In [42]:

```python
import seaborn as sns
import pandas as pd
import numpy as np
import sklearn
from sklearn.metrics import classification_report,confusion_matrix,accuracy_score
from sklearn.model_selection import train_test_split
import matplotlib.pyplot as plt
import keras
from keras import Sequential
from keras.models import Sequential
from keras.optimizers import SGD,Adam,Adagrad
from keras.layers import InputLayer, Dense
%matplotlib inline
from keras.wrappers.scikit_learn import KerasClassifier
from sklearn.model_selection import cross_val_score,KFold
from sklearn.preprocessing import StandardScaler
```

In [43]:

```python
pwd
```

Out[43]:

```
'C:\\Users\\user\\Desktop\\python\\zero_to_deep_learning_video-master'
```

In [44]:

```python
df=pd.read_csv('C:\\Users\\user\\Desktop\\python\\zero_to_deep_learning_video-master\\data\\diabetes.csv')
```

In [45]:

```python
df.head()
```

Out[45]:

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

In [46]:

```
df.describe()
```

Out[46]:

	Pregnancies	Glucose	BloodPressure	SkinThickness	Insulin	BMI	Diab
count	768.000000	768.000000	768.000000	768.000000	768.000000	768.000000	
mean	3.845052	120.894531	69.105469	20.536458	79.799479	31.992578	
std	3.369578	31.972618	19.355807	15.952218	115.244002	7.884160	
min	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	
25%	1.000000	99.000000	62.000000	0.000000	0.000000	27.300000	
50%	3.000000	117.000000	72.000000	23.000000	30.500000	32.000000	
75%	6.000000	140.250000	80.000000	32.000000	127.250000	36.600000	
max	17.000000	199.000000	122.000000	99.000000	846.000000	67.100000	

In [47]:

```python
#Plotting the variables using histogram
df.hist(figsize=(12,10))
```
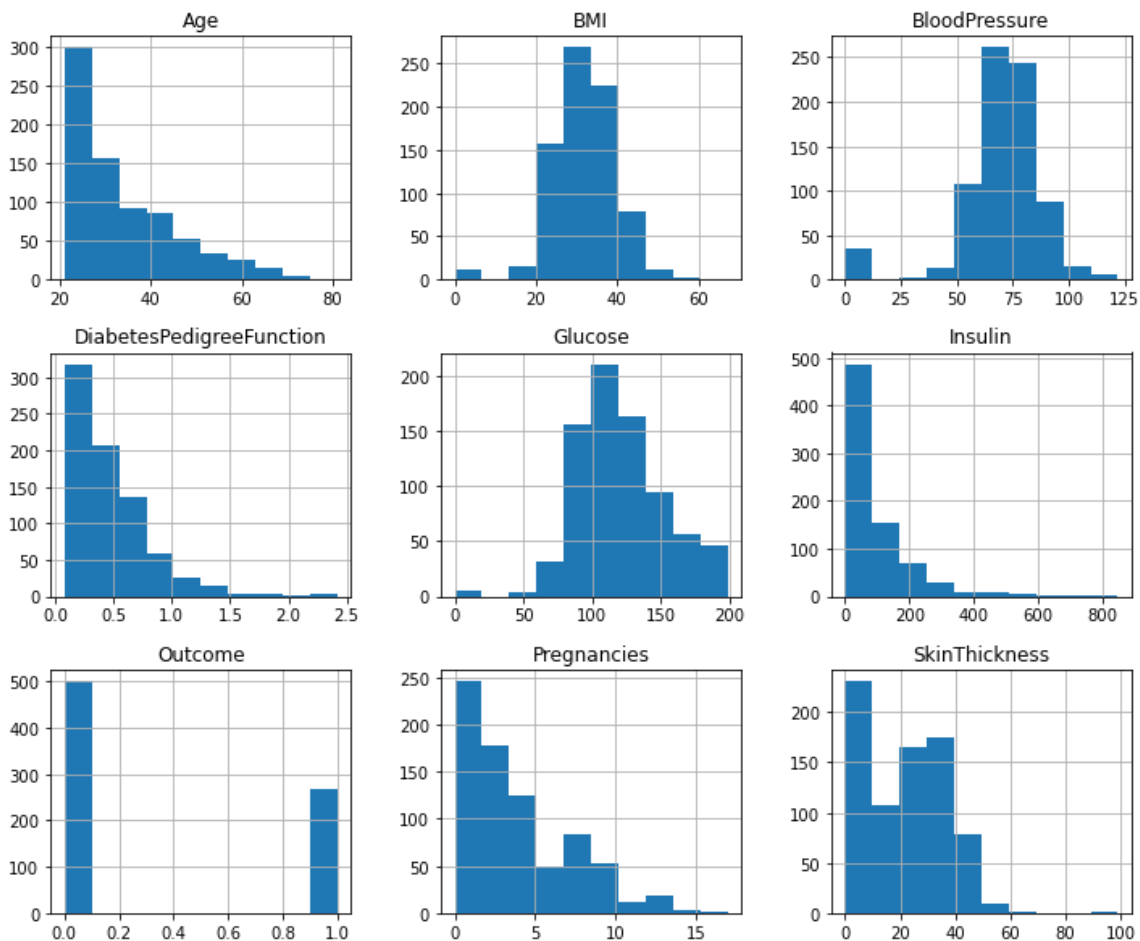
Out[47]:

```
array([[<matplotlib.axes._subplots.AxesSubplot object at 0x0000018CCD441D0
8>,
        <matplotlib.axes._subplots.AxesSubplot object at 0x0000018CCD46DC8
8>,
        <matplotlib.axes._subplots.AxesSubplot object at 0x0000018CCD4A488
8>],
       [<matplotlib.axes._subplots.AxesSubplot object at 0x0000018CCD4DB48
8>,
        <matplotlib.axes._subplots.AxesSubplot object at 0x0000018CCD512E0
8>,
        <matplotlib.axes._subplots.AxesSubplot object at 0x0000018CCD54DC8
8>],
       [<matplotlib.axes._subplots.AxesSubplot object at 0x0000018CCD586AC
8>,
        <matplotlib.axes._subplots.AxesSubplot object at 0x0000018CCD5C080
8>,
        <matplotlib.axes._subplots.AxesSubplot object at 0x0000018CCD5C0A0
8>]],
      dtype=object)
```

In [48]:

```python
fig,ax=plt.subplots(figsize=(15,15))

plt.hist(df['Pregnancies'],color='skyblue',bins=30,alpha=0.3)
plt.hist(df['Glucose'],color='black',bins=30,alpha=0.3)
plt.hist(df['BloodPressure'],color='lime',bins=30,alpha=0.3)
plt.hist(df['BMI'],color='red',bins=30,alpha=0.3)
plt.hist(df['DiabetesPedigreeFunction'],color='navy',bins=30,alpha=0.1)
plt.hist(df['Age'],color='goldenrod',bins=30,alpha=0.3)

plt.title('Histogram of Variables')
plt.legend(df[['Pregnancies','Glucose','BloodPressure','BMI','DiabetesPedigreeFunction'
,'Age']])
```
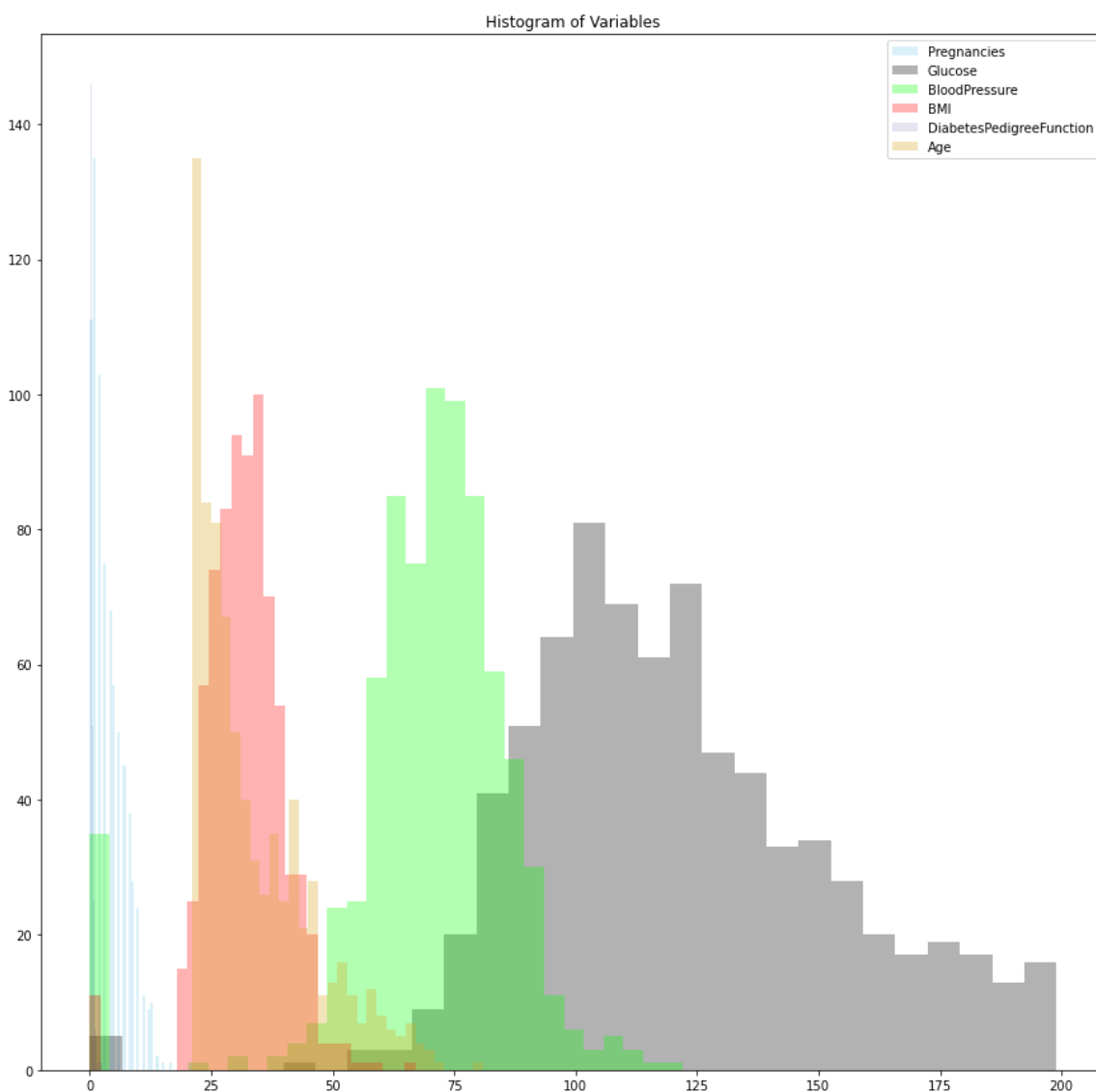
Out[48]:

<matplotlib.legend.Legend at 0x18cc5e33c88>

In [49]:

```python
#Replacing the zero-values for Blood Pressure
df1 = df.loc[df['Outcome'] == 1]
df2 = df.loc[df['Outcome'] == 0]
df1 = df1.replace({'BloodPressure':0}, np.median(df1['BloodPressure']))
df2 = df2.replace({'BloodPressure':0}, np.median(df2['BloodPressure']))
dataframe = [df1, df2]
df = pd.concat(dataframe)
```

In [50]:

```python
#Replacing the zero-values for BMI
df1 = df.loc[df['Outcome'] == 1]
df2 = df.loc[df['Outcome'] == 0]
df1 = df1.replace({'BMI':0}, np.mean(df1['BMI']))
df2 = df2.replace({'BMI':0}, np.mean(df2['BMI']))
dataframe = [df1, df2]
df = pd.concat(dataframe)
```

In [51]:

```python
#Replacing the zero-values for Glucose
df1 = df.loc[df['Outcome'] == 1]
df2 = df.loc[df['Outcome'] == 0]
df1 = df1.replace({'Glucose':0}, np.median(df1['Glucose']))
df2 = df2.replace({'Glucose':0}, np.median(df2['Glucose']))
dataframe = [df1, df2]
df = pd.concat(dataframe)
```

In [52]:

```python
#Replacing the zero-values for Insulin
df1 = df.loc[df['Outcome'] == 1]
df2 = df.loc[df['Outcome'] == 0]
df1 = df1.replace({'Insulin':0}, np.mean(df1['Insulin']))
df2 = df2.replace({'Insulin':0}, np.mean(df2['Insulin']))
dataframe = [df1, df2]
df = pd.concat(dataframe)
```

In [53]:

```python
#Replacing the zero-values for SkinThickness
df1 = df.loc[df['Outcome'] == 1]
df2 = df.loc[df['Outcome'] == 0]
df1 = df1.replace({'SkinThickness':0}, np.median(df1['SkinThickness']))
df2 = df2.replace({'SkinThickness':0}, np.median(df2['SkinThickness']))
dataframe = [df1, df2]
df = pd.concat(dataframe)
```

In [54]:

```
df.describe()
```

Out[54]:

	Pregnancies	Glucose	BloodPressure	SkinThickness	Insulin	BMI	Diab
count	768.000000	768.000000	768.000000	768.00000	768.000000	768.000000	
mean	3.845052	121.677083	72.378906	27.43099	118.967780	32.439222	
std	3.369578	30.464161	12.104431	9.32146	93.557899	6.880449	
min	0.000000	44.000000	24.000000	7.00000	14.000000	18.200000	
25%	1.000000	99.750000	64.000000	21.00000	68.792000	27.500000	
50%	3.000000	117.000000	72.000000	27.00000	100.000000	32.050000	
75%	6.000000	140.250000	80.000000	32.00000	127.250000	36.600000	
max	17.000000	199.000000	122.000000	99.00000	846.000000	67.100000	

In [55]:

```
#Checking for missing values
df.isna().sum()
```

Out[55]:

```
Pregnancies                 0
Glucose                     0
BloodPressure               0
SkinThickness               0
Insulin                     0
BMI                         0
DiabetesPedigreeFunction    0
Age                         0
Outcome                     0
dtype: int64
```

In [56]:

```
#Checking the correlation between variables
sns.pairplot(df,hue='Outcome')
```

Out[56]:

`<seaborn.axisgrid.PairGrid at 0x18cc54468c8>`
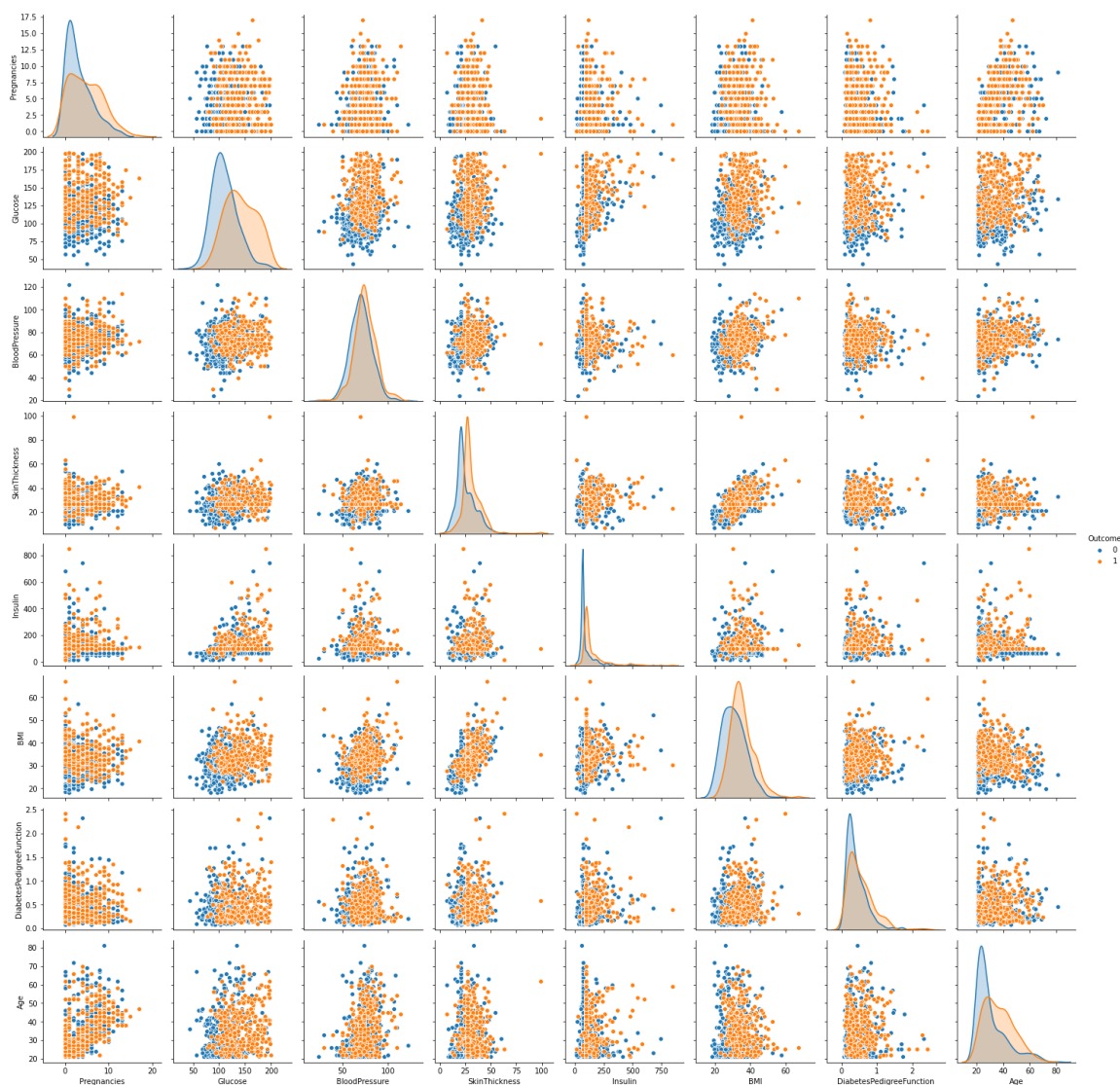
In [57]:

```python
df1=df.corr('pearson')
f, ax = plt.subplots(figsize=(11, 9))
sns.heatmap(df1,center=0,square=True,annot=True,cmap="YlGnBu")
```

Out[57]:

```
<matplotlib.axes._subplots.AxesSubplot at 0x18ccf87a208>
```

In [58]:

```python
df.describe()
```

Out[58]:

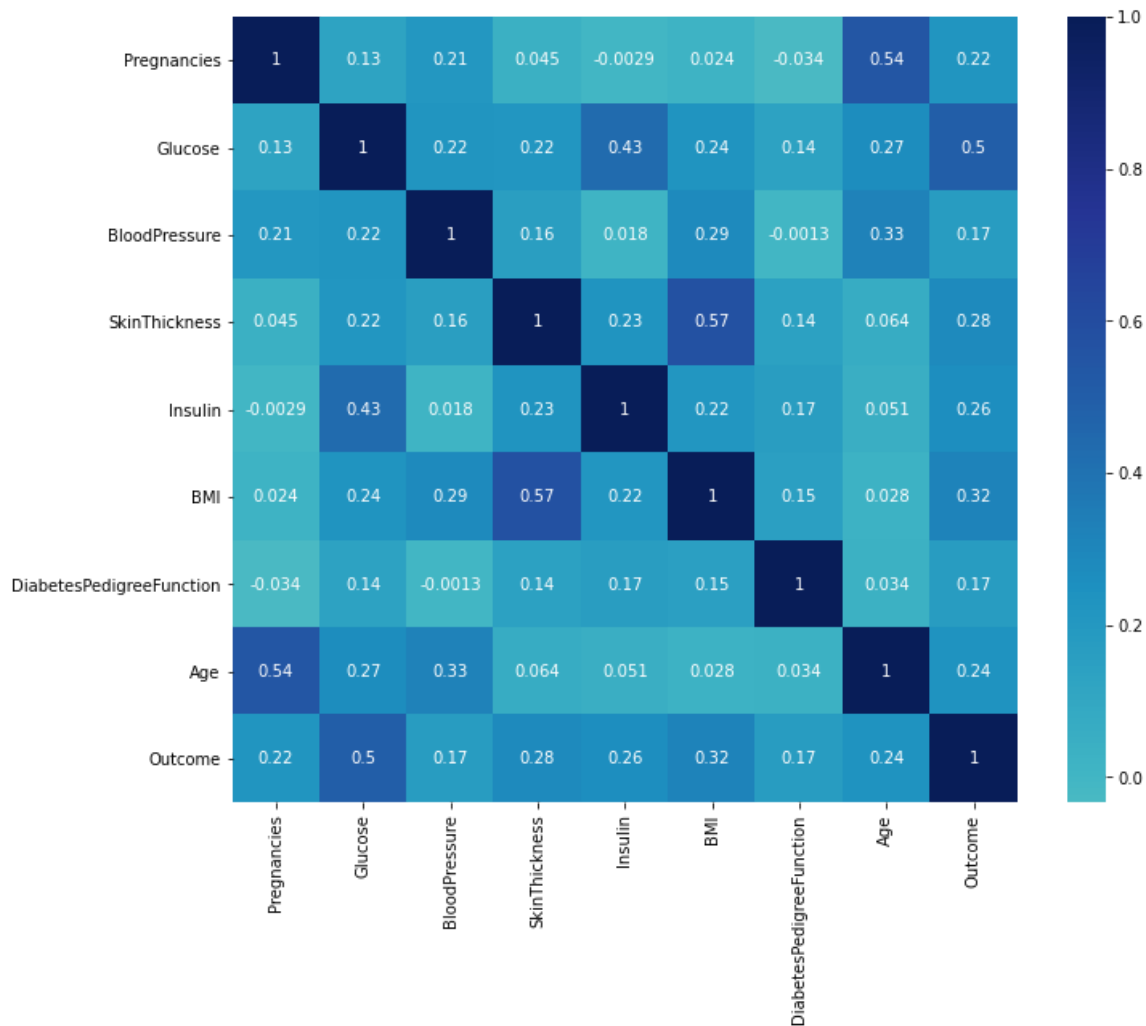|	Pregnancies	Glucose	BloodPressure	SkinThickness	Insulin	BMI	Diab
count	768.000000	768.000000	768.000000	768.00000	768.000000	768.000000	
mean	3.845052	121.677083	72.378906	27.43099	118.967780	32.439222	
std	3.369578	30.464161	12.104431	9.32146	93.557899	6.880449	
min	0.000000	44.000000	24.000000	7.00000	14.000000	18.200000	
25%	1.000000	99.750000	64.000000	21.00000	68.792000	27.500000	
50%	3.000000	117.000000	72.000000	27.00000	100.000000	32.050000	
75%	6.000000	140.250000	80.000000	32.00000	127.250000	36.600000	
max	17.000000	199.000000	122.000000	99.00000	846.000000	67.100000	

