1
4           M        20.29         14.34          135.10     1297.0
..        ...          ...           ...             ...        ...
564         M        21.56         22.39          142.00     1479.0
565         M        20.13         28.25          131.20     1261.0
566         M        16.60         28.08          108.30      858.1
567         M        20.60         29.33          140.10     1265.0
568         B         7.76         24.54           47.92      181.0

     smoothness_mean  compactness_mean  concavity_mean  concave
points_mean  \
0            0.11840           0.27760         0.30010
0.14710
1            0.08474           0.07864         0.08690
0.07017
2            0.10960           0.15990         0.19740
0.12790
3            0.14250           0.28390         0.24140
0.10520
4            0.10030           0.13280         0.19800
0.10430
..               ...               ...             ...
...
564          0.11100           0.11590         0.24390
0.13890
565          0.09780           0.10340         0.14400
0.09791
566          0.08455           0.10230         0.09251
0.05302
567          0.11780           0.27700         0.35140
0.15200
568          0.05263           0.04362         0.00000
0.00000
```

```
     symmetry_mean  ...  radius_worst  texture_worst  perimeter_worst
\
0           0.2419  ...        25.380          17.33           184.60

1           0.1812  ...        24.990          23.41           158.80

2           0.2069  ...        23.570          25.53           152.50

3           0.2597  ...        14.910          26.50            98.87

4           0.1809  ...        22.540          16.67           152.20

..             ...  ...           ...            ...              ...

564         0.1726  ...        25.450          26.40           166.10

565         0.1752  ...        23.690          38.25           155.00

566         0.1590  ...        18.980          34.12           126.70

567         0.2397  ...        25.740          39.42           184.60

568         0.1587  ...         9.456          30.37            59.16


     area_worst  smoothness_worst  compactness_worst  concavity_worst
\
0        2019.0           0.16220            0.66560           0.7119

1        1956.0           0.12380            0.18660           0.2416

2        1709.0           0.14440            0.42450           0.4504

3         567.7           0.20980            0.86630           0.6869

4        1575.0           0.13740            0.20500           0.4000

..          ...               ...                ...              ...

564      2027.0           0.14100            0.21130           0.4107

565      1731.0           0.11660            0.19220           0.3215

566      1124.0           0.11390            0.30940           0.3403

567      1821.0           0.16500            0.86810           0.9387

568       268.6           0.08996            0.06444           0.0000
```

```
     concave points_worst  symmetry_worst  fractal_dimension_worst
0                  0.2654          0.4601                  0.11890
1                  0.1860          0.2750                  0.08902
2                  0.2430          0.3613                  0.08758
3                  0.2575          0.6638                  0.17300
4                  0.1625          0.2364                  0.07678
..                    ...             ...                      ...
564                0.2216          0.2060                  0.07115
565                0.1628          0.2572                  0.06637
566                0.1418          0.2218                  0.07820
567                0.2650          0.4087                  0.12400
568                0.0000          0.2871                  0.07039

[569 rows x 31 columns]
```

```
data.info()
```

```
<class 'pandas.core.frame.DataFrame'>
RangeIndex: 569 entries, 0 to 568
Data columns (total 31 columns):
 #   Column                   Non-Null Count  Dtype  
---  ------                   --------------  -----  
 0   diagnosis                569 non-null    object 
 1   radius_mean              569 non-null    float64
 2   texture_mean             569 non-null    float64
 3   perimeter_mean           569 non-null    float64
 4   area_mean                569 non-null    float64
 5   smoothness_mean          569 non-null    float64
 6   compactness_mean         569 non-null    float64
 7   concavity_mean           569 non-null    float64
 8   concave points_mean      569 non-null    float64
 9   symmetry_mean            569 non-null    float64
 10  fractal_dimension_mean   569 non-null    float64
 11  radius_se                569 non-null    float64
 12  texture_se               569 non-null    float64
 13  perimeter_se             569 non-null    float64
 14  area_se                  569 non-null    float64
 15  smoothness_se            569 non-null    float64
 16  compactness_se           569 non-null    float64
 17  concavity_se             569 non-null    float64
 18  concave points_se        569 non-null    float64
 19  symmetry_se              569 non-null    float64
 20  fractal_dimension_se     569 non-null    float64
 21  radius_worst             569 non-null    float64
 22  texture_worst            569 non-null    float64
 23  perimeter_worst          569 non-null    float64
 24  area_worst               569 non-null    float64
 25  smoothness_worst         569 non-null    float64
```

```
 26  compactness_worst        569 non-null    float64
 27  concavity_worst          569 non-null    float64
 28  concave points_worst     569 non-null    float64
 29  symmetry_worst           569 non-null    float64
 30  fractal_dimension_worst  569 non-null    float64
dtypes: float64(30), object(1)
memory usage: 137.9+ KB
```

```
data["diagnosis"].unique()
```

```
array(['M', 'B'], dtype=object)
```

```
from sklearn import preprocessing          #applying lable-encoder to convert categorical variable into numerical.
Encode = preprocessing.LabelEncoder()
Encode.fit(['M','B'])
data["diagnosis"] = Encode.transform(data['diagnosis'])
```

```
data["diagnosis"].unique()
```

```
array([1, 0])
```

```
data
```

```
     diagnosis  radius_mean  texture_mean  perimeter_mean
area_mean  \
0            1        17.99         10.38          122.80     1001.0

1            1        20.57         17.77          132.90     1326.0

2            1        19.69         21.25          130.00     1203.0

3            1        11.42         20.38           77.58      386.1

4            1        20.29         14.34          135.10     1297.0

..         ...          ...           ...             ...        ...

564          1        21.56         22.39          142.00     1479.0

565          1        20.13         28.25          131.20     1261.0

566          1        16.60         28.08          108.30      858.1

567          1        20.60         29.33          140.10     1265.0

568          0         7.76         24.54           47.92      181.0


     smoothness_mean  compactness_mean  concavity_mean  concave
```

```
points_mean  \
0            0.11840          0.27760         0.30010
0.14710
1            0.08474          0.07864         0.08690
0.07017
2            0.10960          0.15990         0.19740
0.12790
3            0.14250          0.28390         0.24140
0.10520
4            0.10030          0.13280         0.19800
0.10430
..               ...              ...             ...
...
564          0.11100          0.11590         0.24390
0.13890
565          0.09780          0.10340         0.14400
0.09791
566          0.08455          0.10230         0.09251
0.05302
567          0.11780          0.27700         0.35140
0.15200
568          0.05263          0.04362         0.00000
0.00000

     symmetry_mean  ...  radius_worst  texture_worst  perimeter_worst
\
0           0.2419  ...        25.380          17.33           184.60

1           0.1812  ...        24.990          23.41           158.80

2           0.2069  ...        23.570          25.53           152.50

3           0.2597  ...        14.910          26.50            98.87

4           0.1809  ...        22.540          16.67           152.20

..             ...  ...           ...            ...              ...

564         0.1726  ...        25.450          26.40           166.10

565         0.1752  ...        23.690          38.25           155.00

566         0.1590  ...        18.980          34.12           126.70

567         0.2397  ...        25.740          39.42           184.60

568         0.1587  ...         9.456          30.37            59.16
```

```
     area_worst  smoothness_worst  compactness_worst  concavity_worst
\
0        2019.0           0.16220            0.66560           0.7119

1        1956.0           0.12380            0.18660           0.2416

2        1709.0           0.14440            0.42450           0.4504

3         567.7           0.20980            0.86630           0.6869

4        1575.0           0.13740            0.20500           0.4000

..          ...               ...                ...              ...

564      2027.0           0.14100            0.21130           0.4107

565      1731.0           0.11660            0.19220           0.3215

566      1124.0           0.11390            0.30940           0.3403

567      1821.0           0.16500            0.86810           0.9387

568       268.6           0.08996            0.06444           0.0000


     concave points_worst  symmetry_worst  fractal_dimension_worst
0                  0.2654          0.4601                  0.11890
1                  0.1860          0.2750                  0.08902
2                  0.2430          0.3613                  0.08758
3                  0.2575          0.6638                  0.17300
4                  0.1625          0.2364                  0.07678
..                    ...             ...                      ...
564                0.2216          0.2060                  0.07115
565                0.1628          0.2572                  0.06637
566                0.1418          0.2218                  0.07820
567                0.2650          0.4087                  0.12400
568                0.0000          0.2871                  0.07039