In [59]:

```python
out=[]
def ZRscore_outlier(df):
    med = np.median(df)
    ma = stats.median_absolute_deviation(df)
    for i in df:
        z = (0.6745*(i-med))/ (np.median(ma))
        if np.abs(z) > 3:
            out.append(i)
    print("Outliers:",out)
```

In [60]:

```python
from sklearn.preprocessing import StandardScaler
```

In [61]:

```python
#Splitting data into data and target
X=df.drop('Outcome',axis=1)
y=df['Outcome']
X.head()
```

Out[61]:

	Pregnancies	Glucose	BloodPressure	SkinThickness	Insulin	BMI	DiabetesPedigreeF
0	6	148	72	35	100.335821	33.6	
2	8	183	64	27	100.335821	23.3	
4	0	137	40	35	168.000000	43.1	
6	3	78	50	32	88.000000	31.0	
8	2	197	70	45	543.000000	30.5	

In [62]:

```
#Setting a benchmark
y.value_counts()/len(y)
```

Out[62]:

```
0    0.651042
1    0.348958
Name: Outcome, dtype: float64
```

In [63]:

```
#Converting to category
y=y.astype('category')
```

In [64]:

```
#Scaling the X data
columns = X.columns
scale=StandardScaler()
X=scale.fit_transform(X)
X
```

Out[64]:

```
array([[ 0.63994726,  0.86462486, -0.0313235 , ...,  0.16881659,
         0.46849198,  1.4259954 ],
       [ 1.23388019,  2.01426457, -0.69266918, ..., -1.32915431,
         0.60439732, -0.10558415],
       [-1.14185152,  0.50330953, -2.67670622, ...,  1.55044024,
         5.4849091 , -0.0204964 ],
       ...,
       [-0.54791859,  0.01060679, -0.19665992, ...,  0.63420561,
        -0.39828208, -0.53102292],
       [ 0.3429808 , -0.02224005, -0.0313235 , ..., -0.90739551,
        -0.68519336, -0.27575966],
       [-0.84488505, -0.94195182, -0.19665992, ..., -0.29657242,
        -0.47378505, -0.87137393]])
```

In [65]:

```
X=pd.DataFrame(X, columns = columns)
```

In [66]:

```
#Splitting the data between Train and Test
X_train,X_test,y_train,y_test=train_test_split(X,y,test_size=0.2,random_state=22)
X.shape
```

Out[66]:

```
(768, 8)
```

In [67]:

```
X.describe
```

Out[67]:

```
<bound method NDFrame.describe of      Pregnancies   Glucose   BloodPressur
e  SkinThickness    Insulin       BMI  \
0       0.639947  0.864625       -0.031324        0.812528 -0.199279  0.1688
17
1       1.233880  2.014265       -0.692669       -0.046266 -0.199279 -1.3291
54
2      -1.141852  0.503310       -2.676706        0.812528  0.524426  1.5504
40
3      -0.250952 -1.434655       -1.850024        0.490480 -0.331217 -0.2093
12
4      -0.547919  2.474120       -0.196660        1.886020  4.535251 -0.2820
29
..           ...       ...             ...             ...       ...
...
763     1.530847 -1.073339       -0.858006       -0.690362 -0.536657 -1.4455
02
764     1.827813 -0.679177        0.299349        2.208068  0.652772  0.0670
13
765    -0.547919  0.010607       -0.196660       -0.046266 -0.536657  0.6342
06
766     0.342981 -0.022240       -0.031324       -0.475663 -0.074524 -0.9073
96
767    -0.844885 -0.941952       -0.196660        0.383131 -0.536657 -0.2965
72

     DiabetesPedigreeFunction       Age
0                    0.468492  1.425995
1                    0.604397 -0.105584
2                    5.484909 -0.020496
3                   -0.676133 -0.616111
4                   -0.947944  1.681259
..                        ...       ...
763                 -0.996266 -0.020496
764                 -0.908682  2.532136
765                 -0.398282 -0.531023
766                 -0.685193 -0.275760
767                 -0.473785 -0.871374

[768 rows x 8 columns]>
```

In [68]:

```python
from keras.layers import Dropout
#Model Creation
model=Sequential()
model.add(Dense(64,input_shape=(8,),activation='softmax'))
model.add(Dense(32,activation='softmax'))
model.add(Dense(16,activation='softmax'))
model.add(Dense(8,activation='softmax'))
model.add(Dense(4,activation='sigmoid'))
#model.add(Dense(2,activation='sigmoid'))
#model.add(Dropout(0.5))
model.add(Dense(1,activation='sigmoid'))
model.compile(Adagrad(lr=0.05),'binary_crossentropy',metrics=['accuracy'])

history=model.fit(X_train, y_train,validation_data=(X_test, y_test),epochs = 100)


print(model.evaluate(X_train,y_train))
print(model.evaluate(X_test,y_test))
```

```
Train on 614 samples, validate on 154 samples
Epoch 1/100
614/614 [==============================] - 1s 2ms/step - loss: 0.6484 - ac
curacy: 0.6547 - val_loss: 0.6585 - val_accuracy: 0.6364
Epoch 2/100
614/614 [==============================] - 0s 397us/step - loss: 0.6456 -
accuracy: 0.6547 - val_loss: 0.6586 - val_accuracy: 0.6364
Epoch 3/100
614/614 [==============================] - 0s 371us/step - loss: 0.6452 -
accuracy: 0.6547 - val_loss: 0.6554 - val_accuracy: 0.6364
Epoch 4/100
614/614 [==============================] - 0s 508us/step - loss: 0.6429 -
accuracy: 0.6547 - val_loss: 0.6536 - val_accuracy: 0.6364
Epoch 5/100
614/614 [==============================] - 0s 508us/step - loss: 0.6379 -
accuracy: 0.6547 - val_loss: 0.6455 - val_accuracy: 0.6364
Epoch 6/100
614/614 [==============================] - 0s 295us/step - loss: 0.6266 -
accuracy: 0.6547 - val_loss: 0.6312 - val_accuracy: 0.6364
Epoch 7/100
614/614 [==============================] - 0s 410us/step - loss: 0.6091 -
accuracy: 0.6547 - val_loss: 0.6113 - val_accuracy: 0.6364
Epoch 8/100
614/614 [==============================] - 0s 449us/step - loss: 0.5879 -
accuracy: 0.6547 - val_loss: 0.5897 - val_accuracy: 0.6364
Epoch 9/100
614/614 [==============================] - 0s 560us/step - loss: 0.5643 -
accuracy: 0.6547 - val_loss: 0.5680 - val_accuracy: 0.6364
Epoch 10/100
614/614 [==============================] - 0s 541us/step - loss: 0.5425 -
accuracy: 0.6547 - val_loss: 0.5457 - val_accuracy: 0.6364
Epoch 11/100
614/614 [==============================] - 0s 300us/step - loss: 0.5205 -
accuracy: 0.6547 - val_loss: 0.5280 - val_accuracy: 0.6364
Epoch 12/100
614/614 [==============================] - 0s 495us/step - loss: 0.5009 -
accuracy: 0.7085 - val_loss: 0.5138 - val_accuracy: 0.6364
Epoch 13/100
614/614 [==============================] - 0s 410us/step - loss: 0.4844 -
accuracy: 0.7752 - val_loss: 0.4997 - val_accuracy: 0.8052
Epoch 14/100
614/614 [==============================] - 0s 482us/step - loss: 0.4686 -
accuracy: 0.8208 - val_loss: 0.4815 - val_accuracy: 0.8117
Epoch 15/100
614/614 [==============================] - 0s 365us/step - loss: 0.4561 -
accuracy: 0.8290 - val_loss: 0.4694 - val_accuracy: 0.8182
Epoch 16/100
614/614 [==============================] - 0s 449us/step - loss: 0.4466 -
accuracy: 0.8306 - val_loss: 0.4590 - val_accuracy: 0.7987
Epoch 17/100
614/614 [==============================] - 0s 287us/step - loss: 0.4358 -
accuracy: 0.8322 - val_loss: 0.4498 - val_accuracy: 0.8052
Epoch 18/100
614/614 [==============================] - 0s 247us/step - loss: 0.4284 -
accuracy: 0.8322 - val_loss: 0.4415 - val_accuracy: 0.8117
Epoch 19/100
614/614 [==============================] - 0s 469us/step - loss: 0.4208 -
accuracy: 0.8388 - val_loss: 0.4356 - val_accuracy: 0.8117
Epoch 20/100
614/614 [==============================] - 0s 488us/step - loss: 0.4156 -
accuracy: 0.8388 - val_loss: 0.4312 - val_accuracy: 0.8117
```

```
Epoch 21/100
614/614 [==============================] - 0s 384us/step - loss: 0.4106 -
accuracy: 0.8420 - val_loss: 0.4268 - val_accuracy: 0.8247
Epoch 22/100
614/614 [==============================] - 0s 462us/step - loss: 0.4066 -
accuracy: 0.8404 - val_loss: 0.4227 - val_accuracy: 0.8247
Epoch 23/100
614/614 [==============================] - 0s 488us/step - loss: 0.4031 -
accuracy: 0.8436 - val_loss: 0.4203 - val_accuracy: 0.8247
Epoch 24/100
614/614 [==============================] - 0s 332us/step - loss: 0.4005 -
accuracy: 0.8404 - val_loss: 0.4162 - val_accuracy: 0.8312
Epoch 25/100
614/614 [==============================] - 0s 391us/step - loss: 0.3973 -
accuracy: 0.8453 - val_loss: 0.4136 - val_accuracy: 0.8312
Epoch 26/100
614/614 [==============================] - 0s 358us/step - loss: 0.3939 -
accuracy: 0.8485 - val_loss: 0.4136 - val_accuracy: 0.8247
Epoch 27/100
614/614 [==============================] - 0s 443us/step - loss: 0.3924 -
accuracy: 0.8469 - val_loss: 0.4101 - val_accuracy: 0.8312
Epoch 28/100
614/614 [==============================] - 0s 358us/step - loss: 0.3897 -
accuracy: 0.8485 - val_loss: 0.4083 - val_accuracy: 0.8312
Epoch 29/100
614/614 [==============================] - 0s 417us/step - loss: 0.3880 -
accuracy: 0.8502 - val_loss: 0.4080 - val_accuracy: 0.8312
Epoch 30/100
614/614 [==============================] - 0s 586us/step - loss: 0.3871 -
accuracy: 0.8502 - val_loss: 0.4057 - val_accuracy: 0.8312
Epoch 31/100
614/614 [==============================] - 0s 567us/step - loss: 0.3852 -
accuracy: 0.8518 - val_loss: 0.4050 - val_accuracy: 0.8312
Epoch 32/100
614/614 [==============================] - 0s 345us/step - loss: 0.3835 -
accuracy: 0.8518 - val_loss: 0.4057 - val_accuracy: 0.8312
Epoch 33/100
614/614 [==============================] - 0s 397us/step - loss: 0.3826 -
accuracy: 0.8518 - val_loss: 0.4048 - val_accuracy: 0.8312
Epoch 34/100
614/614 [==============================] - 0s 508us/step - loss: 0.3817 -
accuracy: 0.8518 - val_loss: 0.4025 - val_accuracy: 0.8312
Epoch 35/100
614/614 [==============================] - 0s 247us/step - loss: 0.3811 -
accuracy: 0.8518 - val_loss: 0.4042 - val_accuracy: 0.8312
Epoch 36/100
614/614 [==============================] - 0s 358us/step - loss: 0.3804 -
accuracy: 0.8518 - val_loss: 0.4038 - val_accuracy: 0.8312
Epoch 37/100
614/614 [==============================] - 0s 287us/step - loss: 0.3796 -
accuracy: 0.8518 - val_loss: 0.4031 - val_accuracy: 0.8312
Epoch 38/100
614/614 [==============================] - 0s 280us/step - loss: 0.3790 -
accuracy: 0.8518 - val_loss: 0.4030 - val_accuracy: 0.8312
Epoch 39/100
614/614 [==============================] - 0s 404us/step - loss: 0.3785 -
accuracy: 0.8518 - val_loss: 0.4050 - val_accuracy: 0.8247
Epoch 40/100
614/614 [==============================] - 0s 586us/step - loss: 0.3779 -
accuracy: 0.8518 - val_loss: 0.4058 - val_accuracy: 0.8312
Epoch 41/100
```

```
614/614 [==============================] - 0s 384us/step - loss: 0.3775 -
accuracy: 0.8534 - val_loss: 0.4073 - val_accuracy: 0.8247
Epoch 42/100
614/614 [==============================] - 0s 580us/step - loss: 0.3771 -
accuracy: 0.8534 - val_loss: 0.4063 - val_accuracy: 0.8247
Epoch 43/100
614/614 [==============================] - 0s 352us/step - loss: 0.3764 -
accuracy: 0.8550 - val_loss: 0.4075 - val_accuracy: 0.8247
Epoch 44/100
614/614 [==============================] - 0s 384us/step - loss: 0.3759 -
accuracy: 0.8550 - val_loss: 0.4076 - val_accuracy: 0.8247
Epoch 45/100
614/614 [==============================] - 0s 326us/step - loss: 0.3756 -
accuracy: 0.8550 - val_loss: 0.4089 - val_accuracy: 0.8247
Epoch 46/100
614/614 [==============================] - 0s 443us/step - loss: 0.3750 -
accuracy: 0.8550 - val_loss: 0.4095 - val_accuracy: 0.8247
Epoch 47/100
614/614 [==============================] - 0s 254us/step - loss: 0.3747 -
accuracy: 0.8550 - val_loss: 0.4112 - val_accuracy: 0.8247
Epoch 48/100
614/614 [==============================] - 0s 274us/step - loss: 0.3743 -
accuracy: 0.8550 - val_loss: 0.4090 - val_accuracy: 0.8247
Epoch 49/100
614/614 [==============================] - 0s 378us/step - loss: 0.3737 -
accuracy: 0.8550 - val_loss: 0.4099 - val_accuracy: 0.8247
Epoch 50/100
614/614 [==============================] - 0s 469us/step - loss: 0.3726 -
accuracy: 0.8567 - val_loss: 0.4093 - val_accuracy: 0.8247
Epoch 51/100
614/614 [==============================] - 0s 398us/step - loss: 0.3716 -
accuracy: 0.8583 - val_loss: 0.4115 - val_accuracy: 0.8247
Epoch 52/100
614/614 [==============================] - 0s 306us/step - loss: 0.3707 -
accuracy: 0.8583 - val_loss: 0.4123 - val_accuracy: 0.8247
Epoch 53/100
614/614 [==============================] - 0s 326us/step - loss: 0.3704 -
accuracy: 0.8583 - val_loss: 0.4129 - val_accuracy: 0.8247
Epoch 54/100
614/614 [==============================] - 0s 260us/step - loss: 0.3698 -
accuracy: 0.8583 - val_loss: 0.4125 - val_accuracy: 0.8247
Epoch 55/100
614/614 [==============================] - 0s 469us/step - loss: 0.3697 -
accuracy: 0.8583 - val_loss: 0.4134 - val_accuracy: 0.8247
Epoch 56/100
614/614 [==============================] - 0s 254us/step - loss: 0.3694 -
accuracy: 0.8583 - val_loss: 0.4130 - val_accuracy: 0.8247
Epoch 57/100
614/614 [==============================] - 0s 280us/step - loss: 0.3692 -
accuracy: 0.8583 - val_loss: 0.4124 - val_accuracy: 0.8247
Epoch 58/100
614/614 [==============================] - 0s 247us/step - loss: 0.3690 -
accuracy: 0.8583 - val_loss: 0.4130 - val_accuracy: 0.8117
Epoch 59/100
614/614 [==============================] - 0s 371us/step - loss: 0.3688 -
accuracy: 0.8583 - val_loss: 0.4131 - val_accuracy: 0.8182
Epoch 60/100
614/614 [==============================] - 0s 436us/step - loss: 0.3686 -
accuracy: 0.8583 - val_loss: 0.4135 - val_accuracy: 0.8182
Epoch 61/100
614/614 [==============================] - 0s 287us/step - loss: 0.3684 -
```

```
accuracy: 0.8583 - val_loss: 0.4131 - val_accuracy: 0.8182
Epoch 62/100
614/614 [==============================] - 0s 280us/step - loss: 0.3681 -
accuracy: 0.8583 - val_loss: 0.4132 - val_accuracy: 0.8182
Epoch 63/100
614/614 [==============================] - 0s 352us/step - loss: 0.3680 -
accuracy: 0.8583 - val_loss: 0.4134 - val_accuracy: 0.8247
Epoch 64/100
614/614 [==============================] - 0s 332us/step - loss: 0.3679 -
accuracy: 0.8583 - val_loss: 0.4131 - val_accuracy: 0.8312
Epoch 65/100
614/614 [==============================] - 0s 391us/step - loss: 0.3675 -
accuracy: 0.8583 - val_loss: 0.4136 - val_accuracy: 0.8312
Epoch 66/100
614/614 [==============================] - 0s 300us/step - loss: 0.3671 -
accuracy: 0.8599 - val_loss: 0.4221 - val_accuracy: 0.8312
Epoch 67/100
614/614 [==============================] - 0s 365us/step - loss: 0.3688 -
accuracy: 0.8567 - val_loss: 0.4173 - val_accuracy: 0.8312
Epoch 68/100
614/614 [==============================] - 0s 410us/step - loss: 0.3664 -
accuracy: 0.8599 - val_loss: 0.4143 - val_accuracy: 0.8312
Epoch 69/100
614/614 [==============================] - 0s 478us/step - loss: 0.3662 -
accuracy: 0.8599 - val_loss: 0.4151 - val_accuracy: 0.8312
Epoch 70/100
614/614 [==============================] - 0s 365us/step - loss: 0.3658 -
accuracy: 0.8616 - val_loss: 0.4136 - val_accuracy: 0.8312
Epoch 71/100
614/614 [==============================] - 0s 423us/step - loss: 0.3655 -
accuracy: 0.8616 - val_loss: 0.4139 - val_accuracy: 0.8312
Epoch 72/100
614/614 [==============================] - 1s 853us/step - loss: 0.3652 -
accuracy: 0.8632 - val_loss: 0.4152 - val_accuracy: 0.8312
Epoch 73/100
614/614 [==============================] - 1s 899us/step - loss: 0.3650 -
accuracy: 0.8632 - val_loss: 0.4123 - val_accuracy: 0.8312
Epoch 74/100
614/614 [==============================] - 0s 495us/step - loss: 0.3646 -
accuracy: 0.8632 - val_loss: 0.4109 - val_accuracy: 0.8312
Epoch 75/100
614/614 [==============================] - 1s 1ms/step - loss: 0.3642 - ac
curacy: 0.8632 - val_loss: 0.4066 - val_accuracy: 0.8312
Epoch 76/100
614/614 [==============================] - 0s 527us/step - loss: 0.3635 -
accuracy: 0.8632 - val_loss: 0.4073 - val_accuracy: 0.8377
Epoch 77/100
614/614 [==============================] - 0s 274us/step - loss: 0.3622 -
accuracy: 0.8648 - val_loss: 0.4047 - val_accuracy: 0.8377
Epoch 78/100
614/614 [==============================] - 0s 384us/step - loss: 0.3618 -
accuracy: 0.8648 - val_loss: 0.4050 - val_accuracy: 0.8377
Epoch 79/100
614/614 [==============================] - 0s 410us/step - loss: 0.3617 -
accuracy: 0.8648 - val_loss: 0.4047 - val_accuracy: 0.8377
Epoch 80/100
614/614 [==============================] - 0s 351us/step - loss: 0.3616 -
accuracy: 0.8648 - val_loss: 0.4033 - val_accuracy: 0.8377
Epoch 81/100
614/614 [==============================] - 0s 326us/step - loss: 0.3613 -
accuracy: 0.8648 - val_loss: 0.4024 - val_accuracy: 0.8377
```

```
Epoch 82/100
614/614 [==============================] - 0s 319us/step - loss: 0.3613 -
accuracy: 0.8648 - val_loss: 0.4033 - val_accuracy: 0.8377
Epoch 83/100
614/614 [==============================] - 0s 241us/step - loss: 0.3611 -
accuracy: 0.8648 - val_loss: 0.4022 - val_accuracy: 0.8377
Epoch 84/100
614/614 [==============================] - 0s 241us/step - loss: 0.3610 -
accuracy: 0.8648 - val_loss: 0.4017 - val_accuracy: 0.8377
Epoch 85/100
614/614 [==============================] - 0s 287us/step - loss: 0.3610 -
accuracy: 0.8648 - val_loss: 0.4019 - val_accuracy: 0.8377
Epoch 86/100
614/614 [==============================] - 0s 287us/step - loss: 0.3607 -
accuracy: 0.8648 - val_loss: 0.4018 - val_accuracy: 0.8377
Epoch 87/100
614/614 [==============================] - 0s 267us/step - loss: 0.3606 -
accuracy: 0.8648 - val_loss: 0.4019 - val_accuracy: 0.8377
Epoch 88/100
614/614 [==============================] - 0s 247us/step - loss: 0.3606 -
accuracy: 0.8648 - val_loss: 0.4013 - val_accuracy: 0.8377
Epoch 89/100
614/614 [==============================] - 0s 260us/step - loss: 0.3605 -
accuracy: 0.8648 - val_loss: 0.4013 - val_accuracy: 0.8377
Epoch 90/100
614/614 [==============================] - 0s 345us/step - loss: 0.3605 -
accuracy: 0.8648 - val_loss: 0.4010 - val_accuracy: 0.8377
Epoch 91/100
614/614 [==============================] - 0s 267us/step - loss: 0.3605 -
accuracy: 0.8648 - val_loss: 0.4012 - val_accuracy: 0.8377
Epoch 92/100
614/614 [==============================] - 0s 358us/step - loss: 0.3603 -
accuracy: 0.8648 - val_loss: 0.4009 - val_accuracy: 0.8377
Epoch 93/100
614/614 [==============================] - 0s 319us/step - loss: 0.3602 -
accuracy: 0.8648 - val_loss: 0.4009 - val_accuracy: 0.8377
Epoch 94/100
614/614 [==============================] - 0s 254us/step - loss: 0.3603 -
accuracy: 0.8648 - val_loss: 0.4011 - val_accuracy: 0.8377
Epoch 95/100
614/614 [==============================] - 0s 267us/step - loss: 0.3602 -
accuracy: 0.8648 - val_loss: 0.4000 - val_accuracy: 0.8377
Epoch 96/100
614/614 [==============================] - 0s 306us/step - loss: 0.3602 -
accuracy: 0.8648 - val_loss: 0.4003 - val_accuracy: 0.8377
Epoch 97/100
614/614 [==============================] - 0s 267us/step - loss: 0.3601 -
accuracy: 0.8648 - val_loss: 0.3999 - val_accuracy: 0.8377
Epoch 98/100
614/614 [==============================] - 0s 300us/step - loss: 0.3600 -
accuracy: 0.8648 - val_loss: 0.4001 - val_accuracy: 0.8377
Epoch 99/100
614/614 [==============================] - 0s 293us/step - loss: 0.3600 -
accuracy: 0.8648 - val_loss: 0.3997 - val_accuracy: 0.8377
Epoch 100/100
614/614 [==============================] - 0s 267us/step - loss: 0.3599 -
accuracy: 0.8648 - val_loss: 0.4000 - val_accuracy: 0.8377
614/614 [==============================] - 0s 156us/step
[0.3596610827098452, 0.8648208379745483]
154/154 [==============================] - 0s 130us/step
[0.39995639664786203, 0.8376623392105103]
```