[569 rows x 31 columns]
```

```
x = data.drop("diagnosis", axis= 1)
x
```

```
     radius_mean  texture_mean  perimeter_mean  area_mean
smoothness_mean  \
0          17.99         10.38          122.80     1001.0
0.11840
1          20.57         17.77          132.90     1326.0
0.08474
```

```
2          19.69         21.25          130.00     1203.0
0.10960
3          11.42         20.38           77.58      386.1
0.14250
4          20.29         14.34          135.10     1297.0
0.10030
..           ...           ...             ...        ...
...
564        21.56         22.39          142.00     1479.0
0.11100
565        20.13         28.25          131.20     1261.0
0.09780
566        16.60         28.08          108.30      858.1
0.08455
567        20.60         29.33          140.10     1265.0
0.11780
568         7.76         24.54           47.92      181.0
0.05263

     compactness_mean  concavity_mean  concave points_mean
symmetry_mean  \
0             0.27760         0.30010              0.14710
0.2419
1             0.07864         0.08690              0.07017
0.1812
2             0.15990         0.19740              0.12790
0.2069
3             0.28390         0.24140              0.10520
0.2597
4             0.13280         0.19800              0.10430
0.1809
..                ...             ...                  ...
...
564           0.11590         0.24390              0.13890
0.1726
565           0.10340         0.14400              0.09791
0.1752
566           0.10230         0.09251              0.05302
0.1590
567           0.27700         0.35140              0.15200
0.2397
568           0.04362         0.00000              0.00000
0.1587

     fractal_dimension_mean  ...  radius_worst  texture_worst  \
0                   0.07871  ...        25.380          17.33
1                   0.05667  ...        24.990          23.41
2                   0.05999  ...        23.570          25.53
3                   0.09744  ...        14.910          26.50
4                   0.05883  ...        22.540          16.67
```

```
..                   ...  ...          ...           ...
564              0.05623  ...       25.450         26.40
565              0.05533  ...       23.690         38.25
566              0.05648  ...       18.980         34.12
567              0.07016  ...       25.740         39.42
568              0.05884  ...        9.456         30.37

     perimeter_worst  area_worst  smoothness_worst  compactness_worst
\
0              184.60      2019.0           0.16220            0.66560

1              158.80      1956.0           0.12380            0.18660

2              152.50      1709.0           0.14440            0.42450

3               98.87       567.7           0.20980            0.86630

4              152.20      1575.0           0.13740            0.20500

..                ...         ...               ...                ...

564            166.10      2027.0           0.14100            0.21130

565            155.00      1731.0           0.11660            0.19220

566            126.70      1124.0           0.11390            0.30940

567            184.60      1821.0           0.16500            0.86810

568             59.16       268.6           0.08996            0.06444


     concavity_worst  concave points_worst  symmetry_worst  \
0             0.7119                0.2654          0.4601
1             0.2416                0.1860          0.2750
2             0.4504                0.2430          0.3613
3             0.6869                0.2575          0.6638
4             0.4000                0.1625          0.2364
..               ...                   ...             ...
564           0.4107                0.2216          0.2060
565           0.3215                0.1628          0.2572
566           0.3403                0.1418          0.2218
567           0.9387                0.2650          0.4087
568           0.0000                0.0000          0.2871

     fractal_dimension_worst
0                    0.11890
1                    0.08902
2                    0.08758
```

```
3                    0.17300
4                    0.07678
..                       ...
564                  0.07115
565                  0.06637
566                  0.07820
567                  0.12400
568                  0.07039

[569 rows x 30 columns]
```

```
x = np.asanyarray(x)     # Independant variable
```

```
x
```

```
array([[1.799e+01, 1.038e+01, 1.228e+02, ..., 2.654e-01, 4.601e-01,
        1.189e-01],
       [2.057e+01, 1.777e+01, 1.329e+02, ..., 1.860e-01, 2.750e-01,
        8.902e-02],
       [1.969e+01, 2.125e+01, 1.300e+02, ..., 2.430e-01, 3.613e-01,
        8.758e-02],
       ...,
       [1.660e+01, 2.808e+01, 1.083e+02, ..., 1.418e-01, 2.218e-01,
        7.820e-02],
       [2.060e+01, 2.933e+01, 1.401e+02, ..., 2.650e-01, 4.087e-01,
        1.240e-01],
       [7.760e+00, 2.454e+01, 4.792e+01, ..., 0.000e+00, 2.871e-01,
        7.039e-02]])
```