In [69]:

```python
history=pd.DataFrame(history.history)
history.head()
```

Out[69]:

	val_loss	val_accuracy	loss	accuracy
0	0.658483	0.636364	0.648352	0.654723
1	0.658554	0.636364	0.645580	0.654723
2	0.655434	0.636364	0.645212	0.654723
3	0.653578	0.636364	0.642875	0.654723
4	0.645471	0.636364	0.637925	0.654723

In [70]:

```python
y_pred=model.predict_classes(X_test)
score=confusion_matrix(y_test,y_pred)
print('Confusion_matrix \n ', score)
print('acurracy_score:' ,accuracy_score(y_test,y_pred))
```

```
Confusion_matrix
  [[82 16]
 [ 9 47]]
acurracy_score: 0.8376623376623377
```

In [71]:

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

```
              precision    recall  f1-score   support

           0       0.90      0.84      0.87        98
           1       0.75      0.84      0.79        56

    accuracy                           0.84       154
   macro avg       0.82      0.84      0.83       154
weighted avg       0.84      0.84      0.84       154
```

In [ ]:

In [72]:

```python
#Using KerasClassifier to run our  model
```

In [73]:

```python
def model_creation(activation='sigmoid',epochs=15):
    model=Sequential()
    model.add(Dense(256,input_shape=(8,),activation='relu'))
    model.add(Dense(128,activation='relu'))
    model.add(Dense(64,activation='relu'))
    model.add(Dense(16,activation='relu'))
    model.add(Dense(8,activation='relu'))
    model.add(Dense(2,activation='sigmoid'))
#model.add(Dropout(0.5))
    model.add(Dense(1,activation='sigmoid'))
    model.compile(Adagrad(lr=0.018),'binary_crossentropy',metrics=['accuracy'])
    return model
model=KerasClassifier(build_fn=model_creation,epochs=200)

model.fit(X_train,y_train)
pred=model.predict(X_test)
print(classification_report(y_test,pred))
```

```
Epoch 1/200
614/614 [==============================] - 1s 1ms/step - loss: 0.6147 - ac
curacy: 0.6889
Epoch 2/200
614/614 [==============================] - 0s 652us/step - loss: 0.5684 -
accuracy: 0.7850
Epoch 3/200
614/614 [==============================] - 0s 521us/step - loss: 0.5528 -
accuracy: 0.7818
Epoch 4/200
614/614 [==============================] - 0s 671us/step - loss: 0.5392 -
accuracy: 0.78660s - loss: 0.5462 - accuracy
Epoch 5/200
614/614 [==============================] - 0s 534us/step - loss: 0.5284 -
accuracy: 0.7964
Epoch 6/200
614/614 [==============================] - 0s 501us/step - loss: 0.5156 -
accuracy: 0.8176
Epoch 7/200
614/614 [==============================] - 0s 612us/step - loss: 0.5111 -
accuracy: 0.8208
Epoch 8/200
614/614 [==============================] - 0s 534us/step - loss: 0.5007 -
accuracy: 0.8274
Epoch 9/200
614/614 [==============================] - 0s 573us/step - loss: 0.4957 -
accuracy: 0.8274
Epoch 10/200
614/614 [==============================] - 0s 495us/step - loss: 0.4874 -
accuracy: 0.8339
Epoch 11/200
614/614 [==============================] - 0s 560us/step - loss: 0.4824 -
accuracy: 0.8322
Epoch 12/200
614/614 [==============================] - 0s 586us/step - loss: 0.4890 -
accuracy: 0.8160
Epoch 13/200
614/614 [==============================] - 0s 482us/step - loss: 0.4725 -
accuracy: 0.8436
Epoch 14/200
614/614 [==============================] - 0s 508us/step - loss: 0.4692 -
accuracy: 0.8420
Epoch 15/200
614/614 [==============================] - 0s 514us/step - loss: 0.4611 -
accuracy: 0.8469
Epoch 16/200
614/614 [==============================] - 0s 514us/step - loss: 0.4593 -
accuracy: 0.8550
Epoch 17/200
614/614 [==============================] - 0s 495us/step - loss: 0.4516 -
accuracy: 0.8485
Epoch 18/200
614/614 [==============================] - 0s 514us/step - loss: 0.4425 -
accuracy: 0.8632
Epoch 19/200
614/614 [==============================] - 0s 482us/step - loss: 0.4469 -
accuracy: 0.8567
Epoch 20/200
614/614 [==============================] - 0s 469us/step - loss: 0.4410 -
accuracy: 0.8648
Epoch 21/200
```

```
614/614 [==============================] - 0s 488us/step - loss: 0.4371 -
accuracy: 0.8697
Epoch 22/200
614/614 [==============================] - 0s 482us/step - loss: 0.4318 -
accuracy: 0.8697
Epoch 23/200
614/614 [==============================] - 0s 586us/step - loss: 0.4313 -
accuracy: 0.8632
Epoch 24/200
614/614 [==============================] - 0s 527us/step - loss: 0.4255 -
accuracy: 0.8730
Epoch 25/200
614/614 [==============================] - 0s 514us/step - loss: 0.4160 -
accuracy: 0.8811
Epoch 26/200
614/614 [==============================] - 0s 547us/step - loss: 0.4204 -
accuracy: 0.8746
Epoch 27/200
614/614 [==============================] - 0s 436us/step - loss: 0.4188 -
accuracy: 0.8730
Epoch 28/200
614/614 [==============================] - 0s 580us/step - loss: 0.4053 -
accuracy: 0.8860
Epoch 29/200
614/614 [==============================] - 0s 521us/step - loss: 0.4041 -
accuracy: 0.8860
Epoch 30/200
614/614 [==============================] - 0s 606us/step - loss: 0.4029 -
accuracy: 0.8844
Epoch 31/200
614/614 [==============================] - 0s 762us/step - loss: 0.3932 -
accuracy: 0.8958
Epoch 32/200
614/614 [==============================] - 0s 716us/step - loss: 0.3933 -
accuracy: 0.8909
Epoch 33/200
614/614 [==============================] - 0s 622us/step - loss: 0.4035 -
accuracy: 0.8779
Epoch 34/200
614/614 [==============================] - 0s 580us/step - loss: 0.3952 -
accuracy: 0.8795
Epoch 35/200
614/614 [==============================] - 0s 482us/step - loss: 0.3886 -
accuracy: 0.8909
Epoch 36/200
614/614 [==============================] - 0s 530us/step - loss: 0.3830 -
accuracy: 0.8925
Epoch 37/200
614/614 [==============================] - 0s 449us/step - loss: 0.3826 -
accuracy: 0.89090s - loss: 0.3825 - accuracy: 0.89
Epoch 38/200
614/614 [==============================] - 0s 443us/step - loss: 0.3722 -
accuracy: 0.9007
Epoch 39/200
614/614 [==============================] - 0s 521us/step - loss: 0.3715 -
accuracy: 0.9007
Epoch 40/200
614/614 [==============================] - 0s 482us/step - loss: 0.3651 -
accuracy: 0.9039
Epoch 41/200
614/614 [==============================] - 0s 449us/step - loss: 0.3579 -
```

```
accuracy: 0.9121
Epoch 42/200
614/614 [==============================] - 0s 554us/step - loss: 0.3573 -
accuracy: 0.9104
Epoch 43/200
614/614 [==============================] - 0s 456us/step - loss: 0.3525 -
accuracy: 0.9137
Epoch 44/200
614/614 [==============================] - 0s 580us/step - loss: 0.3501 -
accuracy: 0.9137
Epoch 45/200
614/614 [==============================] - 0s 541us/step - loss: 0.3475 -
accuracy: 0.9153
Epoch 46/200
614/614 [==============================] - 0s 475us/step - loss: 0.3459 -
accuracy: 0.9153
Epoch 47/200
614/614 [==============================] - 0s 475us/step - loss: 0.3438 -
accuracy: 0.91530s - loss: 0.3349 - accuracy:
Epoch 48/200
614/614 [==============================] - 0s 469us/step - loss: 0.3424 -
accuracy: 0.9153
Epoch 49/200
614/614 [==============================] - 0s 560us/step - loss: 0.3410 -
accuracy: 0.9153
Epoch 50/200
614/614 [==============================] - 0s 443us/step - loss: 0.3399 -
accuracy: 0.9153
Epoch 51/200
614/614 [==============================] - 0s 482us/step - loss: 0.3385 -
accuracy: 0.9153
Epoch 52/200
614/614 [==============================] - 0s 514us/step - loss: 0.3409 -
accuracy: 0.9121
Epoch 53/200
614/614 [==============================] - 0s 554us/step - loss: 0.3363 -
accuracy: 0.9153
Epoch 54/200
614/614 [==============================] - 0s 430us/step - loss: 0.3352 -
accuracy: 0.9153
Epoch 55/200
614/614 [==============================] - 0s 554us/step - loss: 0.3341 -
accuracy: 0.9153
Epoch 56/200
614/614 [==============================] - 0s 436us/step - loss: 0.3331 -
accuracy: 0.9153
Epoch 57/200
614/614 [==============================] - 0s 436us/step - loss: 0.3320 -
accuracy: 0.9153
Epoch 58/200
614/614 [==============================] - 0s 554us/step - loss: 0.3310 -
accuracy: 0.9153
Epoch 59/200
614/614 [==============================] - 0s 469us/step - loss: 0.3301 -
accuracy: 0.9153
Epoch 60/200
614/614 [==============================] - 0s 567us/step - loss: 0.3293 -
accuracy: 0.9153
Epoch 61/200
614/614 [==============================] - 0s 616us/step - loss: 0.3284 -
accuracy: 0.9153
```

```
Epoch 62/200
614/614 [==============================] - 0s 475us/step - loss: 0.3311 -
accuracy: 0.9121
Epoch 63/200
614/614 [==============================] - 0s 456us/step - loss: 0.3314 -
accuracy: 0.9088
Epoch 64/200
614/614 [==============================] - 0s 488us/step - loss: 0.3262 -
accuracy: 0.9153
Epoch 65/200
614/614 [==============================] - 0s 508us/step - loss: 0.3252 -
accuracy: 0.9153
Epoch 66/200
614/614 [==============================] - 0s 488us/step - loss: 0.3243 -
accuracy: 0.9153
Epoch 67/200
614/614 [==============================] - 0s 449us/step - loss: 0.3235 -
accuracy: 0.9153
Epoch 68/200
614/614 [==============================] - 0s 462us/step - loss: 0.3227 -
accuracy: 0.9153
Epoch 69/200
614/614 [==============================] - 0s 475us/step - loss: 0.3220 -
accuracy: 0.9153
Epoch 70/200
614/614 [==============================] - 0s 430us/step - loss: 0.3213 -
accuracy: 0.9153
Epoch 71/200
614/614 [==============================] - 0s 534us/step - loss: 0.3206 -
accuracy: 0.9153
Epoch 72/200
614/614 [==============================] - 0s 514us/step - loss: 0.3199 -
accuracy: 0.9153
Epoch 73/200
614/614 [==============================] - 0s 436us/step - loss: 0.3192 -
accuracy: 0.9153
Epoch 74/200
614/614 [==============================] - 0s 557us/step - loss: 0.3185 -
accuracy: 0.9153
Epoch 75/200
614/614 [==============================] - 0s 488us/step - loss: 0.3179 -
accuracy: 0.9153
Epoch 76/200
614/614 [==============================] - 0s 449us/step - loss: 0.3173 -
accuracy: 0.9153
Epoch 77/200
614/614 [==============================] - 0s 475us/step - loss: 0.3166 -
accuracy: 0.9153
Epoch 78/200
614/614 [==============================] - 0s 488us/step - loss: 0.3161 -
accuracy: 0.91530s - loss: 0.3090 - accuracy:
Epoch 79/200
614/614 [==============================] - 0s 456us/step - loss: 0.3155 -
accuracy: 0.91530s - loss: 0.3290 - accuracy: 0.90 - ETA: 0s - loss: 0.363
5 - accuracy:
Epoch 80/200
614/614 [==============================] - 0s 456us/step - loss: 0.3148 -
accuracy: 0.9153
Epoch 81/200
614/614 [==============================] - 0s 573us/step - loss: 0.3220 -
accuracy: 0.9104
```

```
Epoch 82/200
614/614 [==============================] - 0s 541us/step - loss: 0.3167 -
accuracy: 0.91370s - loss: 0.3269 - accuracy:
Epoch 83/200
614/614 [==============================] - 0s 638us/step - loss: 0.3218 -
accuracy: 0.9088
Epoch 84/200
614/614 [==============================] - 0s 495us/step - loss: 0.3265 -
accuracy: 0.9039
Epoch 85/200
614/614 [==============================] - 0s 495us/step - loss: 0.3321 -
accuracy: 0.9023
Epoch 86/200
614/614 [==============================] - 0s 534us/step - loss: 0.3126 -
accuracy: 0.9153
Epoch 87/200
614/614 [==============================] - 0s 501us/step - loss: 0.3160 -
accuracy: 0.9137
Epoch 88/200
614/614 [==============================] - 0s 501us/step - loss: 0.3124 -
accuracy: 0.9153
Epoch 89/200
614/614 [==============================] - 0s 462us/step - loss: 0.3087 -
accuracy: 0.9169
Epoch 90/200
614/614 [==============================] - 0s 514us/step - loss: 0.3082 -
accuracy: 0.9169
Epoch 91/200
614/614 [==============================] - 0s 508us/step - loss: 0.3077 -
accuracy: 0.9169
Epoch 92/200
614/614 [==============================] - 0s 541us/step - loss: 0.3073 -
accuracy: 0.9169
Epoch 93/200
614/614 [==============================] - 0s 508us/step - loss: 0.3068 -
accuracy: 0.9169
Epoch 94/200
614/614 [==============================] - 0s 534us/step - loss: 0.3064 -
accuracy: 0.9169
Epoch 95/200
614/614 [==============================] - 0s 482us/step - loss: 0.3060 -
accuracy: 0.9169
Epoch 96/200
614/614 [==============================] - 0s 567us/step - loss: 0.3055 -
accuracy: 0.9169
Epoch 97/200
614/614 [==============================] - 0s 482us/step - loss: 0.3051 -
accuracy: 0.9169
Epoch 98/200
614/614 [==============================] - 0s 488us/step - loss: 0.3047 -
accuracy: 0.9169
Epoch 99/200
614/614 [==============================] - 0s 572us/step - loss: 0.3043 -
accuracy: 0.9169
Epoch 100/200
614/614 [==============================] - 0s 449us/step - loss: 0.3039 -
accuracy: 0.9169
Epoch 101/200
614/614 [==============================] - 0s 482us/step - loss: 0.3035 -
accuracy: 0.9169
Epoch 102/200
```

```
614/614 [==============================] - 0s 488us/step - loss: 0.3031 -
accuracy: 0.9169
Epoch 103/200
614/614 [==============================] - 0s 436us/step - loss: 0.3027 -
accuracy: 0.9169
Epoch 104/200
614/614 [==============================] - 0s 456us/step - loss: 0.3023 -
accuracy: 0.91690s - loss: 0.2905 - accuracy: 0.
Epoch 105/200
614/614 [==============================] - 0s 501us/step - loss: 0.3019 -
accuracy: 0.9169
Epoch 106/200
614/614 [==============================] - 0s 514us/step - loss: 0.3016 -
accuracy: 0.91690s - loss: 0.3146 - accuracy:
Epoch 107/200
614/614 [==============================] - 0s 430us/step - loss: 0.3012 -
accuracy: 0.91690s - loss: 0.3388 - accuracy
Epoch 108/200
614/614 [==============================] - 0s 527us/step - loss: 0.3009 -
accuracy: 0.9169
Epoch 109/200
614/614 [==============================] - 0s 501us/step - loss: 0.3005 -
accuracy: 0.9169
Epoch 110/200
614/614 [==============================] - 0s 521us/step - loss: 0.3002 -
accuracy: 0.9169
Epoch 111/200
614/614 [==============================] - 0s 475us/step - loss: 0.2999 -
accuracy: 0.9169
Epoch 112/200
614/614 [==============================] - 0s 544us/step - loss: 0.2995 -
accuracy: 0.9169
Epoch 113/200
614/614 [==============================] - 0s 488us/step - loss: 0.2992 -
accuracy: 0.9169
Epoch 114/200
614/614 [==============================] - 0s 469us/step - loss: 0.2989 -
accuracy: 0.9169
Epoch 115/200
614/614 [==============================] - 0s 567us/step - loss: 0.2986 -
accuracy: 0.9169
Epoch 116/200
614/614 [==============================] - 0s 482us/step - loss: 0.2983 -
accuracy: 0.9169
Epoch 117/200
614/614 [==============================] - 0s 443us/step - loss: 0.2980 -
accuracy: 0.9169
Epoch 118/200
614/614 [==============================] - 0s 534us/step - loss: 0.2977 -
accuracy: 0.9169
Epoch 119/200
614/614 [==============================] - 0s 462us/step - loss: 0.2974 -
accuracy: 0.9169
Epoch 120/200
614/614 [==============================] - 0s 456us/step - loss: 0.2971 -
accuracy: 0.9169
Epoch 121/200
614/614 [==============================] - 0s 488us/step - loss: 0.2968 -
accuracy: 0.9169
Epoch 122/200
614/614 [==============================] - 0s 469us/step - loss: 0.2965 -
```

```
accuracy: 0.9169
Epoch 123/200
614/614 [==============================] - 0s 456us/step - loss: 0.2962 -
accuracy: 0.9169
Epoch 124/200
614/614 [==============================] - 0s 482us/step - loss: 0.2959 -
accuracy: 0.9169
Epoch 125/200
614/614 [==============================] - 0s 475us/step - loss: 0.2957 -
accuracy: 0.9169
Epoch 126/200
614/614 [==============================] - 0s 475us/step - loss: 0.2954 -
accuracy: 0.9169
Epoch 127/200
614/614 [==============================] - 0s 443us/step - loss: 0.2951 -
accuracy: 0.9169
Epoch 128/200
614/614 [==============================] - 0s 554us/step - loss: 0.2949 -
accuracy: 0.9169
Epoch 129/200
614/614 [==============================] - 0s 508us/step - loss: 0.2946 -
accuracy: 0.9169
Epoch 130/200
614/614 [==============================] - 0s 488us/step - loss: 0.2943 -
accuracy: 0.9169
Epoch 131/200
614/614 [==============================] - 0s 527us/step - loss: 0.2941 -
accuracy: 0.9169
Epoch 132/200
614/614 [==============================] - 0s 501us/step - loss: 0.2938 -
accuracy: 0.91690s - loss: 0.2853 - accuracy:
Epoch 133/200
614/614 [==============================] - 0s 423us/step - loss: 0.2936 -
accuracy: 0.9169
Epoch 134/200
614/614 [==============================] - 0s 541us/step - loss: 0.2934 -
accuracy: 0.91690s - loss: 0.2653 - accuracy
Epoch 135/200
614/614 [==============================] - 0s 475us/step - loss: 0.2932 -
accuracy: 0.9169
Epoch 136/200
614/614 [==============================] - 0s 423us/step - loss: 0.2930 -
accuracy: 0.9169
Epoch 137/200
614/614 [==============================] - 0s 498us/step - loss: 0.2927 -
accuracy: 0.9169
Epoch 138/200
614/614 [==============================] - 0s 482us/step - loss: 0.2925 -
accuracy: 0.9169
Epoch 139/200
614/614 [==============================] - 0s 495us/step - loss: 0.2923 -
accuracy: 0.9169
Epoch 140/200
614/614 [==============================] - 0s 417us/step - loss: 0.2921 -
accuracy: 0.9169
Epoch 141/200
614/614 [==============================] - 0s 547us/step - loss: 0.2919 -
accuracy: 0.9169
Epoch 142/200
614/614 [==============================] - 0s 495us/step - loss: 0.2916 -
accuracy: 0.9169
```

```
Epoch 143/200
614/614 [==============================] - 0s 527us/step - loss: 0.2914 -
accuracy: 0.9169
Epoch 144/200
614/614 [==============================] - 0s 547us/step - loss: 0.2912 -
accuracy: 0.9169
Epoch 145/200
614/614 [==============================] - 0s 482us/step - loss: 0.2910 -
accuracy: 0.9169
Epoch 146/200
614/614 [==============================] - 0s 462us/step - loss: 0.2908 -
accuracy: 0.9169
Epoch 147/200
614/614 [==============================] - 0s 560us/step - loss: 0.2906 -
accuracy: 0.9169
Epoch 148/200
614/614 [==============================] - 0s 475us/step - loss: 0.2904 -
accuracy: 0.9169
Epoch 149/200
614/614 [==============================] - 0s 456us/step - loss: 0.2902 -
accuracy: 0.9169
Epoch 150/200
614/614 [==============================] - 0s 487us/step - loss: 0.2900 -
accuracy: 0.9169
Epoch 151/200
614/614 [==============================] - 0s 443us/step - loss: 0.2898 -
accuracy: 0.9169
Epoch 152/200
614/614 [==============================] - 0s 482us/step - loss: 0.2896 -
accuracy: 0.91690s - loss: 0.2843 - accuracy:
Epoch 153/200
614/614 [==============================] - 0s 534us/step - loss: 0.2895 -
accuracy: 0.9169
Epoch 154/200
614/614 [==============================] - 0s 482us/step - loss: 0.2893 -
accuracy: 0.9169
Epoch 155/200
614/614 [==============================] - 0s 475us/step - loss: 0.2891 -
accuracy: 0.9169
Epoch 156/200
614/614 [==============================] - 0s 482us/step - loss: 0.2890 -
accuracy: 0.9169
Epoch 157/200
614/614 [==============================] - 0s 599us/step - loss: 0.2888 -
accuracy: 0.9169
Epoch 158/200
614/614 [==============================] - 0s 482us/step - loss: 0.2886 -
accuracy: 0.9169
Epoch 159/200
614/614 [==============================] - 0s 456us/step - loss: 0.2884 -
accuracy: 0.9169
Epoch 160/200
614/614 [==============================] - 0s 528us/step - loss: 0.2882 -
accuracy: 0.9169
Epoch 161/200
614/614 [==============================] - 1s 1ms/step - loss: 0.2881 - ac
curacy: 0.9169
Epoch 162/200
614/614 [==============================] - 1s 1ms/step - loss: 0.2879 - ac
curacy: 0.9169
Epoch 163/200
```

```
614/614 [==============================] - 1s 2ms/step - loss: 0.2877 - ac
curacy: 0.9169
Epoch 164/200
614/614 [==============================] - 0s 814us/step - loss: 0.2876 -
accuracy: 0.9169
Epoch 165/200
614/614 [==============================] - 1s 1ms/step - loss: 0.2874 - ac
curacy: 0.9169
Epoch 166/200
614/614 [==============================] - 0s 737us/step - loss: 0.2873 -
accuracy: 0.9169
Epoch 167/200
614/614 [==============================] - 0s 794us/step - loss: 0.2871 -
accuracy: 0.9169
Epoch 168/200
614/614 [==============================] - 0s 703us/step - loss: 0.2870 -
accuracy: 0.9169
Epoch 169/200
614/614 [==============================] - 0s 567us/step - loss: 0.2868 -
accuracy: 0.9169
Epoch 170/200
614/614 [==============================] - 0s 436us/step - loss: 0.2867 -
accuracy: 0.9169
Epoch 171/200
614/614 [==============================] - 0s 534us/step - loss: 0.2865 -
accuracy: 0.9169
Epoch 172/200
614/614 [==============================] - 0s 580us/step - loss: 0.2863 -
accuracy: 0.91690s - loss: 0.3127 - accuracy:
Epoch 173/200
614/614 [==============================] - 0s 651us/step - loss: 0.2862 -
accuracy: 0.9169
Epoch 174/200
614/614 [==============================] - 0s 703us/step - loss: 0.2861 -
accuracy: 0.9169
Epoch 175/200
614/614 [==============================] - 0s 541us/step - loss: 0.2859 -
accuracy: 0.9169
Epoch 176/200
614/614 [==============================] - 0s 533us/step - loss: 0.2858 -
accuracy: 0.9169
Epoch 177/200
614/614 [==============================] - 0s 593us/step - loss: 0.2857 -
accuracy: 0.9169
Epoch 178/200
614/614 [==============================] - 0s 690us/step - loss: 0.2855 -
accuracy: 0.9169
Epoch 179/200
614/614 [==============================] - 0s 697us/step - loss: 0.2854 -
accuracy: 0.9169
Epoch 180/200
614/614 [==============================] - 0s 573us/step - loss: 0.2852 -
accuracy: 0.9169
Epoch 181/200
614/614 [==============================] - 0s 677us/step - loss: 0.2851 -
accuracy: 0.9169
Epoch 182/200
614/614 [==============================] - 0s 534us/step - loss: 0.2850 -
accuracy: 0.9169
Epoch 183/200
614/614 [==============================] - 0s 664us/step - loss: 0.2849 -
```

```
accuracy: 0.9169
Epoch 184/200
614/614 [==============================] - 0s 710us/step - loss: 0.2847 -
accuracy: 0.9169
Epoch 185/200
614/614 [==============================] - 0s 573us/step - loss: 0.2846 -
accuracy: 0.9169
Epoch 186/200
614/614 [==============================] - 0s 756us/step - loss: 0.2845 -
accuracy: 0.9169
Epoch 187/200
614/614 [==============================] - 0s 801us/step - loss: 0.2844 -
accuracy: 0.9169
Epoch 188/200
614/614 [==============================] - 0s 671us/step - loss: 0.2842 -
accuracy: 0.9169
Epoch 189/200
614/614 [==============================] - 0s 742us/step - loss: 0.2841 -
accuracy: 0.9169
Epoch 190/200
614/614 [==============================] - 0s 469us/step - loss: 0.2840 -
accuracy: 0.9169
Epoch 191/200
614/614 [==============================] - 0s 742us/step - loss: 0.2839 -
accuracy: 0.9169
Epoch 192/200
614/614 [==============================] - 0s 723us/step - loss: 0.2838 -
accuracy: 0.9169
Epoch 193/200
614/614 [==============================] - 0s 599us/step - loss: 0.2837 -
accuracy: 0.9169
Epoch 194/200
614/614 [==============================] - 0s 742us/step - loss: 0.2836 -
accuracy: 0.9169
Epoch 195/200
614/614 [==============================] - 0s 768us/step - loss: 0.2835 -
accuracy: 0.9169
Epoch 196/200
614/614 [==============================] - 1s 925us/step - loss: 0.2833 -
accuracy: 0.9169
Epoch 197/200
614/614 [==============================] - 1s 983us/step - loss: 0.2832 -
accuracy: 0.9169
Epoch 198/200
614/614 [==============================] - 0s 612us/step - loss: 0.2831 -
accuracy: 0.9169
Epoch 199/200
614/614 [==============================] - 0s 664us/step - loss: 0.2830 -
accuracy: 0.9169
Epoch 200/200
614/614 [==============================] - 0s 651us/step - loss: 0.2829 -
accuracy: 0.9169
              precision    recall  f1-score   support

           0       0.90      0.78      0.84        98
           1       0.69      0.86      0.76        56

    accuracy                           0.81       154
   macro avg       0.80      0.82      0.80       154
weighted avg       0.83      0.81      0.81       154
```

In [ ]:

```python
#Cross vaidation on the model
cv=KFold(n_splits=5,shuffle=True)
scores=cross_val_score(model,X,y,cv=cv,verbose=0)
```

```
Epoch 1/200
614/614 [==============================] - 1s 2ms/step - loss: 0.6003 - ac
curacy: 0.7052
Epoch 2/200
614/614 [==============================] - 0s 699us/step - loss: 0.5369 -
accuracy: 0.7769
Epoch 3/200
614/614 [==============================] - 0s 788us/step - loss: 0.5184 -
accuracy: 0.7948
Epoch 4/200
614/614 [==============================] - 1s 944us/step - loss: 0.5048 -
accuracy: 0.7980
Epoch 5/200
614/614 [==============================] - 0s 651us/step - loss: 0.4849 -
accuracy: 0.8225
Epoch 6/200
614/614 [==============================] - 0s 501us/step - loss: 0.4713 -
accuracy: 0.8339
Epoch 7/200
614/614 [==============================] - 0s 632us/step - loss: 0.4636 -
accuracy: 0.8208
Epoch 8/200
614/614 [==============================] - 0s 527us/step - loss: 0.4507 -
accuracy: 0.8274
Epoch 9/200
614/614 [==============================] - 0s 632us/step - loss: 0.4420 -
accuracy: 0.8453
Epoch 10/200
614/614 [==============================] - 0s 508us/step - loss: 0.4281 -
accuracy: 0.8583
Epoch 11/200
614/614 [==============================] - 0s 469us/step - loss: 0.4152 -
accuracy: 0.8730
Epoch 12/200
614/614 [==============================] - 0s 488us/step - loss: 0.4052 -
accuracy: 0.8746
Epoch 13/200
614/614 [==============================] - 0s 718us/step - loss: 0.3966 -
accuracy: 0.87790s - loss: 0.3854 - accura - ETA: 0s - loss: 0.3972 - accu
racy: 0.87
Epoch 14/200
614/614 [==============================] - 0s 651us/step - loss: 0.3789 -
accuracy: 0.8990
Epoch 15/200
614/614 [==============================] - 1s 873us/step - loss: 0.3724 -
accuracy: 0.9039
Epoch 16/200
614/614 [==============================] - 0s 788us/step - loss: 0.3680 -
accuracy: 0.9039
Epoch 17/200
614/614 [==============================] - 0s 749us/step - loss: 0.3593 -
accuracy: 0.90880s - loss: 0.3297 - accuracy: 0. - ETA: 0s - loss: 0.3529
- accuracy: 0.
Epoch 18/200
614/614 [==============================] - 0s 658us/step - loss: 0.3553 -
accuracy: 0.9088
Epoch 19/200
614/614 [==============================] - 0s 762us/step - loss: 0.3581 -
accuracy: 0.90070s - loss: 0.3435 - accu
Epoch 20/200
614/614 [==============================] - 0s 736us/step - loss: 0.3482 -
```

```
    accuracy: 0.91210s - loss: 0.3529 - accuracy
    Epoch 21/200
    614/614 [==============================] - 0s 658us/step - loss: 0.3386 -
    accuracy: 0.9202
    Epoch 22/200
    614/614 [==============================] - 1s 1ms/step - loss: 0.3398 - ac
    curacy: 0.9137
    Epoch 23/200
    614/614 [==============================] - 0s 723us/step - loss: 0.3372 -
    accuracy: 0.9104
    Epoch 24/200
    614/614 [==============================] - 0s 586us/step - loss: 0.3474 -
    accuracy: 0.9072
    Epoch 25/200
    614/614 [==============================] - 0s 554us/step - loss: 0.3329 -
    accuracy: 0.9104
    Epoch 26/200
    614/614 [==============================] - 0s 697us/step - loss: 0.3314 -
    accuracy: 0.9121
    Epoch 27/200
    614/614 [==============================] - 0s 554us/step - loss: 0.3342 -
    accuracy: 0.9121
    Epoch 28/200
    614/614 [==============================] - 0s 723us/step - loss: 0.3202 -
    accuracy: 0.92180s - loss: 0.3703 - accu
    Epoch 29/200
    614/614 [==============================] - 0s 710us/step - loss: 0.3179 -
    accuracy: 0.9235
    Epoch 30/200
    614/614 [==============================] - 0s 593us/step - loss: 0.3103 -
    accuracy: 0.92670s - loss: 0.3571 - accura
    Epoch 31/200
    614/614 [==============================] - 0s 606us/step - loss: 0.3062 -
    accuracy: 0.9283
    Epoch 32/200
    614/614 [==============================] - 0s 469us/step - loss: 0.3040 -
    accuracy: 0.9316
    Epoch 33/200
    614/614 [==============================] - 0s 664us/step - loss: 0.3013 -
    accuracy: 0.9316
    Epoch 34/200
    614/614 [==============================] - 0s 456us/step - loss: 0.3009 -
    accuracy: 0.9283
    Epoch 35/200
    614/614 [==============================] - 0s 560us/step - loss: 0.2997 -
    accuracy: 0.9300
    Epoch 36/200
    614/614 [==============================] - 0s 729us/step - loss: 0.2966 -
    accuracy: 0.9316
    Epoch 37/200
    614/614 [==============================] - 0s 534us/step - loss: 0.2958 -
    accuracy: 0.9316
    Epoch 38/200
    614/614 [==============================] - 0s 528us/step - loss: 0.2930 -
    accuracy: 0.9316
    Epoch 39/200
    614/614 [==============================] - 0s 599us/step - loss: 0.2915 -
    accuracy: 0.9316
    Epoch 40/200
    614/614 [==============================] - 0s 554us/step - loss: 0.2900 -
    accuracy: 0.9316
```

```
Epoch 41/200
614/614 [==============================] - 0s 449us/step - loss: 0.2887 -
accuracy: 0.9316
Epoch 42/200
614/614 [==============================] - 0s 661us/step - loss: 0.2983 -
accuracy: 0.9202
Epoch 43/200
614/614 [==============================] - 0s 456us/step - loss: 0.2931 -
accuracy: 0.9251
Epoch 44/200
614/614 [==============================] - 0s 554us/step - loss: 0.2881 -
accuracy: 0.93000s - loss: 0.2786 - accuracy: 0.
Epoch 45/200
614/614 [==============================] - 0s 554us/step - loss: 0.2844 -
accuracy: 0.9316
Epoch 46/200
614/614 [==============================] - 0s 547us/step - loss: 0.2834 -
accuracy: 0.9316
Epoch 47/200
614/614 [==============================] - 0s 729us/step - loss: 0.2824 -
accuracy: 0.9316
Epoch 48/200
614/614 [==============================] - 0s 462us/step - loss: 0.2805 -
accuracy: 0.9316
Epoch 49/200
614/614 [==============================] - 0s 710us/step - loss: 0.2820 -
accuracy: 0.9283
Epoch 50/200
614/614 [==============================] - 0s 664us/step - loss: 0.2853 -
accuracy: 0.92670s - loss: 0.2756 - accuracy
Epoch 51/200
614/614 [==============================] - 0s 619us/step - loss: 0.2784 -
accuracy: 0.9332
Epoch 52/200
614/614 [==============================] - 0s 508us/step - loss: 0.2762 -
accuracy: 0.9332
Epoch 53/200
614/614 [==============================] - 0s 514us/step - loss: 0.2754 -
accuracy: 0.9332
Epoch 54/200
614/614 [==============================] - 0s 534us/step - loss: 0.2744 -
accuracy: 0.9332
Epoch 55/200
614/614 [==============================] - 1s 1ms/step - loss: 0.2735 - ac
curacy: 0.9332
Epoch 56/200
614/614 [==============================] - 0s 677us/step - loss: 0.2730 -
accuracy: 0.9332
Epoch 57/200
614/614 [==============================] - 1s 1ms/step - loss: 0.2719 - ac
curacy: 0.9332
Epoch 58/200
614/614 [==============================] - 1s 1ms/step - loss: 0.2716 - ac
curacy: 0.9332: 0s - loss: 0.2640 - accu
Epoch 59/200
614/614 [==============================] - ETA: 0s - loss: 0.2719 - accura
cy: 0.93 - 0s 781us/step - loss: 0.2706 - accuracy: 0.9332
Epoch 60/200
614/614 [==============================] - 0s 716us/step - loss: 0.2699 -
accuracy: 0.9332
Epoch 61/200
```

```
614/614 [==============================] - 0s 612us/step - loss: 0.2682 -
accuracy: 0.9365
Epoch 62/200
614/614 [==============================] - 0s 430us/step - loss: 0.2670 -
accuracy: 0.9349
Epoch 63/200
614/614 [==============================] - 0s 521us/step - loss: 0.2675 -
accuracy: 0.9332
Epoch 64/200
614/614 [==============================] - 0s 501us/step - loss: 0.2651 -
accuracy: 0.9349
Epoch 65/200
614/614 [==============================] - 0s 580us/step - loss: 0.2633 -
accuracy: 0.9381
Epoch 66/200
614/614 [==============================] - 0s 563us/step - loss: 0.2647 -
accuracy: 0.9365
Epoch 67/200
614/614 [==============================] - 0s 527us/step - loss: 0.2626 -
accuracy: 0.9365
Epoch 68/200
614/614 [==============================] - 0s 528us/step - loss: 0.2613 -
accuracy: 0.9365
Epoch 69/200
614/614 [==============================] - 0s 619us/step - loss: 0.2616 -
accuracy: 0.9381
Epoch 70/200
614/614 [==============================] - 0s 560us/step - loss: 0.2598 -
accuracy: 0.9381
Epoch 71/200
614/614 [==============================] - 0s 449us/step - loss: 0.2590 -
accuracy: 0.9381
Epoch 72/200
614/614 [==============================] - 0s 535us/step - loss: 0.2582 -
accuracy: 0.9381
Epoch 73/200
614/614 [==============================] - 0s 449us/step - loss: 0.2575 -
accuracy: 0.9381
Epoch 74/200
614/614 [==============================] - 0s 462us/step - loss: 0.2571 -
accuracy: 0.9381
Epoch 75/200
614/614 [==============================] - 0s 541us/step - loss: 0.2566 -
accuracy: 0.9381
Epoch 76/200
614/614 [==============================] - 0s 436us/step - loss: 0.2560 -
accuracy: 0.9381
Epoch 77/200
614/614 [==============================] - 0s 625us/step - loss: 0.2554 -
accuracy: 0.9381
Epoch 78/200
614/614 [==============================] - 0s 580us/step - loss: 0.2550 -
accuracy: 0.9381
Epoch 79/200
614/614 [==============================] - 0s 606us/step - loss: 0.2544 -
accuracy: 0.9381
Epoch 80/200
614/614 [==============================] - 0s 495us/step - loss: 0.2539 -
accuracy: 0.9381
Epoch 81/200
614/614 [==============================] - 0s 625us/step - loss: 0.2531 -
```

```
  accuracy: 0.9381
  Epoch 82/200
  614/614 [==============================] - 0s 501us/step - loss: 0.2531 -
  accuracy: 0.9381
  Epoch 83/200
  614/614 [==============================] - 0s 648us/step - loss: 0.2522 -
  accuracy: 0.9381
  Epoch 84/200
  614/614 [==============================] - 0s 534us/step - loss: 0.2517 -
  accuracy: 0.9381
  Epoch 85/200
  614/614 [==============================] - 0s 534us/step - loss: 0.2514 -
  accuracy: 0.9381
  Epoch 86/200
  614/614 [==============================] - 0s 527us/step - loss: 0.2509 -
  accuracy: 0.9381
  Epoch 87/200
  614/614 [==============================] - 0s 462us/step - loss: 0.2504 -
  accuracy: 0.9381
  Epoch 88/200
  614/614 [==============================] - 0s 469us/step - loss: 0.2500 -
  accuracy: 0.9381
  Epoch 89/200
  614/614 [==============================] - 0s 632us/step - loss: 0.2496 -
  accuracy: 0.9381
  Epoch 90/200
  614/614 [==============================] - 0s 449us/step - loss: 0.2492 -
  accuracy: 0.9381
  Epoch 91/200
  614/614 [==============================] - 0s 456us/step - loss: 0.2494 -
  accuracy: 0.9381
  Epoch 92/200
  614/614 [==============================] - 0s 664us/step - loss: 0.2486 -
  accuracy: 0.9381
  Epoch 93/200
  614/614 [==============================] - 0s 567us/step - loss: 0.2483 -
  accuracy: 0.9381
  Epoch 94/200
  614/614 [==============================] - 0s 599us/step - loss: 0.2479 -
  accuracy: 0.9381
  Epoch 95/200
  614/614 [==============================] - 0s 668us/step - loss: 0.2475 -
  accuracy: 0.9381
  Epoch 96/200
  614/614 [==============================] - 0s 723us/step - loss: 0.2471 -
  accuracy: 0.9381
  Epoch 97/200
  614/614 [==============================] - 0s 560us/step - loss: 0.2468 -
  accuracy: 0.9381
  Epoch 98/200
  614/614 [==============================] - 0s 449us/step - loss: 0.2465 -
  accuracy: 0.9381
  Epoch 99/200
  614/614 [==============================] - 0s 658us/step - loss: 0.2462 -
  accuracy: 0.9381
  Epoch 100/200
  614/614 [==============================] - 0s 677us/step - loss: 0.2459 -
  accuracy: 0.9381
  Epoch 101/200
  614/614 [==============================] - 0s 632us/step - loss: 0.2461 -
  accuracy: 0.9381
```

```
Epoch 102/200
614/614 [==============================] - 0s 482us/step - loss: 0.2459 -
accuracy: 0.9365
Epoch 103/200
614/614 [==============================] - 0s 560us/step - loss: 0.2449 -
accuracy: 0.93810s - loss: 0.2511 - accura
Epoch 104/200
614/614 [==============================] - 0s 567us/step - loss: 0.2439 -
accuracy: 0.9397
Epoch 105/200
614/614 [==============================] - 0s 687us/step - loss: 0.2435 -
accuracy: 0.9397
Epoch 106/200
614/614 [==============================] - 0s 475us/step - loss: 0.2430 -
accuracy: 0.9397
Epoch 107/200
614/614 [==============================] - 0s 658us/step - loss: 0.2425 -
accuracy: 0.93970s - loss: 0.2524 - accuracy
Epoch 108/200
614/614 [==============================] - 0s 573us/step - loss: 0.2418 -
accuracy: 0.9397
Epoch 109/200
614/614 [==============================] - 0s 625us/step - loss: 0.2416 -
accuracy: 0.9397
Epoch 110/200
614/614 [==============================] - 0s 521us/step - loss: 0.2412 -
accuracy: 0.9397
Epoch 111/200
614/614 [==============================] - 0s 632us/step - loss: 0.2409 -
accuracy: 0.9397
Epoch 112/200
614/614 [==============================] - 0s 475us/step - loss: 0.2407 -
accuracy: 0.9397
Epoch 113/200
614/614 [==============================] - 0s 528us/step - loss: 0.2404 -
accuracy: 0.9397
Epoch 114/200
614/614 [==============================] - 0s 567us/step - loss: 0.2402 -
accuracy: 0.9397
Epoch 115/200
614/614 [==============================] - 0s 528us/step - loss: 0.2399 -
accuracy: 0.9397
Epoch 116/200
614/614 [==============================] - 0s 524us/step - loss: 0.2397 -
accuracy: 0.9397
Epoch 117/200
614/614 [==============================] - 0s 768us/step - loss: 0.2394 -
accuracy: 0.9397
Epoch 118/200
614/614 [==============================] - 0s 736us/step - loss: 0.2392 -
accuracy: 0.93970s - loss: 0.2388 - ac
Epoch 119/200
614/614 [==============================] - 0s 632us/step - loss: 0.2390 -
accuracy: 0.9397
Epoch 120/200
614/614 [==============================] - 0s 527us/step - loss: 0.2387 -
accuracy: 0.9397
Epoch 121/200
614/614 [==============================] - ETA: 0s - loss: 0.2457 - accura
cy: 0.93 - 0s 580us/step - loss: 0.2385 - accuracy: 0.9397
Epoch 122/200
```