```
y = np.asanyarray(data["diagnosis"])    #Dependent veriable
y
```

```
array([1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 0, 0,
0,
       1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 0, 1, 1, 1, 1, 1,
1,
       1, 1, 0, 1, 0, 0, 0, 0, 0, 1, 1, 0, 1, 1, 0, 0, 0, 0, 1, 0, 1,
1,
       0, 0, 0, 0, 1, 0, 1, 1, 0, 1, 0, 1, 1, 0, 0, 0, 1, 1, 0, 1, 1,
1,
       0, 0, 0, 1, 0, 0, 1, 1, 0, 0, 0, 1, 1, 0, 0, 0, 0, 1, 0, 0, 1,
0,
       0, 0, 0, 0, 0, 0, 0, 1, 1, 1, 0, 1, 1, 0, 0, 0, 1, 1, 0, 1, 0,
1,
       1, 0, 1, 1, 0, 0, 1, 0, 0, 1, 0, 0, 0, 0, 1, 0, 0, 0, 0, 0, 0,
0,
       0, 0, 1, 0, 0, 0, 0, 1, 1, 0, 1, 0, 0, 1, 1, 0, 0, 1, 1, 0, 0,
0,
       0, 1, 0, 0, 1, 1, 1, 0, 1, 0, 1, 0, 0, 0, 1, 0, 0, 1, 1, 0, 1,
1,
       1, 1, 0, 1, 1, 1, 0, 1, 0, 1, 0, 0, 1, 0, 1, 1, 1, 1, 0, 0, 1,
```

```
1,
       0, 0, 0, 1, 0, 0, 0, 0, 0, 1, 1, 0, 0, 1, 0, 0, 1, 1, 0, 1, 0,
0,
       0, 0, 1, 0, 0, 0, 0, 0, 1, 0, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1,
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       1, 1, 0, 0, 0, 0, 0, 0, 1, 0, 1, 0, 0, 1, 0, 0, 1, 0, 1, 1, 0,
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       1, 0, 0, 0, 0, 1, 0, 1, 0, 1, 0, 0, 0, 1, 0, 0, 0, 0, 0, 0, 0,
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       1, 1, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 1, 1, 0, 1, 1, 1, 0, 1,
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       0, 0, 0, 0, 0, 1, 0, 1, 1, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0,
0,
       0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 1, 1, 1, 1, 1, 1, 0])

# Split the dataset into training and testing sets
x_train,x_test,y_train,y_test =
train_test_split(x,y,test_size=0.2,random_state=40)

print(x_train.shape, y_train.shape)
print(x_test.shape, y_test.shape)

(455, 30) (455,)
(114, 30) (114,)

# Define the model architecture
model = Sequential()
model.add(Dense(16, activation = "relu", input_dim = 30)) # inpte
layer
model.add(Dense(32, activation = "relu"))                 #1st hiden
layer
model.add(Dense(1, activation = "sigmoid"))               #output
layer
```
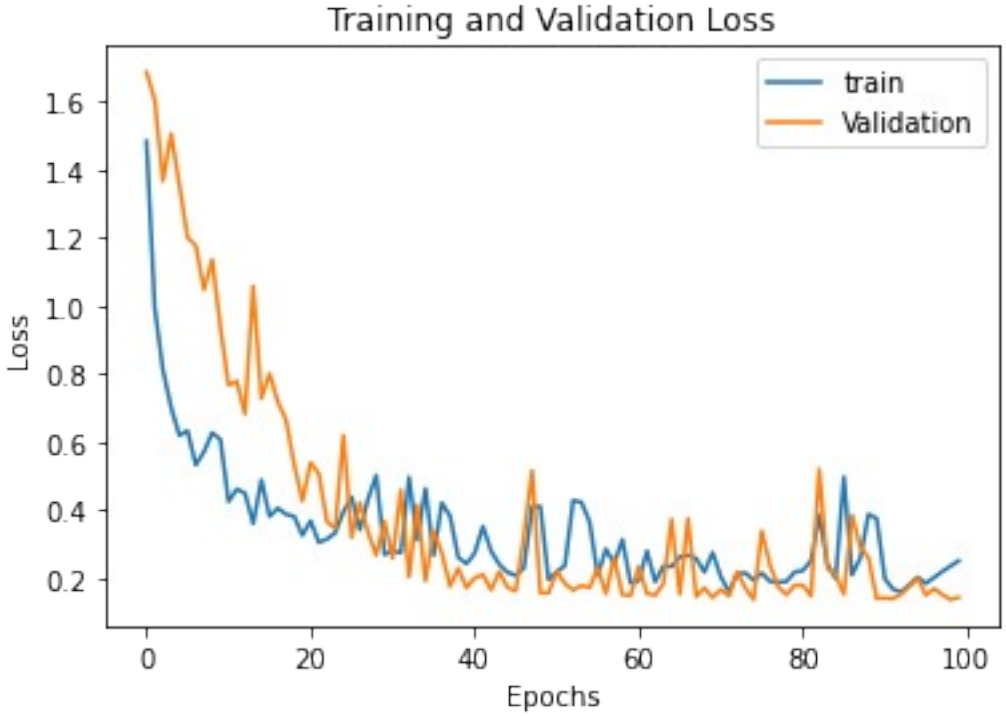

```
# Compile the model
model.compile(optimizer="adam",            # optimizer adjest the
model wieghts to maximize a loss fuctions.
              loss = "binary_crossentropy", # For integer target we
using "sparse_categorical_crossentropy"
              metrics = ['accuracy'])      # For finalizing the model
& make it comletely ready for use

history = model.fit(x_train, y_train, batch_size=32, epochs=100,
verbose=0, validation_data=(x_test, y_test))
history

<keras.callbacks.History at 0x1b76542c130>

# Evaluate the model on training and testing data
train_loss, train_accuracy = model.evaluate(x_train, y_train,
verbose=0)
test_loss, test_accuracy = model.evaluate(x_test, y_test, verbose=0)

# Calculating F1-Score
y_train_pred = model.predict(x_train).round()
y_test_pred = model.predict(x_test).round()

15/15 [==============================] - 0s 1ms/step
4/4 [==============================] - 0s 0s/step

f1_train = f1_score(y_train, y_train_pred)
f1_test = f1_score(y_test, y_test_pred)

# Print the evaluation metrics
print("Train Loss:", train_loss*100)
print("Test Loss:", test_loss*100)
print("Train Accuracy:", train_accuracy*100)
print("Test Accuracy:", test_accuracy*100)
print("Train F1-Score:", f1_train*100)
print("Test F1-Score:", f1_test*100)

Train Loss: 17.658890783786774
Test Loss: 14.237135648727417
Train Accuracy: 92.74725317955017
Test Accuracy: 95.61403393745422
Train F1-Score: 89.58990536277604
Test F1-Score: 93.33333333333333

# Ploting the loss function
plt.plot(history.history['loss'])
plt.plot(history.history['val_loss'])
plt.title('Training and Validation Loss')
plt.xlabel('Epochs')
plt.ylabel('Loss')
plt.legend(["train", "Validation"], loc="upper right")
```

```
<matplotlib.legend.Legend at 0x1b76533e520>
```




```
# Ploting the accuracy function
print(history.history.keys())
plt.plot(history.history['accuracy'])
plt.plot(history.history['val_accuracy'])
plt.title('Training and Validation Accuracy')
plt.xlabel('Epochs')
plt.ylabel('accuracy')
plt.legend(["train", "Validation"], loc="lower right")
```

```
dict_keys(['loss', 'accuracy', 'val_loss', 'val_accuracy'])
```

```
<matplotlib.legend.Legend at 0x1b7673ce2e0>
```


```
#F1-Score for both Training and Testing
print("Train F1-Score:", f1_train*100)
print("Test F1-Score:", f1_test*100)
```

```
Train F1-Score: 89.58990536277604
Test F1-Score: 93.33333333333333
```