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614/614 [==============================] - 0s 729us/step - loss: 0.2383 -
accuracy: 0.9397
Epoch 123/200
614/614 [==============================] - 0s 508us/step - loss: 0.2381 -
accuracy: 0.9397
Epoch 124/200
614/614 [==============================] - 0s 554us/step - loss: 0.2379 -
accuracy: 0.93970s - loss: 0.2342 - accuracy: 0.
Epoch 125/200
614/614 [==============================] - 0s 580us/step - loss: 0.2377 -
accuracy: 0.9397
Epoch 126/200
614/614 [==============================] - 0s 544us/step - loss: 0.2375 -
accuracy: 0.9397
Epoch 127/200
614/614 [==============================] - 0s 534us/step - loss: 0.2373 -
accuracy: 0.9397
Epoch 128/200
614/614 [==============================] - 0s 436us/step - loss: 0.2371 -
accuracy: 0.9397
Epoch 129/200
614/614 [==============================] - 0s 443us/step - loss: 0.2369 -
accuracy: 0.9397
Epoch 130/200
614/614 [==============================] - 0s 521us/step - loss: 0.2367 -
accuracy: 0.9397
Epoch 131/200
614/614 [==============================] - 0s 619us/step - loss: 0.2365 -
accuracy: 0.9397
Epoch 132/200
614/614 [==============================] - 0s 462us/step - loss: 0.2364 -
accuracy: 0.9397
Epoch 133/200
614/614 [==============================] - 0s 534us/step - loss: 0.2362 -
accuracy: 0.9397
Epoch 134/200
614/614 [==============================] - 0s 482us/step - loss: 0.2361 -
accuracy: 0.9397
Epoch 135/200
614/614 [==============================] - 0s 449us/step - loss: 0.2359 -
accuracy: 0.9397
Epoch 136/200
614/614 [==============================] - 0s 527us/step - loss: 0.2357 -
accuracy: 0.9397
Epoch 137/200
614/614 [==============================] - 0s 462us/step - loss: 0.2355 -
accuracy: 0.9397
Epoch 138/200
614/614 [==============================] - 0s 488us/step - loss: 0.2353 -
accuracy: 0.9397
Epoch 139/200
614/614 [==============================] - 0s 603us/step - loss: 0.2352 -
accuracy: 0.9397
Epoch 140/200
614/614 [==============================] - 0s 462us/step - loss: 0.2350 -
accuracy: 0.9397
Epoch 141/200
614/614 [==============================] - 0s 606us/step - loss: 0.2348 -
accuracy: 0.9397
Epoch 142/200
614/614 [==============================] - 0s 677us/step - loss: 0.2347 -
```

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accuracy: 0.9397
Epoch 143/200
614/614 [==============================] - 0s 560us/step - loss: 0.2345 -
accuracy: 0.9397
Epoch 144/200
614/614 [==============================] - 0s 462us/step - loss: 0.2343 -
accuracy: 0.9397
Epoch 145/200
614/614 [==============================] - 0s 567us/step - loss: 0.2342 -
accuracy: 0.93970s - loss: 0.2386 - accuracy: 0.93
Epoch 146/200
614/614 [==============================] - 0s 521us/step - loss: 0.2340 -
accuracy: 0.9397
Epoch 147/200
614/614 [==============================] - 0s 501us/step - loss: 0.2339 -
accuracy: 0.9397
Epoch 148/200
614/614 [==============================] - 0s 684us/step - loss: 0.2338 -
accuracy: 0.9397
Epoch 149/200
614/614 [==============================] - 0s 762us/step - loss: 0.2336 -
accuracy: 0.9397
Epoch 150/200
614/614 [==============================] - 0s 595us/step - loss: 0.2335 -
accuracy: 0.9397
Epoch 151/200
614/614 [==============================] - 0s 527us/step - loss: 0.2333 -
accuracy: 0.9397
Epoch 152/200
614/614 [==============================] - 0s 456us/step - loss: 0.2332 -
accuracy: 0.9397
Epoch 153/200
614/614 [==============================] - 0s 677us/step - loss: 0.2331 -
accuracy: 0.9397
Epoch 154/200
614/614 [==============================] - 0s 475us/step - loss: 0.2329 -
accuracy: 0.9397
Epoch 155/200
614/614 [==============================] - 0s 449us/step - loss: 0.2328 -
accuracy: 0.9397
Epoch 156/200
614/614 [==============================] - 0s 599us/step - loss: 0.2326 -
accuracy: 0.9397
Epoch 157/200
614/614 [==============================] - 0s 527us/step - loss: 0.2325 -
accuracy: 0.93970s - loss: 0.2162 - accuracy: 0.94
Epoch 158/200
614/614 [==============================] - 0s 462us/step - loss: 0.2324 -
accuracy: 0.9397
Epoch 159/200
614/614 [==============================] - 0s 567us/step - loss: 0.2323 -
accuracy: 0.9397
Epoch 160/200
614/614 [==============================] - 0s 632us/step - loss: 0.2321 -
accuracy: 0.93970s - loss: 0.2420 - accuracy:
Epoch 161/200
614/614 [==============================] - 0s 621us/step - loss: 0.2320 -
accuracy: 0.9397
Epoch 162/200
614/614 [==============================] - 0s 554us/step - loss: 0.2319 -
accuracy: 0.9397
```

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Epoch 163/200
614/614 [==============================] - 0s 475us/step - loss: 0.2317 -
accuracy: 0.9397
Epoch 164/200
614/614 [==============================] - 0s 462us/step - loss: 0.2316 -
accuracy: 0.93970s - loss: 0.2393 - accuracy: 0.
Epoch 165/200
614/614 [==============================] - 0s 547us/step - loss: 0.2315 -
accuracy: 0.9397
Epoch 166/200
614/614 [==============================] - 0s 469us/step - loss: 0.2314 -
accuracy: 0.9397
Epoch 167/200
614/614 [==============================] - 0s 495us/step - loss: 0.2313 -
accuracy: 0.9397
Epoch 168/200
614/614 [==============================] - 0s 527us/step - loss: 0.2311 -
accuracy: 0.9397
Epoch 169/200
614/614 [==============================] - 0s 443us/step - loss: 0.2310 -
accuracy: 0.9397
Epoch 170/200
614/614 [==============================] - 0s 469us/step - loss: 0.2309 -
accuracy: 0.9397
Epoch 171/200
614/614 [==============================] - 0s 547us/step - loss: 0.2308 -
accuracy: 0.9397
Epoch 172/200
614/614 [==============================] - 0s 462us/step - loss: 0.2307 -
accuracy: 0.9397
Epoch 173/200
614/614 [==============================] - 0s 475us/step - loss: 0.2306 -
accuracy: 0.9397
Epoch 174/200
614/614 [==============================] - 0s 572us/step - loss: 0.2305 -
accuracy: 0.9397
Epoch 175/200
614/614 [==============================] - 0s 514us/step - loss: 0.2304 -
accuracy: 0.9397
Epoch 176/200
614/614 [==============================] - 0s 671us/step - loss: 0.2303 -
accuracy: 0.93970s - loss: 0.2322 - accuracy: 0.93
Epoch 177/200
614/614 [==============================] - 0s 664us/step - loss: 0.2302 -
accuracy: 0.9397
Epoch 178/200
614/614 [==============================] - 0s 534us/step - loss: 0.2301 -
accuracy: 0.9397
Epoch 179/200
614/614 [==============================] - 0s 541us/step - loss: 0.2300 -
accuracy: 0.93970s - loss: 0.2266 - accuracy:
Epoch 180/200
614/614 [==============================] - 0s 599us/step - loss: 0.2299 -
accuracy: 0.9397
Epoch 181/200
614/614 [==============================] - 0s 645us/step - loss: 0.2298 -
accuracy: 0.9397
Epoch 182/200
614/614 [==============================] - 0s 710us/step - loss: 0.2297 -
accuracy: 0.93970s - loss: 0.2282 - accuracy: 0.94
Epoch 183/200
```

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614/614 [==============================] - 0s 567us/step - loss: 0.2296 -
accuracy: 0.9397
Epoch 184/200
614/614 [==============================] - 0s 462us/step - loss: 0.2295 -
accuracy: 0.9397
Epoch 185/200
614/614 [==============================] - 0s 641us/step - loss: 0.2294 -
accuracy: 0.9397
Epoch 186/200
614/614 [==============================] - 0s 462us/step - loss: 0.2293 -
accuracy: 0.9397
Epoch 187/200
614/614 [==============================] - 0s 567us/step - loss: 0.2292 -
accuracy: 0.9397
Epoch 188/200
614/614 [==============================] - 0s 658us/step - loss: 0.2291 -
accuracy: 0.93970s - loss: 0.2431 - accura
Epoch 189/200
614/614 [==============================] - 0s 488us/step - loss: 0.2290 -
accuracy: 0.93970s - loss: 0.2111 - accuracy:
Epoch 190/200
614/614 [==============================] - 0s 469us/step - loss: 0.2289 -
accuracy: 0.9397
Epoch 191/200
614/614 [==============================] - 0s 541us/step - loss: 0.2288 -
accuracy: 0.9397
Epoch 192/200
614/614 [==============================] - 0s 554us/step - loss: 0.2287 -
accuracy: 0.9397
Epoch 193/200
614/614 [==============================] - 0s 495us/step - loss: 0.2286 -
accuracy: 0.9397
Epoch 194/200
614/614 [==============================] - 0s 703us/step - loss: 0.2285 -
accuracy: 0.9397
Epoch 195/200
614/614 [==============================] - 0s 573us/step - loss: 0.2284 -
accuracy: 0.9397
Epoch 196/200
614/614 [==============================] - 0s 700us/step - loss: 0.2284 -
accuracy: 0.9397
Epoch 197/200
614/614 [==============================] - 0s 599us/step - loss: 0.2283 -
accuracy: 0.9397
Epoch 198/200
614/614 [==============================] - 0s 586us/step - loss: 0.2282 -
accuracy: 0.9397
Epoch 199/200
614/614 [==============================] - 0s 521us/step - loss: 0.2281 -
accuracy: 0.9397
Epoch 200/200
614/614 [==============================] - 0s 488us/step - loss: 0.2280 -
accuracy: 0.9397
154/154 [==============================] - 0s 831us/step
Epoch 1/200
614/614 [==============================] - 1s 2ms/step - loss: 0.5678 - ac
curacy: 0.7182
Epoch 2/200
614/614 [==============================] - 0s 606us/step - loss: 0.5212 -
accuracy: 0.7606
Epoch 3/200
```

```
614/614 [==============================] - 0s 671us/step - loss: 0.5066 -
accuracy: 0.7850
Epoch 4/200
614/614 [==============================] - 0s 599us/step - loss: 0.4885 -
accuracy: 0.8078
Epoch 5/200
614/614 [==============================] - 1s 1ms/step - loss: 0.4828 - ac
curacy: 0.8127
Epoch 6/200
614/614 [==============================] - 0s 755us/step - loss: 0.4680 -
accuracy: 0.8192
Epoch 7/200
614/614 [==============================] - 0s 475us/step - loss: 0.4592 -
accuracy: 0.8339
Epoch 8/200
614/614 [==============================] - 0s 619us/step - loss: 0.4512 -
accuracy: 0.8371
Epoch 9/200
614/614 [==============================] - 0s 716us/step - loss: 0.4432 -
accuracy: 0.8404
Epoch 10/200
614/614 [==============================] - 0s 554us/step - loss: 0.4386 -
accuracy: 0.8420
Epoch 11/200
614/614 [==============================] - 0s 677us/step - loss: 0.4376 -
accuracy: 0.8404
Epoch 12/200
614/614 [==============================] - 0s 554us/step - loss: 0.4523 -
accuracy: 0.8225
Epoch 13/200
614/614 [==============================] - 0s 781us/step - loss: 0.4196 -
accuracy: 0.86160s - loss: 0.4185 - accura
Epoch 14/200
614/614 [==============================] - 0s 469us/step - loss: 0.4118 -
accuracy: 0.8632
Epoch 15/200
614/614 [==============================] - 0s 449us/step - loss: 0.4064 -
accuracy: 0.8632
Epoch 16/200
614/614 [==============================] - 0s 550us/step - loss: 0.4040 -
accuracy: 0.8664
Epoch 17/200
614/614 [==============================] - 0s 554us/step - loss: 0.3976 -
accuracy: 0.8730
Epoch 18/200
614/614 [==============================] - 0s 501us/step - loss: 0.3941 -
accuracy: 0.8762
Epoch 19/200
614/614 [==============================] - 0s 664us/step - loss: 0.3899 -
accuracy: 0.8730
Epoch 20/200
614/614 [==============================] - 0s 593us/step - loss: 0.3890 -
accuracy: 0.8713
Epoch 21/200
614/614 [==============================] - 0s 495us/step - loss: 0.3799 -
accuracy: 0.8762
Epoch 22/200
614/614 [==============================] - 0s 599us/step - loss: 0.3743 -
accuracy: 0.8876
Epoch 23/200
614/614 [==============================] - 0s 469us/step - loss: 0.3824 -
```

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accuracy: 0.8713
Epoch 24/200
614/614 [==============================] - 0s 456us/step - loss: 0.3759 -
accuracy: 0.8795
Epoch 25/200
614/614 [==============================] - 0s 723us/step - loss: 0.3650 -
accuracy: 0.8860
Epoch 26/200
614/614 [==============================] - 0s 527us/step - loss: 0.3620 -
accuracy: 0.8860
Epoch 27/200
614/614 [==============================] - 0s 571us/step - loss: 0.3569 -
accuracy: 0.8876
Epoch 28/200
614/614 [==============================] - ETA: 0s - loss: 0.3623 - accura
cy: 0.88 - 0s 632us/step - loss: 0.3564 - accuracy: 0.8909
Epoch 29/200
614/614 [==============================] - 0s 514us/step - loss: 0.3553 -
accuracy: 0.8909
Epoch 30/200
614/614 [==============================] - 0s 606us/step - loss: 0.3500 -
accuracy: 0.8941
Epoch 31/200
614/614 [==============================] - 0s 482us/step - loss: 0.3486 -
accuracy: 0.8893
Epoch 32/200
614/614 [==============================] - 0s 586us/step - loss: 0.3409 -
accuracy: 0.9007
Epoch 33/200
614/614 [==============================] - 0s 514us/step - loss: 0.3377 -
accuracy: 0.8990
Epoch 34/200
614/614 [==============================] - 0s 541us/step - loss: 0.3342 -
accuracy: 0.9007
Epoch 35/200
614/614 [==============================] - 0s 456us/step - loss: 0.3300 -
accuracy: 0.9039
Epoch 36/200
614/614 [==============================] - 0s 651us/step - loss: 0.3333 -
accuracy: 0.9007
Epoch 37/200
614/614 [==============================] - 0s 567us/step - loss: 0.3264 -
accuracy: 0.9055
Epoch 38/200
614/614 [==============================] - 0s 443us/step - loss: 0.3275 -
accuracy: 0.9007
Epoch 39/200
614/614 [==============================] - 0s 558us/step - loss: 0.3314 -
accuracy: 0.9007
Epoch 40/200
614/614 [==============================] - 0s 514us/step - loss: 0.3287 -
accuracy: 0.8990
Epoch 41/200
614/614 [==============================] - 0s 462us/step - loss: 0.3209 -
accuracy: 0.9088
Epoch 42/200
614/614 [==============================] - 0s 690us/step - loss: 0.3244 -
accuracy: 0.9055
Epoch 43/200
614/614 [==============================] - 0s 501us/step - loss: 0.3160 -
accuracy: 0.9104
```

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Epoch 44/200
614/614 [==============================] - 0s 580us/step - loss: 0.3168 -
accuracy: 0.9072
Epoch 45/200
614/614 [==============================] - 0s 554us/step - loss: 0.3137 -
accuracy: 0.9104
Epoch 46/200
614/614 [==============================] - 0s 560us/step - loss: 0.3117 -
accuracy: 0.9104
Epoch 47/200
614/614 [==============================] - 1s 990us/step - loss: 0.3112 -
accuracy: 0.9104
Epoch 48/200
614/614 [==============================] - 0s 684us/step - loss: 0.3099 -
accuracy: 0.9104
Epoch 49/200
614/614 [==============================] - 0s 598us/step - loss: 0.3090 -
accuracy: 0.9104
Epoch 50/200
614/614 [==============================] - 0s 710us/step - loss: 0.3318 -
accuracy: 0.8893
Epoch 51/200
614/614 [==============================] - 0s 658us/step - loss: 0.3231 -
accuracy: 0.9023
Epoch 52/200
614/614 [==============================] - 0s 586us/step - loss: 0.3163 -
accuracy: 0.9055
Epoch 53/200
614/614 [==============================] - 0s 501us/step - loss: 0.3149 -
accuracy: 0.9088
Epoch 54/200
614/614 [==============================] - 0s 736us/step - loss: 0.3116 -
accuracy: 0.9104
Epoch 55/200
614/614 [==============================] - 0s 586us/step - loss: 0.3068 -
accuracy: 0.9137
Epoch 56/200
614/614 [==============================] - 0s 436us/step - loss: 0.3077 -
accuracy: 0.9121
Epoch 57/200
614/614 [==============================] - 0s 729us/step - loss: 0.3071 -
accuracy: 0.9088
Epoch 58/200
614/614 [==============================] - 0s 436us/step - loss: 0.3034 -
accuracy: 0.9121
Epoch 59/200
614/614 [==============================] - 0s 619us/step - loss: 0.3018 -
accuracy: 0.91370s - loss: 0.3023 - accuracy: 0.
Epoch 60/200
614/614 [==============================] - 0s 572us/step - loss: 0.3032 -
accuracy: 0.9121
Epoch 61/200
614/614 [==============================] - 0s 690us/step - loss: 0.3040 -
accuracy: 0.9104
Epoch 62/200
614/614 [==============================] - 0s 475us/step - loss: 0.2983 -
accuracy: 0.9121
Epoch 63/200
614/614 [==============================] - 0s 625us/step - loss: 0.3037 -
accuracy: 0.9088
Epoch 64/200
```

614/614 [==============================] - 0s 632us/step - loss: 0.2906 -
accuracy: 0.9202
Epoch 65/200
614/614 [==============================] - 0s 677us/step - loss: 0.2896 -
accuracy: 0.9186
Epoch 66/200
614/614 [==============================] - 0s 801us/step - loss: 0.2888 -
accuracy: 0.91860s - loss: 0.2758 - accuracy: 0.92 - ETA: 0s - loss: 0.278
8 - accuracy: 0.
Epoch 67/200
614/614 [==============================] - 0s 808us/step - loss: 0.2881 -
accuracy: 0.9186
Epoch 68/200
614/614 [==============================] - 0s 690us/step - loss: 0.2875 -
accuracy: 0.9186
Epoch 69/200
614/614 [==============================] - 0s 534us/step - loss: 0.2870 -
accuracy: 0.9186
Epoch 70/200
614/614 [==============================] - 1s 938us/step - loss: 0.2864 -
accuracy: 0.9186
Epoch 71/200
614/614 [==============================] - 0s 495us/step - loss: 0.2858 -
accuracy: 0.9186
Epoch 72/200
614/614 [==============================] - 0s 651us/step - loss: 0.2854 -
accuracy: 0.9186
Epoch 73/200
614/614 [==============================] - 0s 651us/step - loss: 0.2848 -
accuracy: 0.9186
Epoch 74/200
614/614 [==============================] - 0s 781us/step - loss: 0.2844 -
accuracy: 0.91860s - loss: 0.2835 - accuracy: 0.91
Epoch 75/200
614/614 [==============================] - 0s 645us/step - loss: 0.2839 -
accuracy: 0.9186
Epoch 76/200
614/614 [==============================] - 0s 488us/step - loss: 0.2834 -
accuracy: 0.9186
Epoch 77/200
614/614 [==============================] - ETA: 0s - loss: 0.2695 - accura
cy: 0.92 - 0s 599us/step - loss: 0.2830 - accuracy: 0.9186
Epoch 78/200
614/614 [==============================] - 0s 664us/step - loss: 0.2825 -
accuracy: 0.9186
Epoch 79/200
614/614 [==============================] - 0s 582us/step - loss: 0.2823 -
accuracy: 0.9202
Epoch 80/200
614/614 [==============================] - 0s 599us/step - loss: 0.2810 -
accuracy: 0.9202
Epoch 81/200
614/614 [==============================] - 0s 443us/step - loss: 0.2805 -
accuracy: 0.9202
Epoch 82/200
614/614 [==============================] - 0s 612us/step - loss: 0.2801 -
accuracy: 0.9202
Epoch 83/200
614/614 [==============================] - 0s 612us/step - loss: 0.2797 -
accuracy: 0.92020s - loss: 0.2795 - accuracy: 0.91
Epoch 84/200

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614/614 [==============================] - 0s 658us/step - loss: 0.2793 -
accuracy: 0.9202
Epoch 85/200
614/614 [==============================] - 0s 755us/step - loss: 0.2789 -
accuracy: 0.9202
Epoch 86/200
614/614 [==============================] - 0s 632us/step - loss: 0.2785 -
accuracy: 0.9202
Epoch 87/200
614/614 [==============================] - 0s 762us/step - loss: 0.2781 -
accuracy: 0.9202
Epoch 88/200
614/614 [==============================] - 0s 508us/step - loss: 0.2778 -
accuracy: 0.9202
Epoch 89/200
614/614 [==============================] - 0s 465us/step - loss: 0.2774 -
accuracy: 0.9202
Epoch 90/200
614/614 [==============================] - 0s 671us/step - loss: 0.2771 -
accuracy: 0.9202
Epoch 91/200
614/614 [==============================] - 0s 482us/step - loss: 0.2767 -
accuracy: 0.9202
Epoch 92/200
614/614 [==============================] - 0s 573us/step - loss: 0.2764 -
accuracy: 0.9202
Epoch 93/200
614/614 [==============================] - 0s 651us/step - loss: 0.2761 -
accuracy: 0.92020s - loss: 0.2664 - accuracy: 0.
Epoch 94/200
614/614 [==============================] - 1s 1ms/step - loss: 0.2757 - ac
curacy: 0.9202
Epoch 95/200
614/614 [==============================] - 1s 892us/step - loss: 0.2754 -
accuracy: 0.9202
Epoch 96/200
614/614 [==============================] - 1s 1ms/step - loss: 0.2751 - ac
curacy: 0.9202
Epoch 97/200
614/614 [==============================] - 0s 631us/step - loss: 0.2748 -
accuracy: 0.92020s - loss: 0.2760 - accuracy: 0.
Epoch 98/200
614/614 [==============================] - 0s 567us/step - loss: 0.2746 -
accuracy: 0.9202
Epoch 99/200
614/614 [==============================] - 0s 443us/step - loss: 0.2743 -
accuracy: 0.9202
Epoch 100/200
614/614 [==============================] - 0s 521us/step - loss: 0.2740 -
accuracy: 0.9202
Epoch 101/200
614/614 [==============================] - 0s 541us/step - loss: 0.2737 -
accuracy: 0.9202
Epoch 102/200
614/614 [==============================] - 0s 534us/step - loss: 0.2734 -
accuracy: 0.9202
Epoch 103/200
614/614 [==============================] - 0s 554us/step - loss: 0.2731 -
accuracy: 0.9202
Epoch 104/200
614/614 [==============================] - 0s 781us/step - loss: 0.2729 -
```

```
    accuracy: 0.9202
    Epoch 105/200
    614/614 [==============================] - 0s 567us/step - loss: 0.2726 -
    accuracy: 0.9202
    Epoch 106/200
    614/614 [==============================] - 0s 716us/step - loss: 0.2723 -
    accuracy: 0.9202
    Epoch 107/200
    614/614 [==============================] - 0s 554us/step - loss: 0.2721 -
    accuracy: 0.9202
    Epoch 108/200
    614/614 [==============================] - 0s 502us/step - loss: 0.2718 -
    accuracy: 0.9202
    Epoch 109/200
    614/614 [==============================] - 0s 536us/step - loss: 0.2715 -
    accuracy: 0.9202
    Epoch 110/200
    614/614 [==============================] - 0s 462us/step - loss: 0.2713 -
    accuracy: 0.9202
    Epoch 111/200
    614/614 [==============================] - 0s 443us/step - loss: 0.2710 -
    accuracy: 0.9202
    Epoch 112/200
    614/614 [==============================] - 0s 501us/step - loss: 0.2708 -
    accuracy: 0.9202
    Epoch 113/200
    614/614 [==============================] - 0s 456us/step - loss: 0.2706 -
    accuracy: 0.9202
    Epoch 114/200
    614/614 [==============================] - 0s 456us/step - loss: 0.2703 -
    accuracy: 0.9202
    Epoch 115/200
    614/614 [==============================] - 0s 501us/step - loss: 0.2701 -
    accuracy: 0.9202
    Epoch 116/200
    614/614 [==============================] - 0s 514us/step - loss: 0.2699 -
    accuracy: 0.9202
    Epoch 117/200
    614/614 [==============================] - 0s 443us/step - loss: 0.2696 -
    accuracy: 0.9202
    Epoch 118/200
    614/614 [==============================] - 0s 456us/step - loss: 0.2694 -
    accuracy: 0.9202
    Epoch 119/200
    614/614 [==============================] - 0s 528us/step - loss: 0.2692 -
    accuracy: 0.9202
    Epoch 120/200
    614/614 [==============================] - 0s 475us/step - loss: 0.2690 -
    accuracy: 0.9202
    Epoch 121/200
    614/614 [==============================] - 0s 447us/step - loss: 0.2688 -
    accuracy: 0.9202
    Epoch 122/200
    614/614 [==============================] - 0s 514us/step - loss: 0.2686 -
    accuracy: 0.9202
    Epoch 123/200
    614/614 [==============================] - 0s 436us/step - loss: 0.2684 -
    accuracy: 0.9202
    Epoch 124/200
    614/614 [==============================] - 0s 449us/step - loss: 0.2682 -
    accuracy: 0.9202
```

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Epoch 125/200
614/614 [==============================] - 0s 449us/step - loss: 0.2680 -
accuracy: 0.9202
Epoch 126/200
614/614 [==============================] - 0s 495us/step - loss: 0.2678 -
accuracy: 0.92020s - loss: 0.2457 - accuracy
Epoch 127/200
614/614 [==============================] - 0s 456us/step - loss: 0.2676 -
accuracy: 0.9202
Epoch 128/200
614/614 [==============================] - 0s 443us/step - loss: 0.2674 -
accuracy: 0.9202
Epoch 129/200
614/614 [==============================] - 0s 534us/step - loss: 0.2672 -
accuracy: 0.92020s - loss: 0.2715 - accuracy:
Epoch 130/200
614/614 [==============================] - 0s 436us/step - loss: 0.2671 -
accuracy: 0.9202
Epoch 131/200
614/614 [==============================] - 0s 541us/step - loss: 0.2669 -
accuracy: 0.9202
Epoch 132/200
614/614 [==============================] - 0s 593us/step - loss: 0.2667 -
accuracy: 0.9202
Epoch 133/200
614/614 [==============================] - 0s 462us/step - loss: 0.2666 -
accuracy: 0.9202
Epoch 134/200
614/614 [==============================] - 0s 642us/step - loss: 0.2664 -
accuracy: 0.9202
Epoch 135/200
614/614 [==============================] - 0s 703us/step - loss: 0.2662 -
accuracy: 0.9202
Epoch 136/200
614/614 [==============================] - 0s 508us/step - loss: 0.2661 -
accuracy: 0.9202
Epoch 137/200
614/614 [==============================] - 0s 508us/step - loss: 0.2659 -
accuracy: 0.9202
Epoch 138/200
614/614 [==============================] - 0s 508us/step - loss: 0.2657 -
accuracy: 0.9202
Epoch 139/200
614/614 [==============================] - 0s 443us/step - loss: 0.2656 -
accuracy: 0.9202
Epoch 140/200
614/614 [==============================] - 0s 469us/step - loss: 0.2654 -
accuracy: 0.9202
Epoch 141/200
614/614 [==============================] - 0s 528us/step - loss: 0.2653 -
accuracy: 0.9202
Epoch 142/200
614/614 [==============================] - 0s 436us/step - loss: 0.2651 -
accuracy: 0.9202
Epoch 143/200
614/614 [==============================] - 0s 443us/step - loss: 0.2650 -
accuracy: 0.9202
Epoch 144/200
614/614 [==============================] - 0s 449us/step - loss: 0.2648 -
accuracy: 0.9202
Epoch 145/200
```

```
614/614 [==============================] - 0s 456us/step - loss: 0.2647 -
accuracy: 0.9202
Epoch 146/200
614/614 [==============================] - 0s 436us/step - loss: 0.2645 -
accuracy: 0.9202
Epoch 147/200
614/614 [==============================] - 0s 438us/step - loss: 0.2644 -
accuracy: 0.9202
Epoch 148/200
614/614 [==============================] - 0s 488us/step - loss: 0.2642 -
accuracy: 0.9202
Epoch 149/200
614/614 [==============================] - 0s 651us/step - loss: 0.2641 -
accuracy: 0.92020s - loss: 0.3020 - accu
Epoch 150/200
614/614 [==============================] - 0s 508us/step - loss: 0.2639 -
accuracy: 0.9202
Epoch 151/200
614/614 [==============================] - 0s 573us/step - loss: 0.2638 -
accuracy: 0.9202
Epoch 152/200
614/614 [==============================] - 0s 436us/step - loss: 0.2637 -
accuracy: 0.9202
Epoch 153/200
614/614 [==============================] - 0s 443us/step - loss: 0.2636 -
accuracy: 0.9202
Epoch 154/200
614/614 [==============================] - 0s 495us/step - loss: 0.2634 -
accuracy: 0.9202
Epoch 155/200
614/614 [==============================] - 0s 567us/step - loss: 0.2633 -
accuracy: 0.9202
Epoch 156/200
614/614 [==============================] - 0s 573us/step - loss: 0.2632 -
accuracy: 0.9202
Epoch 157/200
614/614 [==============================] - 0s 703us/step - loss: 0.2631 -
accuracy: 0.9202
Epoch 158/200
614/614 [==============================] - 0s 462us/step - loss: 0.2629 -
accuracy: 0.9202
Epoch 159/200
614/614 [==============================] - 0s 445us/step - loss: 0.2628 -
accuracy: 0.9202
Epoch 160/200
614/614 [==============================] - 0s 547us/step - loss: 0.2627 -
accuracy: 0.9202
Epoch 161/200
614/614 [==============================] - 0s 495us/step - loss: 0.2626 -
accuracy: 0.9202
Epoch 162/200
614/614 [==============================] - 0s 534us/step - loss: 0.2625 -
accuracy: 0.92020s - loss: 0.2750 - accuracy: 0.
Epoch 163/200
614/614 [==============================] - 0s 580us/step - loss: 0.2624 -
accuracy: 0.92020s - loss: 0.2714 - accuracy: 0.91
Epoch 164/200
614/614 [==============================] - 0s 619us/step - loss: 0.2622 -
accuracy: 0.9202
Epoch 165/200
614/614 [==============================] - 0s 560us/step - loss: 0.2621 -
```

```
accuracy: 0.9202
Epoch 166/200
614/614 [==============================] - 0s 554us/step - loss: 0.2620 -
accuracy: 0.9202
Epoch 167/200
614/614 [==============================] - 0s 469us/step - loss: 0.2619 -
accuracy: 0.9202
Epoch 168/200
614/614 [==============================] - 0s 567us/step - loss: 0.2618 -
accuracy: 0.92020s - loss: 0.2576 - accuracy
Epoch 169/200
614/614 [==============================] - 0s 554us/step - loss: 0.2617 -
accuracy: 0.9202
Epoch 170/200
614/614 [==============================] - 0s 808us/step - loss: 0.2616 -
accuracy: 0.9202
Epoch 171/200
614/614 [==============================] - 1s 882us/step - loss: 0.2615 -
accuracy: 0.9202
Epoch 172/200
614/614 [==============================] - 0s 690us/step - loss: 0.2614 -
accuracy: 0.9202
Epoch 173/200
614/614 [==============================] - 0s 788us/step - loss: 0.2613 -
accuracy: 0.9202
Epoch 174/200
614/614 [==============================] - 0s 703us/step - loss: 0.2612 -
accuracy: 0.9202
Epoch 175/200
614/614 [==============================] - 0s 619us/step - loss: 0.2611 -
accuracy: 0.9202
Epoch 176/200
614/614 [==============================] - 0s 586us/step - loss: 0.2610 -
accuracy: 0.9202
Epoch 177/200
614/614 [==============================] - 0s 625us/step - loss: 0.2609 -
accuracy: 0.9202
Epoch 178/200
614/614 [==============================] - ETA: 0s - loss: 0.2622 - accura
cy: 0.91 - 0s 814us/step - loss: 0.2608 - accuracy: 0.9202
Epoch 179/200
614/614 [==============================] - 1s 925us/step - loss: 0.2607 -
accuracy: 0.9202
Epoch 180/200
614/614 [==============================] - 0s 658us/step - loss: 0.2606 -
accuracy: 0.9202
Epoch 181/200
614/614 [==============================] - 0s 593us/step - loss: 0.2605 -
accuracy: 0.9202
Epoch 182/200
614/614 [==============================] - 0s 612us/step - loss: 0.2604 -
accuracy: 0.9202
Epoch 183/200
614/614 [==============================] - 0s 625us/step - loss: 0.2603 -
accuracy: 0.9202
Epoch 184/200
614/614 [==============================] - 0s 684us/step - loss: 0.2602 -
accuracy: 0.9202
Epoch 185/200
614/614 [==============================] - 0s 586us/step - loss: 0.2602 -
accuracy: 0.9202
```

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Epoch 186/200
614/614 [==============================] - 0s 495us/step - loss: 0.2601 -
accuracy: 0.9202
Epoch 187/200
614/614 [==============================] - 0s 632us/step - loss: 0.2600 -
accuracy: 0.9202
Epoch 188/200
614/614 [==============================] - 0s 619us/step - loss: 0.2599 -
accuracy: 0.9202
Epoch 189/200
614/614 [==============================] - 0s 553us/step - loss: 0.2598 -
accuracy: 0.9202
Epoch 190/200
614/614 [==============================] - 0s 541us/step - loss: 0.2597 -
accuracy: 0.9202
Epoch 191/200
614/614 [==============================] - 0s 710us/step - loss: 0.2596 -
accuracy: 0.9202
Epoch 192/200
614/614 [==============================] - 0s 690us/step - loss: 0.2595 -
accuracy: 0.9202
Epoch 193/200
614/614 [==============================] - 0s 645us/step - loss: 0.2595 -
accuracy: 0.9202
Epoch 194/200
614/614 [==============================] - 0s 593us/step - loss: 0.2594 -
accuracy: 0.9202
Epoch 195/200
614/614 [==============================] - 0s 593us/step - loss: 0.2593 -
accuracy: 0.9202
Epoch 196/200
614/614 [==============================] - 0s 495us/step - loss: 0.2592 -
accuracy: 0.9202
Epoch 197/200
614/614 [==============================] - 0s 527us/step - loss: 0.2592 -
accuracy: 0.9202
Epoch 198/200
614/614 [==============================] - 0s 430us/step - loss: 0.2591 -
accuracy: 0.9202
Epoch 199/200
614/614 [==============================] - 0s 482us/step - loss: 0.2590 -
accuracy: 0.9202
Epoch 200/200
614/614 [==============================] - 0s 554us/step - loss: 0.2589 -
accuracy: 0.9202
154/154 [==============================] - 0s 1ms/step
Epoch 1/200
614/614 [==============================] - 1s 2ms/step - loss: 0.5715 - ac
curacy: 0.6629
Epoch 2/200
614/614 [==============================] - 0s 469us/step - loss: 0.5256 -
accuracy: 0.7557
Epoch 3/200
614/614 [==============================] - 0s 567us/step - loss: 0.5119 -
accuracy: 0.7883
Epoch 4/200
614/614 [==============================] - 0s 456us/step - loss: 0.4975 -
accuracy: 0.8062
Epoch 5/200
614/614 [==============================] - 0s 723us/step - loss: 0.4862 -
accuracy: 0.8241
```

```
Epoch 6/200
614/614 [==============================] - 0s 449us/step - loss: 0.4891 -
accuracy: 0.8094
Epoch 7/200
614/614 [==============================] - 0s 443us/step - loss: 0.4734 -
accuracy: 0.8355
Epoch 8/200
614/614 [==============================] - 0s 801us/step - loss: 0.4592 -
accuracy: 0.8485
Epoch 9/200
614/614 [==============================] - 0s 521us/step - loss: 0.4519 -
accuracy: 0.8518
Epoch 10/200
614/614 [==============================] - 0s 669us/step - loss: 0.4456 -
accuracy: 0.8599
Epoch 11/200
614/614 [==============================] - 0s 645us/step - loss: 0.4397 -
accuracy: 0.8681
Epoch 12/200
614/614 [==============================] - 0s 443us/step - loss: 0.4335 -
accuracy: 0.8648
Epoch 13/200
614/614 [==============================] - 1s 886us/step - loss: 0.4266 -
accuracy: 0.8730
Epoch 14/200
614/614 [==============================] - 0s 677us/step - loss: 0.4249 -
accuracy: 0.8762
Epoch 15/200
614/614 [==============================] - ETA: 0s - loss: 0.4224 - accura
cy: 0.87 - 0s 495us/step - loss: 0.4216 - accuracy: 0.8746
Epoch 16/200
614/614 [==============================] - 0s 508us/step - loss: 0.4129 -
accuracy: 0.8811
Epoch 17/200
614/614 [==============================] - 0s 690us/step - loss: 0.4072 -
accuracy: 0.8876
Epoch 18/200
614/614 [==============================] - 0s 638us/step - loss: 0.4020 -
accuracy: 0.8876
Epoch 19/200
614/614 [==============================] - 0s 671us/step - loss: 0.3969 -
accuracy: 0.8876
Epoch 20/200
614/614 [==============================] - 0s 567us/step - loss: 0.3897 -
accuracy: 0.8909
Epoch 21/200
614/614 [==============================] - 0s 567us/step - loss: 0.3909 -
accuracy: 0.8860
Epoch 22/200
614/614 [==============================] - 0s 501us/step - loss: 0.3854 -
accuracy: 0.8876
Epoch 23/200
614/614 [==============================] - 0s 521us/step - loss: 0.3782 -
accuracy: 0.8958
Epoch 24/200
614/614 [==============================] - 0s 514us/step - loss: 0.3747 -
accuracy: 0.8990
Epoch 25/200
614/614 [==============================] - 0s 423us/step - loss: 0.3768 -
accuracy: 0.8974
Epoch 26/200
```

```
614/614 [==============================] - 0s 514us/step - loss: 0.3663 -
accuracy: 0.9055
Epoch 27/200
614/614 [==============================] - 0s 612us/step - loss: 0.3997 -
accuracy: 0.8746
Epoch 28/200
614/614 [==============================] - 0s 456us/step - loss: 0.3625 -
accuracy: 0.9023
Epoch 29/200
614/614 [==============================] - 1s 2ms/step - loss: 0.3632 - ac
curacy: 0.9007
Epoch 30/200
614/614 [==============================] - 1s 1ms/step - loss: 0.3558 - ac
curacy: 0.9039
Epoch 31/200
614/614 [==============================] - 0s 449us/step - loss: 0.3585 -
accuracy: 0.9039
Epoch 32/200
614/614 [==============================] - 0s 495us/step - loss: 0.3535 -
accuracy: 0.9088
Epoch 33/200
614/614 [==============================] - 0s 521us/step - loss: 0.3531 -
accuracy: 0.9104
Epoch 34/200
614/614 [==============================] - 0s 475us/step - loss: 0.3462 -
accuracy: 0.9137
Epoch 35/200
614/614 [==============================] - 1s 918us/step - loss: 0.3431 -
accuracy: 0.91530s - loss: 0.3682 - accuracy:  - ETA: 0s - loss: 0.3633 -
accuracy
Epoch 36/200
614/614 [==============================] - 0s 528us/step - loss: 0.3410 -
accuracy: 0.91530s - loss: 0.3484 - accuracy: 0.
Epoch 37/200
614/614 [==============================] - 0s 612us/step - loss: 0.3394 -
accuracy: 0.9153
Epoch 38/200
614/614 [==============================] - 0s 716us/step - loss: 0.3379 -
accuracy: 0.9153
Epoch 39/200
614/614 [==============================] - 0s 596us/step - loss: 0.3366 -
accuracy: 0.9153
Epoch 40/200
614/614 [==============================] - 0s 729us/step - loss: 0.3353 -
accuracy: 0.9153
Epoch 41/200
614/614 [==============================] - 0s 606us/step - loss: 0.3341 -
accuracy: 0.9153
Epoch 42/200
614/614 [==============================] - 0s 658us/step - loss: 0.3329 -
accuracy: 0.9153
Epoch 43/200
614/614 [==============================] - 0s 808us/step - loss: 0.3317 -
accuracy: 0.91530s - loss: 0.3005 - accu
Epoch 44/200
614/614 [==============================] - 0s 677us/step - loss: 0.3305 -
accuracy: 0.9153
Epoch 45/200
614/614 [==============================] - 0s 742us/step - loss: 0.3296 -
accuracy: 0.91530s - loss: 0.3174 - accuracy:
Epoch 46/200
```

```
614/614 [==============================] - 0s 716us/step - loss: 0.3302 -
accuracy: 0.91370s - loss: 0.3105 - accura
Epoch 47/200
614/614 [==============================] - 0s 736us/step - loss: 0.3375 -
accuracy: 0.9023
Epoch 48/200
614/614 [==============================] - 0s 699us/step - loss: 0.3327 -
accuracy: 0.9072
Epoch 49/200
614/614 [==============================] - 0s 723us/step - loss: 0.3232 -
accuracy: 0.9169
Epoch 50/200
614/614 [==============================] - 0s 638us/step - loss: 0.3357 -
accuracy: 0.9007
Epoch 51/200
614/614 [==============================] - 0s 801us/step - loss: 0.3277 -
accuracy: 0.9104
Epoch 52/200
614/614 [==============================] - 0s 658us/step - loss: 0.3356 -
accuracy: 0.9039
Epoch 53/200
614/614 [==============================] - 0s 755us/step - loss: 0.3311 -
accuracy: 0.9039
Epoch 54/200
614/614 [==============================] - 1s 918us/step - loss: 0.3266 -
accuracy: 0.9121
Epoch 55/200
614/614 [==============================] - 0s 801us/step - loss: 0.3207 -
accuracy: 0.9137
Epoch 56/200
614/614 [==============================] - 0s 677us/step - loss: 0.3166 -
accuracy: 0.9169
Epoch 57/200
614/614 [==============================] - 0s 775us/step - loss: 0.3157 -
accuracy: 0.9169
Epoch 58/200
614/614 [==============================] - 0s 651us/step - loss: 0.3149 -
accuracy: 0.9169
Epoch 59/200
614/614 [==============================] - 1s 866us/step - loss: 0.3142 -
accuracy: 0.9169
Epoch 60/200
614/614 [==============================] - 0s 716us/step - loss: 0.3134 -
accuracy: 0.9169
Epoch 61/200
614/614 [==============================] - 1s 892us/step - loss: 0.3127 -
accuracy: 0.9169
Epoch 62/200
614/614 [==============================] - 1s 964us/step - loss: 0.3119 -
accuracy: 0.91690s - loss: 0.2930 - ac
Epoch 63/200
614/614 [==============================] - ETA: 0s - loss: 0.3080 - accura
cy: 0.91 - 0s 801us/step - loss: 0.3112 - accuracy: 0.9169
Epoch 64/200
614/614 [==============================] - 0s 795us/step - loss: 0.3104 -
accuracy: 0.9169
Epoch 65/200
614/614 [==============================] - 1s 847us/step - loss: 0.3097 -
accuracy: 0.9169
Epoch 66/200
614/614 [==============================] - 0s 632us/step - loss: 0.3090 -
```

```
  accuracy: 0.9169
  Epoch 67/200
  614/614 [==============================] - 0s 710us/step - loss: 0.3083 -
  accuracy: 0.9169
  Epoch 68/200
  614/614 [==============================] - 0s 690us/step - loss: 0.3077 -
  accuracy: 0.9169
  Epoch 69/200
  614/614 [==============================] - 1s 892us/step - loss: 0.3071 -
  accuracy: 0.9169
  Epoch 70/200
  614/614 [==============================] - 0s 651us/step - loss: 0.3065 -
  accuracy: 0.9169
  Epoch 71/200
  614/614 [==============================] - 1s 899us/step - loss: 0.3058 -
  accuracy: 0.9169
  Epoch 72/200
  614/614 [==============================] - 0s 560us/step - loss: 0.3053 -
  accuracy: 0.9169
  Epoch 73/200
  614/614 [==============================] - 0s 713us/step - loss: 0.3047 -
  accuracy: 0.9169
  Epoch 74/200
  614/614 [==============================] - 0s 710us/step - loss: 0.3041 -
  accuracy: 0.9169
  Epoch 75/200
  614/614 [==============================] - 0s 736us/step - loss: 0.3036 -
  accuracy: 0.9169
  Epoch 76/200
  614/614 [==============================] - 0s 808us/step - loss: 0.3030 -
  accuracy: 0.9169
  Epoch 77/200
  614/614 [==============================] - 1s 905us/step - loss: 0.3024 -
  accuracy: 0.9169
  Epoch 78/200
  614/614 [==============================] - 1s 840us/step - loss: 0.3036 -
  accuracy: 0.9153
  Epoch 79/200
  614/614 [==============================] - 0s 710us/step - loss: 0.3040 -
  accuracy: 0.9153
  Epoch 80/200
  614/614 [==============================] - 1s 1ms/step - loss: 0.3248 - ac
  curacy: 0.8925
  Epoch 81/200
  614/614 [==============================] - 0s 808us/step - loss: 0.3114 -
  accuracy: 0.9072
  Epoch 82/200
  614/614 [==============================] - 0s 723us/step - loss: 0.3063 -
  accuracy: 0.9121
  Epoch 83/200
  614/614 [==============================] - 0s 736us/step - loss: 0.3060 -
  accuracy: 0.9137
  Epoch 84/200
  614/614 [==============================] - 0s 703us/step - loss: 0.3052 -
  accuracy: 0.9137
  Epoch 85/200
  614/614 [==============================] - 0s 736us/step - loss: 0.3101 -
  accuracy: 0.9121
  Epoch 86/200
  614/614 [==============================] - 0s 729us/step - loss: 0.3037 -
  accuracy: 0.9121
```

```
Epoch 87/200
614/614 [==============================] - 1s 847us/step - loss: 0.2997 -
accuracy: 0.91530s - loss: 0.3028 - accuracy
Epoch 88/200
614/614 [==============================] - 0s 736us/step - loss: 0.2965 -
accuracy: 0.9186
Epoch 89/200
614/614 [==============================] - 0s 543us/step - loss: 0.2992 -
accuracy: 0.9169
Epoch 90/200
614/614 [==============================] - 0s 723us/step - loss: 0.2972 -
accuracy: 0.9186
Epoch 91/200
614/614 [==============================] - 0s 638us/step - loss: 0.2965 -
accuracy: 0.9169
Epoch 92/200
614/614 [==============================] - 0s 697us/step - loss: 0.2956 -
accuracy: 0.9169
Epoch 93/200
614/614 [==============================] - 0s 729us/step - loss: 0.2977 -
accuracy: 0.9169
Epoch 94/200
614/614 [==============================] - 0s 749us/step - loss: 0.2974 -
accuracy: 0.9153
Epoch 95/200
614/614 [==============================] - 0s 684us/step - loss: 0.2951 -
accuracy: 0.9169
Epoch 96/200
614/614 [==============================] - 0s 755us/step - loss: 0.2933 -
accuracy: 0.9186
Epoch 97/200
614/614 [==============================] - 0s 664us/step - loss: 0.2910 -
accuracy: 0.9202
Epoch 98/200
614/614 [==============================] - 0s 798us/step - loss: 0.2901 -
accuracy: 0.9202
Epoch 99/200
614/614 [==============================] - 0s 762us/step - loss: 0.2895 -
accuracy: 0.9202
Epoch 100/200
614/614 [==============================] - 0s 671us/step - loss: 0.2890 -
accuracy: 0.9202
Epoch 101/200
614/614 [==============================] - 0s 729us/step - loss: 0.2887 -
accuracy: 0.9202
Epoch 102/200
614/614 [==============================] - 0s 742us/step - loss: 0.2883 -
accuracy: 0.9202
Epoch 103/200
614/614 [==============================] - 0s 755us/step - loss: 0.2879 -
accuracy: 0.9202
Epoch 104/200
614/614 [==============================] - 0s 573us/step - loss: 0.2875 -
accuracy: 0.9202
Epoch 105/200
614/614 [==============================] - 0s 781us/step - loss: 0.2871 -
accuracy: 0.9202
Epoch 106/200
614/614 [==============================] - 0s 710us/step - loss: 0.2867 -
accuracy: 0.92020s - loss: 0.2840 - accura
Epoch 107/200
```

```
614/614 [==============================] - 0s 778us/step - loss: 0.2864 -
accuracy: 0.9202
Epoch 108/200
614/614 [==============================] - 0s 781us/step - loss: 0.2860 -
accuracy: 0.9202
Epoch 109/200
614/614 [==============================] - 0s 645us/step - loss: 0.2857 -
accuracy: 0.9202
Epoch 110/200
614/614 [==============================] - 0s 651us/step - loss: 0.2853 -
accuracy: 0.9202
Epoch 111/200
614/614 [==============================] - 0s 449us/step - loss: 0.2850 -
accuracy: 0.9202
Epoch 112/200
614/614 [==============================] - 1s 821us/step - loss: 0.2847 -
accuracy: 0.9202
Epoch 113/200
614/614 [==============================] - ETA: 0s - loss: 0.2933 - accura
cy: 0.91 - 0s 619us/step - loss: 0.2843 - accuracy: 0.9202
Epoch 114/200
614/614 [==============================] - 0s 664us/step - loss: 0.2840 -
accuracy: 0.9202
Epoch 115/200
614/614 [==============================] - 0s 703us/step - loss: 0.2837 -
accuracy: 0.9202
Epoch 116/200
614/614 [==============================] - ETA: 0s - loss: 0.2904 - accura
cy: 0.91 - 0s 778us/step - loss: 0.2834 - accuracy: 0.9202
Epoch 117/200
614/614 [==============================] - 0s 684us/step - loss: 0.2831 -
accuracy: 0.9202
Epoch 118/200
614/614 [==============================] - 1s 827us/step - loss: 0.2828 -
accuracy: 0.9202
Epoch 119/200
614/614 [==============================] - 0s 729us/step - loss: 0.2825 -
accuracy: 0.9202
Epoch 120/200
614/614 [==============================] - 0s 723us/step - loss: 0.2822 -
accuracy: 0.9202
Epoch 121/200
614/614 [==============================] - 0s 729us/step - loss: 0.2819 -
accuracy: 0.9202
Epoch 122/200
614/614 [==============================] - ETA: 0s - loss: 0.2827 - accura
cy: 0.9194 ETA: 0s - loss: 0.2815 - accuracy:  - 0s 703us/step - loss: 0.2
816 - accuracy: 0.9202
Epoch 123/200
614/614 [==============================] - 0s 684us/step - loss: 0.2813 -
accuracy: 0.9202
Epoch 124/200
614/614 [==============================] - 0s 593us/step - loss: 0.2810 -
accuracy: 0.9202
Epoch 125/200
614/614 [==============================] - 0s 699us/step - loss: 0.2807 -
accuracy: 0.9202
Epoch 126/200
614/614 [==============================] - 0s 645us/step - loss: 0.2805 -
accuracy: 0.9202
Epoch 127/200
```

```
614/614 [==============================] - 0s 677us/step - loss: 0.2802 -
accuracy: 0.9202
Epoch 128/200
614/614 [==============================] - 0s 645us/step - loss: 0.2799 -
accuracy: 0.9202
Epoch 129/200
614/614 [==============================] - 0s 716us/step - loss: 0.2796 -
accuracy: 0.9202
Epoch 130/200
614/614 [==============================] - 1s 860us/step - loss: 0.2794 -
accuracy: 0.9202
Epoch 131/200
614/614 [==============================] - 0s 495us/step - loss: 0.2792 -
accuracy: 0.9202
Epoch 132/200
614/614 [==============================] - 0s 606us/step - loss: 0.2789 -
accuracy: 0.9202
Epoch 133/200
614/614 [==============================] - 0s 736us/step - loss: 0.2787 -
accuracy: 0.9202
Epoch 134/200
614/614 [==============================] - 0s 710us/step - loss: 0.2784 -
accuracy: 0.9202
Epoch 135/200
614/614 [==============================] - 0s 788us/step - loss: 0.2782 -
accuracy: 0.9202
Epoch 136/200
614/614 [==============================] - 0s 723us/step - loss: 0.2780 -
accuracy: 0.9202
Epoch 137/200
614/614 [==============================] - 0s 606us/step - loss: 0.2777 -
accuracy: 0.9202
Epoch 138/200
614/614 [==============================] - 0s 651us/step - loss: 0.2775 -
accuracy: 0.9202
Epoch 139/200
614/614 [==============================] - ETA: 0s - loss: 0.2830 - accura
cy: 0.91 - 0s 788us/step - loss: 0.2772 - accuracy: 0.9202
Epoch 140/200
614/614 [==============================] - 0s 794us/step - loss: 0.2770 -
accuracy: 0.9202
Epoch 141/200
614/614 [==============================] - 0s 801us/step - loss: 0.2768 -
accuracy: 0.9202
Epoch 142/200
614/614 [==============================] - 0s 762us/step - loss: 0.2766 -
accuracy: 0.9202
Epoch 143/200
614/614 [==============================] - 0s 734us/step - loss: 0.2764 -
accuracy: 0.9202
Epoch 144/200
614/614 [==============================] - 0s 710us/step - loss: 0.2762 -
accuracy: 0.9202
Epoch 145/200
614/614 [==============================] - 0s 801us/step - loss: 0.2759 -
accuracy: 0.9202
Epoch 146/200
614/614 [==============================] - 0s 723us/step - loss: 0.2757 -
accuracy: 0.9202
Epoch 147/200
614/614 [==============================] - 0s 755us/step - loss: 0.2755 -
```

```
accuracy: 0.9202
Epoch 148/200
614/614 [==============================] - 0s 651us/step - loss: 0.2753 -
accuracy: 0.9202
Epoch 149/200
614/614 [==============================] - 0s 703us/step - loss: 0.2750 -
accuracy: 0.9202
Epoch 150/200
614/614 [==============================] - 0s 716us/step - loss: 0.2748 -
accuracy: 0.9202
Epoch 151/200
614/614 [==============================] - 0s 501us/step - loss: 0.2746 -
accuracy: 0.9202
Epoch 152/200
614/614 [==============================] - 0s 474us/step - loss: 0.2745 -
accuracy: 0.9202
Epoch 153/200
614/614 [==============================] - 0s 664us/step - loss: 0.2742 -
accuracy: 0.9202
Epoch 154/200
614/614 [==============================] - 0s 645us/step - loss: 0.2740 -
accuracy: 0.9202
Epoch 155/200
614/614 [==============================] - 0s 697us/step - loss: 0.2738 -
accuracy: 0.9202
Epoch 156/200
614/614 [==============================] - 0s 788us/step - loss: 0.2737 -
accuracy: 0.9202
Epoch 157/200
614/614 [==============================] - 0s 775us/step - loss: 0.2735 -
accuracy: 0.9202
Epoch 158/200
614/614 [==============================] - 0s 736us/step - loss: 0.2733 -
accuracy: 0.92020s - loss: 0.3091 - accura
Epoch 159/200
614/614 [==============================] - 0s 654us/step - loss: 0.2731 -
accuracy: 0.9202
Epoch 160/200
614/614 [==============================] - 0s 781us/step - loss: 0.2729 -
accuracy: 0.9202
Epoch 161/200
614/614 [==============================] - 0s 791us/step - loss: 0.2728 -
accuracy: 0.9202
Epoch 162/200
614/614 [==============================] - 0s 775us/step - loss: 0.2726 -
accuracy: 0.9202
Epoch 163/200
614/614 [==============================] - 0s 736us/step - loss: 0.2724 -
accuracy: 0.9202
Epoch 164/200
614/614 [==============================] - 0s 755us/step - loss: 0.2722 -
accuracy: 0.9202
Epoch 165/200
614/614 [==============================] - 0s 808us/step - loss: 0.2721 -
accuracy: 0.9202
Epoch 166/200
614/614 [==============================] - 0s 788us/step - loss: 0.2719 -
accuracy: 0.9202
Epoch 167/200
614/614 [==============================] - 1s 951us/step - loss: 0.2717 -
accuracy: 0.9202
```

```
Epoch 168/200
614/614 [==============================] - 1s 2ms/step - loss: 0.2715 - ac
curacy: 0.9202
Epoch 169/200
614/614 [==============================] - 0s 560us/step - loss: 0.2714 -
accuracy: 0.9202
Epoch 170/200
614/614 [==============================] - 0s 430us/step - loss: 0.2712 -
 accuracy: 0.9202
Epoch 171/200
614/614 [==============================] - 0s 508us/step - loss: 0.2710 -
 accuracy: 0.9202
Epoch 172/200
614/614 [==============================] - 0s 514us/step - loss: 0.2709 -
 accuracy: 0.9202
Epoch 173/200
614/614 [==============================] - 0s 423us/step - loss: 0.2707 -
 accuracy: 0.9202
Epoch 174/200
614/614 [==============================] - 0s 573us/step - loss: 0.2706 -
 accuracy: 0.9202
Epoch 175/200
614/614 [==============================] - 0s 501us/step - loss: 0.2704 -
 accuracy: 0.9202
Epoch 176/200
614/614 [==============================] - 1s 964us/step - loss: 0.2702 -
 accuracy: 0.9202
Epoch 177/200
614/614 [==============================] - 0s 729us/step - loss: 0.2701 -
 accuracy: 0.92020s - loss: 0.2682 - accura
Epoch 178/200
614/614 [==============================] - 0s 488us/step - loss: 0.2700 -
 accuracy: 0.9202
Epoch 179/200
614/614 [==============================] - 0s 513us/step - loss: 0.2698 -
 accuracy: 0.9202
Epoch 180/200
614/614 [==============================] - 0s 690us/step - loss: 0.2697 -
 accuracy: 0.9202
Epoch 181/200
614/614 [==============================] - 0s 573us/step - loss: 0.2695 -
 accuracy: 0.9202
Epoch 182/200
614/614 [==============================] - 0s 508us/step - loss: 0.2694 -
 accuracy: 0.9202
Epoch 183/200
614/614 [==============================] - 1s 821us/step - loss: 0.2692 -
 accuracy: 0.9202
Epoch 184/200
614/614 [==============================] - 0s 580us/step - loss: 0.2691 -
 accuracy: 0.9202
Epoch 185/200
614/614 [==============================] - 0s 710us/step - loss: 0.2690 -
 accuracy: 0.9202
Epoch 186/200
614/614 [==============================] - 0s 710us/step - loss: 0.2688 -
 accuracy: 0.9202
Epoch 187/200
614/614 [==============================] - 0s 593us/step - loss: 0.2687 -
 accuracy: 0.9202
Epoch 188/200
```

```
614/614 [==============================] - 0s 619us/step - loss: 0.2686 -
 accuracy: 0.9202
Epoch 189/200
614/614 [==============================] - 0s 493us/step - loss: 0.2684 -
 accuracy: 0.9202
Epoch 190/200
614/614 [==============================] - 0s 645us/step - loss: 0.2683 -
 accuracy: 0.9202
Epoch 191/200
614/614 [==============================] - 0s 514us/step - loss: 0.2681 -
 accuracy: 0.9202
Epoch 192/200
614/614 [==============================] - 0s 541us/step - loss: 0.2680 -
 accuracy: 0.9202
Epoch 193/200
614/614 [==============================] - 0s 567us/step - loss: 0.2679 -
 accuracy: 0.9202
Epoch 194/200
614/614 [==============================] - 0s 475us/step - loss: 0.2678 -
 accuracy: 0.9202
Epoch 195/200
614/614 [==============================] - 0s 547us/step - loss: 0.2676 -
 accuracy: 0.9202
Epoch 196/200
614/614 [==============================] - 0s 560us/step - loss: 0.2675 -
 accuracy: 0.9202
Epoch 197/200
614/614 [==============================] - 0s 443us/step - loss: 0.2674 -
 accuracy: 0.9202
Epoch 198/200
614/614 [==============================] - 0s 449us/step - loss: 0.2672 -
 accuracy: 0.9202
Epoch 199/200
614/614 [==============================] - 0s 703us/step - loss: 0.2671 -
 accuracy: 0.9202
Epoch 200/200
614/614 [==============================] - 0s 567us/step - loss: 0.2670 -
 accuracy: 0.9202
154/154 [==============================] - 0s 883us/step
Epoch 1/200
615/615 [==============================] - 1s 2ms/step - loss: 0.5649 - ac
curacy: 0.7187
Epoch 2/200
615/615 [==============================] - 0s 670us/step - loss: 0.5309 -
 accuracy: 0.7528
Epoch 3/200
615/615 [==============================] - 0s 631us/step - loss: 0.5080 -
 accuracy: 0.7789
Epoch 4/200
615/615 [==============================] - 0s 481us/step - loss: 0.4935 -
 accuracy: 0.8000
Epoch 5/200
615/615 [==============================] - 0s 462us/step - loss: 0.4854 -
 accuracy: 0.8114
Epoch 6/200
615/615 [==============================] - 0s 546us/step - loss: 0.4641 -
 accuracy: 0.8276
Epoch 7/200
615/615 [==============================] - 0s 566us/step - loss: 0.4532 -
 accuracy: 0.8341
Epoch 8/200
```

```
615/615 [==============================] - 0s 546us/step - loss: 0.4376 -
 accuracy: 0.8537
Epoch 9/200
615/615 [==============================] - 0s 449us/step - loss: 0.4384 -
 accuracy: 0.8618
Epoch 10/200
615/615 [==============================] - 0s 429us/step - loss: 0.4233 -
 accuracy: 0.8732
Epoch 11/200
615/615 [==============================] - 0s 436us/step - loss: 0.4186 -
 accuracy: 0.8764
Epoch 12/200
615/615 [==============================] - 0s 488us/step - loss: 0.4182 -
 accuracy: 0.8732
Epoch 13/200
615/615 [==============================] - 0s 585us/step - loss: 0.4047 -
 accuracy: 0.8797
Epoch 14/200
615/615 [==============================] - 0s 429us/step - loss: 0.4104 -
 accuracy: 0.8846
Epoch 15/200
615/615 [==============================] - 0s 481us/step - loss: 0.3906 -
 accuracy: 0.8976
Epoch 16/200
615/615 [==============================] - 0s 462us/step - loss: 0.4005 -
 accuracy: 0.8911
Epoch 17/200
615/615 [==============================] - 0s 546us/step - loss: 0.3999 -
 accuracy: 0.8829
Epoch 18/200
615/615 [==============================] - 0s 566us/step - loss: 0.3864 -
 accuracy: 0.8959
Epoch 19/200
615/615 [==============================] - 0s 462us/step - loss: 0.3888 -
 accuracy: 0.8829
Epoch 20/200
615/615 [==============================] - 0s 455us/step - loss: 0.3800 -
 accuracy: 0.8878
Epoch 21/200
615/615 [==============================] - 0s 540us/step - loss: 0.3830 -
 accuracy: 0.8878
Epoch 22/200
615/615 [==============================] - 0s 481us/step - loss: 0.3644 -
 accuracy: 0.9041
Epoch 23/200
615/615 [==============================] - 0s 458us/step - loss: 0.3582 -
 accuracy: 0.9106
Epoch 24/200
615/615 [==============================] - 0s 468us/step - loss: 0.3643 -
 accuracy: 0.9041
Epoch 25/200
615/615 [==============================] - 0s 514us/step - loss: 0.3575 -
 accuracy: 0.9089
Epoch 26/200
615/615 [==============================] - 0s 494us/step - loss: 0.3502 -
 accuracy: 0.9154
Epoch 27/200
615/615 [==============================] - 0s 514us/step - loss: 0.3489 -
 accuracy: 0.91540s - loss: 0.3521 - accuracy
Epoch 28/200
615/615 [==============================] - 0s 546us/step - loss: 0.3447 -
```

```
  accuracy: 0.9154
Epoch 29/200
615/615 [==============================] - 0s 455us/step - loss: 0.3817 -
 accuracy: 0.8650
Epoch 30/200
615/615 [==============================] - 0s 468us/step - loss: 0.3576 -
 accuracy: 0.8976
Epoch 31/200
615/615 [==============================] - 0s 540us/step - loss: 0.3528 -
 accuracy: 0.8992
Epoch 32/200
615/615 [==============================] - 0s 559us/step - loss: 0.3494 -
 accuracy: 0.9041
Epoch 33/200
615/615 [==============================] - 0s 481us/step - loss: 0.3493 -
 accuracy: 0.90080s - loss: 0.3502 - accuracy: 0.90
Epoch 34/200
615/615 [==============================] - 0s 514us/step - loss: 0.3480 -
 accuracy: 0.9024
Epoch 35/200
615/615 [==============================] - 0s 505us/step - loss: 0.3427 -
 accuracy: 0.9057
Epoch 36/200
615/615 [==============================] - 0s 468us/step - loss: 0.3413 -
 accuracy: 0.9073
Epoch 37/200
615/615 [==============================] - 0s 507us/step - loss: 0.3396 -
 accuracy: 0.9073
Epoch 38/200
615/615 [==============================] - 0s 449us/step - loss: 0.3383 -
 accuracy: 0.9073
Epoch 39/200
615/615 [==============================] - 0s 520us/step - loss: 0.3372 -
 accuracy: 0.9073
Epoch 40/200
615/615 [==============================] - 0s 481us/step - loss: 0.3362 -
 accuracy: 0.9073
Epoch 41/200
615/615 [==============================] - 0s 462us/step - loss: 0.3355 -
 accuracy: 0.9073
Epoch 42/200
615/615 [==============================] - 0s 488us/step - loss: 0.3342 -
 accuracy: 0.9073
Epoch 43/200
615/615 [==============================] - 0s 436us/step - loss: 0.3334 -
 accuracy: 0.9073
Epoch 44/200
615/615 [==============================] - 0s 488us/step - loss: 0.3334 -
 accuracy: 0.9089
Epoch 45/200
615/615 [==============================] - 0s 501us/step - loss: 0.3314 -
 accuracy: 0.9089
Epoch 46/200
615/615 [==============================] - 0s 494us/step - loss: 0.3322 -
 accuracy: 0.90730s - loss: 0.3304 - accuracy:
Epoch 47/200
615/615 [==============================] - 0s 579us/step - loss: 0.3309 -
 accuracy: 0.9073
Epoch 48/200
615/615 [==============================] - 0s 473us/step - loss: 0.3272 -
 accuracy: 0.9089
```

```
Epoch 49/200
615/615 [==============================] - 0s 442us/step - loss: 0.3235 -
 accuracy: 0.9138
Epoch 50/200
615/615 [==============================] - 0s 527us/step - loss: 0.3251 -
 accuracy: 0.9073
Epoch 51/200
615/615 [==============================] - 0s 436us/step - loss: 0.3214 -
 accuracy: 0.9138
Epoch 52/200
615/615 [==============================] - 0s 449us/step - loss: 0.3208 -
 accuracy: 0.9138
Epoch 53/200
615/615 [==============================] - 0s 510us/step - loss: 0.3228 -
 accuracy: 0.9106
Epoch 54/200
615/615 [==============================] - 0s 475us/step - loss: 0.3192 -
 accuracy: 0.9138
Epoch 55/200
615/615 [==============================] - 0s 436us/step - loss: 0.3182 -
 accuracy: 0.9138
Epoch 56/200
615/615 [==============================] - 0s 494us/step - loss: 0.3172 -
 accuracy: 0.9138
Epoch 57/200
615/615 [==============================] - 1s 871us/step - loss: 0.3164 -
 accuracy: 0.91380s - loss: 0.3147 - accuracy: 0.
Epoch 58/200
615/615 [==============================] - 1s 1ms/step - loss: 0.3157 - ac
curacy: 0.9138
Epoch 59/200
615/615 [==============================] - 1s 936us/step - loss: 0.3150 -
 accuracy: 0.9138
Epoch 60/200
615/615 [==============================] - 1s 1ms/step - loss: 0.3143 - ac
curacy: 0.9138
Epoch 61/200
615/615 [==============================] - 0s 774us/step - loss: 0.3136 -
 accuracy: 0.9138
Epoch 62/200
615/615 [==============================] - 1s 1ms/step - loss: 0.3130 - ac
curacy: 0.9138
Epoch 63/200
615/615 [==============================] - 0s 735us/step - loss: 0.3123 -
 accuracy: 0.9138
Epoch 64/200
224/615 [========>.................] - ETA: 0s - loss: 0.3508 - accura
cy: 0.8795


C:\Users\user\Anaconda3\lib\site-packages\keras\callbacks\callbacks.py:95:
RuntimeWarning: Method (on_train_batch_end) is slow compared to the batch
update (0.147946). Check your callbacks.
  % (hook_name, delta_t_median), RuntimeWarning)
```

```
615/615 [==============================] - 1s 1ms/step - loss: 0.3117 - ac
curacy: 0.9138
Epoch 65/200
615/615 [==============================] - 0s 652us/step - loss: 0.3112 -
accuracy: 0.9138
Epoch 66/200
615/615 [==============================] - 0s 514us/step - loss: 0.3106 -
accuracy: 0.9138
Epoch 67/200
615/615 [==============================] - 0s 501us/step - loss: 0.3101 -
accuracy: 0.9138
Epoch 68/200
615/615 [==============================] - 0s 579us/step - loss: 0.3095 -
accuracy: 0.9138
Epoch 69/200
615/615 [==============================] - 0s 585us/step - loss: 0.3089 -
accuracy: 0.9138
Epoch 70/200
615/615 [==============================] - 0s 468us/step - loss: 0.3084 -
accuracy: 0.9138
Epoch 71/200
615/615 [==============================] - 0s 488us/step - loss: 0.3079 -
accuracy: 0.9138
Epoch 72/200
615/615 [==============================] - 0s 585us/step - loss: 0.3073 -
accuracy: 0.9138
Epoch 73/200
615/615 [==============================] - 0s 579us/step - loss: 0.3068 -
accuracy: 0.9138
Epoch 74/200
615/615 [==============================] - 0s 475us/step - loss: 0.3063 -
accuracy: 0.9138
Epoch 75/200
615/615 [==============================] - 0s 553us/step - loss: 0.3059 -
accuracy: 0.9138
Epoch 76/200
615/615 [==============================] - 0s 580us/step - loss: 0.3054 -
accuracy: 0.9138
Epoch 77/200
615/615 [==============================] - 0s 481us/step - loss: 0.3049 -
accuracy: 0.91380s - loss: 0.3244 - accuracy
Epoch 78/200
615/615 [==============================] - 0s 605us/step - loss: 0.3045 -
accuracy: 0.9138
Epoch 79/200
615/615 [==============================] - 0s 481us/step - loss: 0.3040 -
accuracy: 0.9138
Epoch 80/200
615/615 [==============================] - 0s 481us/step - loss: 0.3036 -
accuracy: 0.9138
Epoch 81/200
615/615 [==============================] - 0s 572us/step - loss: 0.3031 -
accuracy: 0.9138
Epoch 82/200
615/615 [==============================] - 0s 449us/step - loss: 0.3027 -
accuracy: 0.9138
Epoch 83/200
615/615 [==============================] - 0s 611us/step - loss: 0.3023 -
accuracy: 0.9138
Epoch 84/200
615/615 [==============================] - 0s 533us/step - loss: 0.3019 -
```

```
accuracy: 0.9138
Epoch 85/200
615/615 [==============================] - 0s 533us/step - loss: 0.3015 -
accuracy: 0.9138
Epoch 86/200
615/615 [==============================] - 0s 449us/step - loss: 0.3011 -
accuracy: 0.9138
Epoch 87/200
615/615 [==============================] - 0s 533us/step - loss: 0.3007 -
accuracy: 0.9138
Epoch 88/200
615/615 [==============================] - 0s 507us/step - loss: 0.3003 -
accuracy: 0.9138
Epoch 89/200
615/615 [==============================] - 0s 462us/step - loss: 0.2999 -
accuracy: 0.9138
Epoch 90/200
615/615 [==============================] - 0s 559us/step - loss: 0.2995 -
accuracy: 0.9138
Epoch 91/200
615/615 [==============================] - 0s 514us/step - loss: 0.2992 -
accuracy: 0.9138
Epoch 92/200
615/615 [==============================] - 0s 449us/step - loss: 0.2988 -
accuracy: 0.9138
Epoch 93/200
615/615 [==============================] - 0s 501us/step - loss: 0.2985 -
accuracy: 0.9138
Epoch 94/200
615/615 [==============================] - 0s 527us/step - loss: 0.2982 -
accuracy: 0.9138
Epoch 95/200
615/615 [==============================] - 0s 468us/step - loss: 0.2978 -
accuracy: 0.9138
Epoch 96/200
615/615 [==============================] - 0s 533us/step - loss: 0.2975 -
accuracy: 0.9138
Epoch 97/200
615/615 [==============================] - 0s 553us/step - loss: 0.2972 -
accuracy: 0.9138
Epoch 98/200
615/615 [==============================] - 0s 507us/step - loss: 0.2968 -
accuracy: 0.9138
Epoch 99/200
615/615 [==============================] - 0s 520us/step - loss: 0.2965 -
accuracy: 0.9138
Epoch 100/200
615/615 [==============================] - 0s 670us/step - loss: 0.2962 -
accuracy: 0.9138
Epoch 101/200
615/615 [==============================] - 0s 514us/step - loss: 0.2959 -
accuracy: 0.9138
Epoch 102/200
615/615 [==============================] - 0s 527us/step - loss: 0.2956 -
accuracy: 0.9138
Epoch 103/200
615/615 [==============================] - 0s 527us/step - loss: 0.2953 -
accuracy: 0.9138
Epoch 104/200
615/615 [==============================] - 0s 514us/step - loss: 0.2950 -
accuracy: 0.9138
```

```
Epoch 105/200
615/615 [==============================] - 0s 527us/step - loss: 0.2947 -
accuracy: 0.9138
Epoch 106/200
615/615 [==============================] - 0s 516us/step - loss: 0.2945 -
accuracy: 0.9138
Epoch 107/200
615/615 [==============================] - 0s 455us/step - loss: 0.2942 -
accuracy: 0.9138
Epoch 108/200
615/615 [==============================] - 0s 592us/step - loss: 0.2939 -
accuracy: 0.91380s - loss: 0.2555 - accuracy:
Epoch 109/200
615/615 [==============================] - 0s 462us/step - loss: 0.2937 -
accuracy: 0.9138
Epoch 110/200
615/615 [==============================] - 0s 507us/step - loss: 0.2934 -
accuracy: 0.9138
Epoch 111/200
615/615 [==============================] - 0s 468us/step - loss: 0.2931 -
accuracy: 0.9138
Epoch 112/200
615/615 [==============================] - 0s 449us/step - loss: 0.2928 -
accuracy: 0.9138
Epoch 113/200
615/615 [==============================] - 0s 476us/step - loss: 0.2926 -
accuracy: 0.9138
Epoch 114/200
615/615 [==============================] - 0s 696us/step - loss: 0.2923 -
accuracy: 0.9138
Epoch 115/200
615/615 [==============================] - 0s 468us/step - loss: 0.2921 -
accuracy: 0.9138
Epoch 116/200
615/615 [==============================] - 0s 507us/step - loss: 0.2918 -
accuracy: 0.9138
Epoch 117/200
615/615 [==============================] - 0s 423us/step - loss: 0.2916 -
accuracy: 0.9138
Epoch 118/200
615/615 [==============================] - 0s 494us/step - loss: 0.2913 -
accuracy: 0.9138
Epoch 119/200
615/615 [==============================] - 0s 436us/step - loss: 0.2911 -
accuracy: 0.9138
Epoch 120/200
615/615 [==============================] - 0s 423us/step - loss: 0.2909 -
accuracy: 0.9138
Epoch 121/200
615/615 [==============================] - 0s 494us/step - loss: 0.2906 -
accuracy: 0.9138
Epoch 122/200
615/615 [==============================] - 0s 436us/step - loss: 0.2904 -
accuracy: 0.9138
Epoch 123/200
615/615 [==============================] - 0s 462us/step - loss: 0.2902 -
accuracy: 0.9138
Epoch 124/200
615/615 [==============================] - 0s 546us/step - loss: 0.2900 -
accuracy: 0.9138
Epoch 125/200
```

```
615/615 [==============================] - 0s 544us/step - loss: 0.2898 -
accuracy: 0.9138
Epoch 126/200
615/615 [==============================] - 0s 527us/step - loss: 0.2896 -
accuracy: 0.9138
Epoch 127/200
615/615 [==============================] - 0s 416us/step - loss: 0.2893 -
accuracy: 0.9138
Epoch 128/200
615/615 [==============================] - 0s 533us/step - loss: 0.2891 -
accuracy: 0.9138
Epoch 129/200
615/615 [==============================] - 0s 507us/step - loss: 0.2889 -
accuracy: 0.9138
Epoch 130/200
615/615 [==============================] - ETA: 0s - loss: 0.3005 - accura
cy: 0.90 - ETA: 0s - loss: 0.2950 - accuracy: 0.90 - 0s 481us/step - loss:
0.2887 - accuracy: 0.9138
Epoch 131/200
615/615 [==============================] - 0s 436us/step - loss: 0.2885 -
accuracy: 0.9138
Epoch 132/200
615/615 [==============================] - 0s 423us/step - loss: 0.2884 -
accuracy: 0.9138
Epoch 133/200
615/615 [==============================] - 0s 462us/step - loss: 0.2882 -
accuracy: 0.9138
Epoch 134/200
615/615 [==============================] - 0s 494us/step - loss: 0.2880 -
accuracy: 0.9138
Epoch 135/200
615/615 [==============================] - 0s 468us/step - loss: 0.2878 -
accuracy: 0.9138
Epoch 136/200
615/615 [==============================] - 0s 442us/step - loss: 0.2876 -
accuracy: 0.9138
Epoch 137/200
615/615 [==============================] - 0s 631us/step - loss: 0.2874 -
accuracy: 0.9138
Epoch 138/200
615/615 [==============================] - 0s 550us/step - loss: 0.2872 -
accuracy: 0.9138
Epoch 139/200
615/615 [==============================] - 0s 468us/step - loss: 0.2871 -
accuracy: 0.9138
Epoch 140/200
615/615 [==============================] - 0s 494us/step - loss: 0.2869 -
accuracy: 0.9138
Epoch 141/200
615/615 [==============================] - 0s 533us/step - loss: 0.2867 -
accuracy: 0.9138
Epoch 142/200
615/615 [==============================] - 0s 501us/step - loss: 0.2865 -
accuracy: 0.91380s - loss: 0.2915 - accuracy: 0.
Epoch 143/200
615/615 [==============================] - 0s 520us/step - loss: 0.2863 -
accuracy: 0.9138
Epoch 144/200
615/615 [==============================] - 0s 488us/step - loss: 0.2862 -
accuracy: 0.9138
Epoch 145/200
```

```
615/615 [==============================] - 0s 533us/step - loss: 0.2860 -
accuracy: 0.9138
Epoch 146/200
615/615 [==============================] - 0s 501us/step - loss: 0.2858 -
accuracy: 0.91380s - loss: 0.3337 - accuracy
Epoch 147/200
615/615 [==============================] - 0s 455us/step - loss: 0.2857 -
accuracy: 0.9138
Epoch 148/200
615/615 [==============================] - 0s 462us/step - loss: 0.2855 -
accuracy: 0.9138
Epoch 149/200
615/615 [==============================] - 0s 455us/step - loss: 0.2853 -
accuracy: 0.9138
Epoch 150/200
615/615 [==============================] - 0s 559us/step - loss: 0.2852 -
accuracy: 0.9138
Epoch 151/200
615/615 [==============================] - 0s 439us/step - loss: 0.2850 -
accuracy: 0.9138
Epoch 152/200
615/615 [==============================] - 0s 468us/step - loss: 0.2849 -
accuracy: 0.9138
Epoch 153/200
615/615 [==============================] - 0s 527us/step - loss: 0.2847 -
accuracy: 0.91380s - loss: 0.2906 - accuracy
Epoch 154/200
615/615 [==============================] - 0s 507us/step - loss: 0.2846 -
accuracy: 0.9138
Epoch 155/200
615/615 [==============================] - 0s 449us/step - loss: 0.2844 -
accuracy: 0.9138
Epoch 156/200
615/615 [==============================] - 0s 553us/step - loss: 0.2842 -
accuracy: 0.9138
Epoch 157/200
615/615 [==============================] - 0s 462us/step - loss: 0.2841 -
accuracy: 0.9138
Epoch 158/200
615/615 [==============================] - 0s 520us/step - loss: 0.2839 -
accuracy: 0.9138
Epoch 159/200
615/615 [==============================] - 0s 540us/step - loss: 0.2838 -
accuracy: 0.9138
Epoch 160/200
615/615 [==============================] - 0s 462us/step - loss: 0.2837 -
accuracy: 0.9138
Epoch 161/200
615/615 [==============================] - 0s 468us/step - loss: 0.2835 -
accuracy: 0.9138
Epoch 162/200
615/615 [==============================] - 0s 572us/step - loss: 0.2834 -
accuracy: 0.91380s - loss: 0.2693 - accura
Epoch 163/200
615/615 [==============================] - 0s 488us/step - loss: 0.2833 -
accuracy: 0.9138
Epoch 164/200
615/615 [==============================] - 0s 455us/step - loss: 0.2831 -
accuracy: 0.9138
Epoch 165/200
615/615 [==============================] - 0s 696us/step - loss: 0.2830 -
```

```
accuracy: 0.9138
Epoch 166/200
615/615 [==============================] - 0s 494us/step - loss: 0.2829 -
accuracy: 0.9138
Epoch 167/200
615/615 [==============================] - 0s 442us/step - loss: 0.2828 -
accuracy: 0.9138
Epoch 168/200
615/615 [==============================] - 0s 436us/step - loss: 0.2826 -
accuracy: 0.91380s - loss: 0.2631 - accuracy
Epoch 169/200
615/615 [==============================] - 0s 436us/step - loss: 0.2825 -
accuracy: 0.9138
Epoch 170/200
615/615 [==============================] - 0s 549us/step - loss: 0.2824 -
accuracy: 0.9138
Epoch 171/200
615/615 [==============================] - 0s 494us/step - loss: 0.2822 -
accuracy: 0.9138
Epoch 172/200
615/615 [==============================] - 0s 501us/step - loss: 0.2821 -
accuracy: 0.9138
Epoch 173/200
615/615 [==============================] - 0s 507us/step - loss: 0.2820 -
accuracy: 0.9138
Epoch 174/200
416/615 [===================>..........] - ETA: 0s - loss: 0.2843 - accura
cy: 0.9135
```

In [ ]:

```python
scores.mean()
```

In [ ]:

```python
#0.8242339372634888
```

In [ ]:

```python
#Comparing Deep Neural Network with others Classifiers
```

In [ ]:

```python
from sklearn import linear_model as lm
from sklearn.svm import SVC
from sklearn.tree import DecisionTreeClassifier as dtc
from sklearn.neighbors import KNeighborsClassifier as knnc
from sklearn.naive_bayes import GaussianNB as gnb
from sklearn.linear_model import RidgeClassifier as rgc
from sklearn.ensemble import RandomForestClassifier as rfc, AdaBoostClassifier as ada
from sklearn.neural_network import MLPClassifier as MLP
```

In [86]:

```python
classifiers = [
    knnc(),
    dtc(),
    SVC(kernel='sigmoid'),
    SVC(kernel='sigmoid'),
    rgc(),
    rfc(),
    ada()
  ]
classifier_names = [
    'KNN',
    'Decision Tree',
    'SVC',
    'SVC with sigmoid kernel',
    'Gaussian Naive Bayes',
    'RidgeClassifier',
    'RandomForrest',
    'Adaboost'
        ]
```

In [87]:

```python
for clf, clf_name in zip(classifiers, classifier_names):
    cv_scores = cross_val_score(clf, X,y, cv=5)

    print(clf_name, ' mean accuracy: ', round(cv_scores.mean()*100, 3), '% std: ', round(cv_scores.var()*100, 3),'%')
```

```
KNN  mean accuracy:  78.131 % std:  0.073 %
Decision Tree  mean accuracy:  85.162 % std:  0.031 %
SVC  mean accuracy:  71.224 % std:  0.061 %
SVC with sigmoid kernel  mean accuracy:  71.224 % std:  0.061 %
Gaussian Naive Bayes  mean accuracy:  76.827 % std:  0.062 %
RidgeClassifier  mean accuracy:  88.68 % std:  0.096 %
RandomForrest  mean accuracy:  87.762 % std:  0.005 %
```

In [88]:

```python
clf=rfc(n_estimators=100)
```

In [89]:

```python
clf.fit(X_train,y_train)
rfc_pred=clf.predict(X_test)
print(classification_report(y_test,rfc_pred))
```

```
              precision    recall  f1-score   support

           0       0.91      0.95      0.93        98
           1       0.90      0.84      0.87        56

    accuracy                           0.91       154
   macro avg       0.91      0.89      0.90       154
weighted avg       0.91      0.91      0.91       154
```

RandomForest is the best classifier with a prediction of 0.90 and KerasClassifier has a prediction score of 0.81.

In [ ]: