

```
In [99]: import numpy as np
import pandas as pd
import matplotlib.pyplot as plt
import seaborn as sns
```

```
In [13]: df=pd.read_csv('/stroke_data.csv')
```

```
In [16]: df.head()
```

```
Out[16]:
```

	gender	age	hypertension	heart_disease	ever_married	work_type	Residence_type	avg_glucose_level
0	Male	58.0	1	0	Yes	Private	Urban	87.9
1	Female	70.0	0	0	Yes	Private	Rural	69.0
2	Female	52.0	0	0	Yes	Private	Urban	77.5
3	Female	75.0	0	1	Yes	Self-employed	Rural	243.5
4	Female	32.0	0	0	Yes	Private	Rural	77.6

```
In [ ]:
```

## label encoding the categorical column

```
In [22]: from sklearn.preprocessing import LabelEncoder
```

```
In [23]: df['gender'].unique()
```

```
Out[23]: array(['Male', 'Female'], dtype=object)
```

```
In [24]: label_encoder=LabelEncoder()
```

```
In [25]: df['gender_label'] = label_encoder.fit_transform(df['gender'])
```

```
In [26]: df.head()
```

```
Out[26]:
```

	gender	age	hypertension	heart_disease	ever_married	work_type	Residence_type	avg_glucose_level
0	Male	58.0	1	0	Yes	Private	Urban	87.9
1	Female	70.0	0	0	Yes	Private	Rural	69.0
2	Female	52.0	0	0	Yes	Private	Urban	77.5
3	Female	75.0	0	1	Yes	Self-employed	Rural	243.5
4	Female	32.0	0	0	Yes	Private	Rural	77.6

In [27]: `df['smoking_label'] = label_encoder.fit_transform(df['smoking_status'])`

In [28]: `df.head()`

Out[28]:

	gender	age	hypertension	heart_disease	ever_married	work_type	Residence_type	avg_glucose_level
0	Male	58.0	1	0	Yes	Private	Urban	87.9
1	Female	70.0	0	0	Yes	Private	Rural	69.0
2	Female	52.0	0	0	Yes	Private	Urban	77.5
3	Female	75.0	0	1	Yes	Self-employed	Rural	243.5
4	Female	32.0	0	0	Yes	Private	Rural	77.6

In [29]: `df['marriage_label'] = label_encoder.fit_transform(df['ever_married'])`

In [30]: `df['residence_label'] = label_encoder.fit_transform(df['Residence_type'])`

In [31]: `df['work_label'] = label_encoder.fit_transform(df['work_type'])`

In [35]: `df.head()`

Out[35]:

	age	hypertension	heart_disease	ever_married	work_type	Residence_type	avg_glucose_level	bmi
0	58.0	1	0	Yes	Private	Urban	87.96	39.2
1	70.0	0	0	Yes	Private	Rural	69.04	35.9
2	52.0	0	0	Yes	Private	Urban	77.59	17.7
3	75.0	0	1	Yes	Self-employed	Rural	243.53	27.0
4	32.0	0	0	Yes	Private	Rural	77.67	32.3

## DIVIDING THE DATA INTO TRAINING SET AND TESTING SET

In [69]: `df.drop('ever_married', axis=1, inplace=True)`

In [70]: `df.drop('work_type', axis=1, inplace=True)`

In [71]: `df.drop('Residence_type', axis=1, inplace=True)`

In [74]: `df.head()`

Out[74]:

	age	hypertension	heart_disease	avg_glucose_level	bmi	stroke	gender_label	smoking_label	mar
0	58.0	1	0	87.96	39.2	0	1	1	
1	70.0	0	0	69.04	35.9	0	0	0	
2	52.0	0	0	77.59	17.7	0	0	0	
3	75.0	0	1	243.53	27.0	0	0	1	
4	32.0	0	0	77.67	32.3	0	0	2	

In [75]: `x=df.drop('stroke', axis=1)`In [76]: `y=df['stroke']`In [77]: `from sklearn.model_selection import train_test_split`In [78]: `x_test,x_train,y_test,y_train=train_test_split(x,y,test_size=0.3,random_state=2021)`In [79]: `import tensorflow as tf  
from tensorflow.keras.models import Sequential  
from tensorflow.keras.layers import Dense, Dropout`In [80]: `ann_model = Sequential()`In [81]: `ann_model.add(Dense(units=30, activation='relu'))` *#input layer*In [82]: `ann_model.add(Dense(units=15, activation='relu'))` *#hidden layer*In [83]: `ann_model.add(Dense(units=1, activation='sigmoid'))` *#output layer*In [84]: `ann_model.compile(loss='binary_crossentropy', optimizer='adam', metrics=['accuracy'])`In [85]: `ann_model.fit(  
x=x_train,  
y=y_train,  
epochs=600,  
validation_data=(x_test, y_test),  
verbose=1  
)`

Epoch 1/600

273/273 [=====] - 2s 4ms/step - loss: 1.0367 - accuracy: 0.8494  
- val\_loss: 0.0969 - val\_accuracy: 0.9816

Epoch 2/600

273/273 [=====] - 1s 3ms/step - loss: 0.0981 - accuracy: 0.9821  
- val\_loss: 0.1057 - val\_accuracy: 0.9816

Epoch 3/600

273/273 [=====] - 1s 3ms/step - loss: 0.1138 - accuracy: 0.9792  
- val\_loss: 0.0952 - val\_accuracy: 0.9811

Epoch 4/600

273/273 [=====] - 1s 3ms/step - loss: 0.1178 - accuracy: 0.9755  
- val\_loss: 0.0949 - val\_accuracy: 0.9811

Epoch 5/600

```
273/273 [=====] - 1s 3ms/step - loss: 0.1047 - accuracy: 0.9817
- val_loss: 0.0883 - val_accuracy: 0.9816
Epoch 6/600
273/273 [=====] - 1s 3ms/step - loss: 0.1058 - accuracy: 0.9778
- val_loss: 0.0937 - val_accuracy: 0.9816
Epoch 7/600
273/273 [=====] - 1s 3ms/step - loss: 0.1045 - accuracy: 0.9794
- val_loss: 0.0888 - val_accuracy: 0.9816
Epoch 8/600
273/273 [=====] - 1s 3ms/step - loss: 0.0966 - accuracy: 0.9819
- val_loss: 0.0886 - val_accuracy: 0.9816
Epoch 9/600
273/273 [=====] - 1s 3ms/step - loss: 0.0986 - accuracy: 0.9792
- val_loss: 0.0867 - val_accuracy: 0.9816
Epoch 10/600
273/273 [=====] - 1s 3ms/step - loss: 0.1057 - accuracy: 0.9791
- val_loss: 0.1034 - val_accuracy: 0.9816
Epoch 11/600
273/273 [=====] - 1s 3ms/step - loss: 0.0966 - accuracy: 0.9808
- val_loss: 0.1017 - val_accuracy: 0.9795
Epoch 12/600
273/273 [=====] - 1s 3ms/step - loss: 0.1082 - accuracy: 0.9789
- val_loss: 0.0861 - val_accuracy: 0.9816
Epoch 13/600
273/273 [=====] - 1s 3ms/step - loss: 0.1048 - accuracy: 0.9777
- val_loss: 0.0872 - val_accuracy: 0.9816
Epoch 14/600
273/273 [=====] - 1s 3ms/step - loss: 0.1042 - accuracy: 0.9791
- val_loss: 0.1118 - val_accuracy: 0.9816
Epoch 15/600
273/273 [=====] - 1s 3ms/step - loss: 0.1052 - accuracy: 0.9785
- val_loss: 0.0851 - val_accuracy: 0.9816
Epoch 16/600
273/273 [=====] - 1s 3ms/step - loss: 0.1007 - accuracy: 0.9772
- val_loss: 0.0885 - val_accuracy: 0.9816
Epoch 17/600
273/273 [=====] - 1s 3ms/step - loss: 0.0873 - accuracy: 0.9811
- val_loss: 0.0846 - val_accuracy: 0.9816
Epoch 18/600
273/273 [=====] - 1s 3ms/step - loss: 0.0974 - accuracy: 0.9793
- val_loss: 0.0856 - val_accuracy: 0.9816
Epoch 19/600
273/273 [=====] - 1s 3ms/step - loss: 0.0926 - accuracy: 0.9799
- val_loss: 0.0950 - val_accuracy: 0.9812
Epoch 20/600
273/273 [=====] - 1s 3ms/step - loss: 0.0971 - accuracy: 0.9785
- val_loss: 0.0956 - val_accuracy: 0.9811
Epoch 21/600
273/273 [=====] - 1s 3ms/step - loss: 0.0895 - accuracy: 0.9816
- val_loss: 0.0907 - val_accuracy: 0.9810
Epoch 22/600
273/273 [=====] - 1s 3ms/step - loss: 0.0956 - accuracy: 0.9798
- val_loss: 0.0869 - val_accuracy: 0.9816
Epoch 23/600
273/273 [=====] - 1s 3ms/step - loss: 0.0914 - accuracy: 0.9797
- val_loss: 0.0858 - val_accuracy: 0.9816
Epoch 24/600
273/273 [=====] - 1s 3ms/step - loss: 0.0836 - accuracy: 0.9828
- val_loss: 0.0892 - val_accuracy: 0.9816
Epoch 25/600
273/273 [=====] - 1s 3ms/step - loss: 0.0965 - accuracy: 0.9797
- val_loss: 0.0910 - val_accuracy: 0.9816
Epoch 26/600
273/273 [=====] - 1s 3ms/step - loss: 0.0984 - accuracy: 0.9781
- val_loss: 0.0852 - val_accuracy: 0.9816
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Epoch 27/600
273/273 [=====] - 1s 3ms/step - loss: 0.0942 - accuracy: 0.9801
- val_loss: 0.0953 - val_accuracy: 0.9816
Epoch 28/600
273/273 [=====] - 1s 3ms/step - loss: 0.0996 - accuracy: 0.9787
- val_loss: 0.0838 - val_accuracy: 0.9816
Epoch 29/600
273/273 [=====] - 1s 3ms/step - loss: 0.0931 - accuracy: 0.9793
- val_loss: 0.0850 - val_accuracy: 0.9816
Epoch 30/600
273/273 [=====] - 1s 3ms/step - loss: 0.0876 - accuracy: 0.9812
- val_loss: 0.0846 - val_accuracy: 0.9816
Epoch 31/600
273/273 [=====] - 1s 3ms/step - loss: 0.0807 - accuracy: 0.9822
- val_loss: 0.0866 - val_accuracy: 0.9816
Epoch 32/600
273/273 [=====] - 1s 3ms/step - loss: 0.1011 - accuracy: 0.9778
- val_loss: 0.0960 - val_accuracy: 0.9816
Epoch 33/600
273/273 [=====] - 1s 3ms/step - loss: 0.0897 - accuracy: 0.9808
- val_loss: 0.0869 - val_accuracy: 0.9816
Epoch 34/600
273/273 [=====] - 1s 3ms/step - loss: 0.0890 - accuracy: 0.9813
- val_loss: 0.0846 - val_accuracy: 0.9816
Epoch 35/600
273/273 [=====] - 1s 3ms/step - loss: 0.0883 - accuracy: 0.9803
- val_loss: 0.0871 - val_accuracy: 0.9815
Epoch 36/600
273/273 [=====] - 1s 3ms/step - loss: 0.0835 - accuracy: 0.9819
- val_loss: 0.0842 - val_accuracy: 0.9816
Epoch 37/600
273/273 [=====] - 1s 3ms/step - loss: 0.0909 - accuracy: 0.9799
- val_loss: 0.0846 - val_accuracy: 0.9816
Epoch 38/600
273/273 [=====] - 1s 3ms/step - loss: 0.0834 - accuracy: 0.9818
- val_loss: 0.0863 - val_accuracy: 0.9816
Epoch 39/600
273/273 [=====] - 1s 3ms/step - loss: 0.0879 - accuracy: 0.9795
- val_loss: 0.0843 - val_accuracy: 0.9816
Epoch 40/600
273/273 [=====] - 1s 3ms/step - loss: 0.0865 - accuracy: 0.9807
- val_loss: 0.0835 - val_accuracy: 0.9816
Epoch 41/600
273/273 [=====] - 1s 3ms/step - loss: 0.0854 - accuracy: 0.9805
- val_loss: 0.0884 - val_accuracy: 0.9816
Epoch 42/600
273/273 [=====] - 1s 3ms/step - loss: 0.1022 - accuracy: 0.9767
- val_loss: 0.0838 - val_accuracy: 0.9816
Epoch 43/600
273/273 [=====] - 1s 3ms/step - loss: 0.1030 - accuracy: 0.9759
- val_loss: 0.0849 - val_accuracy: 0.9816
Epoch 44/600
273/273 [=====] - 1s 3ms/step - loss: 0.0898 - accuracy: 0.9797
- val_loss: 0.0868 - val_accuracy: 0.9816
Epoch 45/600
273/273 [=====] - 1s 3ms/step - loss: 0.0928 - accuracy: 0.9799
- val_loss: 0.0896 - val_accuracy: 0.9814
Epoch 46/600
273/273 [=====] - 1s 3ms/step - loss: 0.0832 - accuracy: 0.9816
- val_loss: 0.0840 - val_accuracy: 0.9816
Epoch 47/600
273/273 [=====] - 1s 3ms/step - loss: 0.0848 - accuracy: 0.9817
- val_loss: 0.0863 - val_accuracy: 0.9816
Epoch 48/600
273/273 [=====] - 1s 3ms/step - loss: 0.0923 - accuracy: 0.9783
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- val_loss: 0.0869 - val_accuracy: 0.9816
Epoch 49/600
273/273 [=====] - 1s 3ms/step - loss: 0.0935 - accuracy: 0.9788
- val_loss: 0.0836 - val_accuracy: 0.9816
Epoch 50/600
273/273 [=====] - 1s 3ms/step - loss: 0.0828 - accuracy: 0.9817
- val_loss: 0.0896 - val_accuracy: 0.9816
Epoch 51/600
273/273 [=====] - 1s 3ms/step - loss: 0.0886 - accuracy: 0.9799
- val_loss: 0.0826 - val_accuracy: 0.9816
Epoch 52/600
273/273 [=====] - 1s 3ms/step - loss: 0.0880 - accuracy: 0.9793
- val_loss: 0.0870 - val_accuracy: 0.9816
Epoch 53/600
273/273 [=====] - 1s 3ms/step - loss: 0.0899 - accuracy: 0.9787
- val_loss: 0.0877 - val_accuracy: 0.9816
Epoch 54/600
273/273 [=====] - 1s 3ms/step - loss: 0.0962 - accuracy: 0.9778
- val_loss: 0.0843 - val_accuracy: 0.9816
Epoch 55/600
273/273 [=====] - 1s 3ms/step - loss: 0.0911 - accuracy: 0.9785
- val_loss: 0.0888 - val_accuracy: 0.9813
Epoch 56/600
273/273 [=====] - 1s 3ms/step - loss: 0.0866 - accuracy: 0.9809
- val_loss: 0.0832 - val_accuracy: 0.9816
Epoch 57/600
273/273 [=====] - 1s 3ms/step - loss: 0.0842 - accuracy: 0.9806
- val_loss: 0.0942 - val_accuracy: 0.9813
Epoch 58/600
273/273 [=====] - 1s 3ms/step - loss: 0.0883 - accuracy: 0.9786
- val_loss: 0.0823 - val_accuracy: 0.9816
Epoch 59/600
273/273 [=====] - 1s 3ms/step - loss: 0.0903 - accuracy: 0.9792
- val_loss: 0.0875 - val_accuracy: 0.9816
Epoch 60/600
273/273 [=====] - 1s 3ms/step - loss: 0.0900 - accuracy: 0.9787
- val_loss: 0.0832 - val_accuracy: 0.9816
Epoch 61/600
273/273 [=====] - 1s 3ms/step - loss: 0.0870 - accuracy: 0.9788
- val_loss: 0.0840 - val_accuracy: 0.9816
Epoch 62/600
273/273 [=====] - 1s 3ms/step - loss: 0.0807 - accuracy: 0.9823
- val_loss: 0.0834 - val_accuracy: 0.9816
Epoch 63/600
273/273 [=====] - 1s 3ms/step - loss: 0.0894 - accuracy: 0.9799
- val_loss: 0.0854 - val_accuracy: 0.9816
Epoch 64/600
273/273 [=====] - 1s 3ms/step - loss: 0.0830 - accuracy: 0.9801
- val_loss: 0.0828 - val_accuracy: 0.9816
Epoch 65/600
273/273 [=====] - 1s 3ms/step - loss: 0.0825 - accuracy: 0.9806
- val_loss: 0.0862 - val_accuracy: 0.9816
Epoch 66/600
273/273 [=====] - 1s 3ms/step - loss: 0.0823 - accuracy: 0.9822
- val_loss: 0.0871 - val_accuracy: 0.9816
Epoch 67/600
273/273 [=====] - 1s 3ms/step - loss: 0.0891 - accuracy: 0.9793
- val_loss: 0.0827 - val_accuracy: 0.9816
Epoch 68/600
273/273 [=====] - 1s 3ms/step - loss: 0.0885 - accuracy: 0.9792
- val_loss: 0.0833 - val_accuracy: 0.9816
Epoch 69/600
273/273 [=====] - 1s 3ms/step - loss: 0.0839 - accuracy: 0.9812
- val_loss: 0.0827 - val_accuracy: 0.9816
Epoch 70/600
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273/273 [=====] - 1s 3ms/step - loss: 0.0808 - accuracy: 0.9817
- val_loss: 0.0834 - val_accuracy: 0.9816
Epoch 71/600
273/273 [=====] - 1s 3ms/step - loss: 0.0855 - accuracy: 0.9801
- val_loss: 0.0865 - val_accuracy: 0.9816
Epoch 72/600
273/273 [=====] - 1s 3ms/step - loss: 0.0857 - accuracy: 0.9807
- val_loss: 0.0833 - val_accuracy: 0.9816
Epoch 73/600
273/273 [=====] - 1s 3ms/step - loss: 0.0835 - accuracy: 0.9803
- val_loss: 0.0831 - val_accuracy: 0.9816
Epoch 74/600
273/273 [=====] - 1s 3ms/step - loss: 0.0857 - accuracy: 0.9793
- val_loss: 0.0866 - val_accuracy: 0.9816
Epoch 75/600
273/273 [=====] - 1s 3ms/step - loss: 0.0900 - accuracy: 0.9798
- val_loss: 0.0840 - val_accuracy: 0.9816
Epoch 76/600
273/273 [=====] - 1s 3ms/step - loss: 0.0852 - accuracy: 0.9799
- val_loss: 0.0852 - val_accuracy: 0.9816
Epoch 77/600
273/273 [=====] - 1s 3ms/step - loss: 0.0912 - accuracy: 0.9778
- val_loss: 0.0888 - val_accuracy: 0.9816
Epoch 78/600
273/273 [=====] - 1s 3ms/step - loss: 0.0845 - accuracy: 0.9799
- val_loss: 0.0826 - val_accuracy: 0.9816
Epoch 79/600
273/273 [=====] - 1s 3ms/step - loss: 0.0891 - accuracy: 0.9784
- val_loss: 0.0833 - val_accuracy: 0.9816
Epoch 80/600
273/273 [=====] - 1s 3ms/step - loss: 0.0841 - accuracy: 0.9808
- val_loss: 0.0843 - val_accuracy: 0.9815
Epoch 81/600
273/273 [=====] - 1s 3ms/step - loss: 0.0861 - accuracy: 0.9801
- val_loss: 0.0826 - val_accuracy: 0.9816
Epoch 82/600
273/273 [=====] - 1s 3ms/step - loss: 0.0911 - accuracy: 0.9789
- val_loss: 0.0842 - val_accuracy: 0.9816
Epoch 83/600
273/273 [=====] - 1s 3ms/step - loss: 0.0916 - accuracy: 0.9781
- val_loss: 0.0832 - val_accuracy: 0.9816
Epoch 84/600
273/273 [=====] - 1s 3ms/step - loss: 0.0876 - accuracy: 0.9793
- val_loss: 0.0829 - val_accuracy: 0.9816
Epoch 85/600
273/273 [=====] - 1s 3ms/step - loss: 0.0728 - accuracy: 0.9823
- val_loss: 0.0840 - val_accuracy: 0.9816
Epoch 86/600
273/273 [=====] - 1s 3ms/step - loss: 0.0827 - accuracy: 0.9808
- val_loss: 0.0828 - val_accuracy: 0.9816
Epoch 87/600
273/273 [=====] - 1s 3ms/step - loss: 0.0861 - accuracy: 0.9798
- val_loss: 0.0843 - val_accuracy: 0.9816
Epoch 88/600
273/273 [=====] - 1s 3ms/step - loss: 0.0862 - accuracy: 0.9799
- val_loss: 0.0828 - val_accuracy: 0.9816
Epoch 89/600
273/273 [=====] - 1s 3ms/step - loss: 0.0860 - accuracy: 0.9793
- val_loss: 0.0826 - val_accuracy: 0.9816
Epoch 90/600
273/273 [=====] - 1s 3ms/step - loss: 0.0853 - accuracy: 0.9796
- val_loss: 0.0832 - val_accuracy: 0.9816
Epoch 91/600
273/273 [=====] - 1s 3ms/step - loss: 0.0829 - accuracy: 0.9803
- val_loss: 0.0851 - val_accuracy: 0.9816
```

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Epoch 92/600
273/273 [=====] - 1s 3ms/step - loss: 0.0920 - accuracy: 0.9782
- val_loss: 0.0843 - val_accuracy: 0.9816
Epoch 93/600
273/273 [=====] - 1s 3ms/step - loss: 0.0901 - accuracy: 0.9782
- val_loss: 0.0861 - val_accuracy: 0.9816
Epoch 94/600
273/273 [=====] - 1s 3ms/step - loss: 0.0759 - accuracy: 0.9821
- val_loss: 0.0831 - val_accuracy: 0.9816
Epoch 95/600
273/273 [=====] - 1s 3ms/step - loss: 0.0835 - accuracy: 0.9804
- val_loss: 0.0822 - val_accuracy: 0.9816
Epoch 96/600
273/273 [=====] - 1s 3ms/step - loss: 0.0873 - accuracy: 0.9795
- val_loss: 0.0829 - val_accuracy: 0.9816
Epoch 97/600
273/273 [=====] - 1s 3ms/step - loss: 0.0861 - accuracy: 0.9797
- val_loss: 0.0821 - val_accuracy: 0.9816
Epoch 98/600
273/273 [=====] - 1s 3ms/step - loss: 0.0873 - accuracy: 0.9790
- val_loss: 0.0830 - val_accuracy: 0.9816
Epoch 99/600
273/273 [=====] - 1s 3ms/step - loss: 0.0829 - accuracy: 0.9809
- val_loss: 0.0847 - val_accuracy: 0.9816
Epoch 100/600
273/273 [=====] - 1s 3ms/step - loss: 0.0859 - accuracy: 0.9802
- val_loss: 0.0825 - val_accuracy: 0.9816
Epoch 101/600
273/273 [=====] - 1s 3ms/step - loss: 0.0790 - accuracy: 0.9808
- val_loss: 0.0837 - val_accuracy: 0.9816
Epoch 102/600
273/273 [=====] - 1s 3ms/step - loss: 0.0919 - accuracy: 0.9778
- val_loss: 0.0830 - val_accuracy: 0.9816
Epoch 103/600
273/273 [=====] - 1s 4ms/step - loss: 0.0797 - accuracy: 0.9816
- val_loss: 0.0823 - val_accuracy: 0.9816
Epoch 104/600
273/273 [=====] - 1s 4ms/step - loss: 0.0844 - accuracy: 0.9799
- val_loss: 0.0825 - val_accuracy: 0.9816
Epoch 105/600
273/273 [=====] - 1s 4ms/step - loss: 0.0780 - accuracy: 0.9816
- val_loss: 0.0825 - val_accuracy: 0.9816
Epoch 106/600
273/273 [=====] - 1s 4ms/step - loss: 0.0834 - accuracy: 0.9804
- val_loss: 0.0825 - val_accuracy: 0.9816
Epoch 107/600
273/273 [=====] - 1s 4ms/step - loss: 0.0771 - accuracy: 0.9814
- val_loss: 0.0827 - val_accuracy: 0.9816
Epoch 108/600
273/273 [=====] - 1s 4ms/step - loss: 0.0704 - accuracy: 0.9835
- val_loss: 0.0823 - val_accuracy: 0.9816
Epoch 109/600
273/273 [=====] - 1s 4ms/step - loss: 0.0841 - accuracy: 0.9806
- val_loss: 0.0821 - val_accuracy: 0.9816
Epoch 110/600
273/273 [=====] - 1s 4ms/step - loss: 0.0778 - accuracy: 0.9823
- val_loss: 0.0833 - val_accuracy: 0.9815
Epoch 111/600
273/273 [=====] - 1s 4ms/step - loss: 0.0798 - accuracy: 0.9812
- val_loss: 0.0831 - val_accuracy: 0.9816
Epoch 112/600
273/273 [=====] - 1s 4ms/step - loss: 0.0830 - accuracy: 0.9802
- val_loss: 0.0822 - val_accuracy: 0.9816
Epoch 113/600
273/273 [=====] - 1s 3ms/step - loss: 0.0816 - accuracy: 0.9795
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- val_loss: 0.0911 - val_accuracy: 0.9816
Epoch 114/600
273/273 [=====] - 1s 3ms/step - loss: 0.0882 - accuracy: 0.9795
- val_loss: 0.0821 - val_accuracy: 0.9816
Epoch 115/600
273/273 [=====] - 1s 4ms/step - loss: 0.0897 - accuracy: 0.9777
- val_loss: 0.0815 - val_accuracy: 0.9816
Epoch 116/600
273/273 [=====] - 1s 4ms/step - loss: 0.0814 - accuracy: 0.9805
- val_loss: 0.0832 - val_accuracy: 0.9816
Epoch 117/600
273/273 [=====] - 1s 4ms/step - loss: 0.0881 - accuracy: 0.9774
- val_loss: 0.0837 - val_accuracy: 0.9816
Epoch 118/600
273/273 [=====] - 1s 4ms/step - loss: 0.0807 - accuracy: 0.9807
- val_loss: 0.0865 - val_accuracy: 0.9816
Epoch 119/600
273/273 [=====] - 1s 4ms/step - loss: 0.0818 - accuracy: 0.9800
- val_loss: 0.0837 - val_accuracy: 0.9816
Epoch 120/600
273/273 [=====] - 1s 4ms/step - loss: 0.0821 - accuracy: 0.9799
- val_loss: 0.0827 - val_accuracy: 0.9816
Epoch 121/600
273/273 [=====] - 1s 4ms/step - loss: 0.0817 - accuracy: 0.9796
- val_loss: 0.0829 - val_accuracy: 0.9816
Epoch 122/600
273/273 [=====] - 1s 4ms/step - loss: 0.0743 - accuracy: 0.9819
- val_loss: 0.0822 - val_accuracy: 0.9816
Epoch 123/600
273/273 [=====] - 1s 4ms/step - loss: 0.0746 - accuracy: 0.9822
- val_loss: 0.0833 - val_accuracy: 0.9816
Epoch 124/600
273/273 [=====] - 1s 3ms/step - loss: 0.0845 - accuracy: 0.9790
- val_loss: 0.0823 - val_accuracy: 0.9816
Epoch 125/600
273/273 [=====] - 1s 3ms/step - loss: 0.0837 - accuracy: 0.9794
- val_loss: 0.0835 - val_accuracy: 0.9816
Epoch 126/600
273/273 [=====] - 1s 3ms/step - loss: 0.0795 - accuracy: 0.9799
- val_loss: 0.0837 - val_accuracy: 0.9816
Epoch 127/600
273/273 [=====] - 1s 3ms/step - loss: 0.0855 - accuracy: 0.9795
- val_loss: 0.0843 - val_accuracy: 0.9816
Epoch 128/600
273/273 [=====] - 1s 3ms/step - loss: 0.0837 - accuracy: 0.9792
- val_loss: 0.0830 - val_accuracy: 0.9816
Epoch 129/600
273/273 [=====] - 1s 3ms/step - loss: 0.0861 - accuracy: 0.9789
- val_loss: 0.0823 - val_accuracy: 0.9816
Epoch 130/600
273/273 [=====] - 1s 3ms/step - loss: 0.0773 - accuracy: 0.9808
- val_loss: 0.0834 - val_accuracy: 0.9816
Epoch 131/600
273/273 [=====] - 1s 3ms/step - loss: 0.0827 - accuracy: 0.9804
- val_loss: 0.0878 - val_accuracy: 0.9816
Epoch 132/600
273/273 [=====] - 1s 3ms/step - loss: 0.0754 - accuracy: 0.9823
- val_loss: 0.0831 - val_accuracy: 0.9816
Epoch 133/600
273/273 [=====] - 1s 3ms/step - loss: 0.0764 - accuracy: 0.9820
- val_loss: 0.0828 - val_accuracy: 0.9816
Epoch 134/600
273/273 [=====] - 1s 3ms/step - loss: 0.0835 - accuracy: 0.9797
- val_loss: 0.0836 - val_accuracy: 0.9816
Epoch 135/600
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273/273 [=====] - 1s 3ms/step - loss: 0.0836 - accuracy: 0.9803
- val_loss: 0.0841 - val_accuracy: 0.9816
Epoch 136/600
273/273 [=====] - 1s 3ms/step - loss: 0.0707 - accuracy: 0.9836
- val_loss: 0.0846 - val_accuracy: 0.9816
Epoch 137/600
273/273 [=====] - 1s 3ms/step - loss: 0.0800 - accuracy: 0.9802
- val_loss: 0.0822 - val_accuracy: 0.9816
Epoch 138/600
273/273 [=====] - 1s 3ms/step - loss: 0.0790 - accuracy: 0.9811
- val_loss: 0.0897 - val_accuracy: 0.9816
Epoch 139/600
273/273 [=====] - 1s 3ms/step - loss: 0.0866 - accuracy: 0.9791
- val_loss: 0.0827 - val_accuracy: 0.9816
Epoch 140/600
273/273 [=====] - 1s 3ms/step - loss: 0.0835 - accuracy: 0.9792
- val_loss: 0.0831 - val_accuracy: 0.9816
Epoch 141/600
273/273 [=====] - 1s 3ms/step - loss: 0.0739 - accuracy: 0.9819
- val_loss: 0.0848 - val_accuracy: 0.9816
Epoch 142/600
273/273 [=====] - 1s 3ms/step - loss: 0.0840 - accuracy: 0.9789
- val_loss: 0.0830 - val_accuracy: 0.9816
Epoch 143/600
273/273 [=====] - 1s 4ms/step - loss: 0.0850 - accuracy: 0.9789
- val_loss: 0.0847 - val_accuracy: 0.9816
Epoch 144/600
273/273 [=====] - 1s 3ms/step - loss: 0.0831 - accuracy: 0.9796
- val_loss: 0.0841 - val_accuracy: 0.9816
Epoch 145/600
273/273 [=====] - 1s 3ms/step - loss: 0.0834 - accuracy: 0.9792
- val_loss: 0.0831 - val_accuracy: 0.9816
Epoch 146/600
273/273 [=====] - 1s 3ms/step - loss: 0.0814 - accuracy: 0.9801
- val_loss: 0.0841 - val_accuracy: 0.9816
Epoch 147/600
273/273 [=====] - 1s 3ms/step - loss: 0.0839 - accuracy: 0.9785
- val_loss: 0.0869 - val_accuracy: 0.9816
Epoch 148/600
273/273 [=====] - 1s 3ms/step - loss: 0.0813 - accuracy: 0.9790
- val_loss: 0.0843 - val_accuracy: 0.9816
Epoch 149/600
273/273 [=====] - 1s 3ms/step - loss: 0.0759 - accuracy: 0.9817
- val_loss: 0.0840 - val_accuracy: 0.9815
Epoch 150/600
273/273 [=====] - 1s 3ms/step - loss: 0.0808 - accuracy: 0.9800
- val_loss: 0.0839 - val_accuracy: 0.9816
Epoch 151/600
273/273 [=====] - 1s 3ms/step - loss: 0.0838 - accuracy: 0.9789
- val_loss: 0.0847 - val_accuracy: 0.9815
Epoch 152/600
273/273 [=====] - 1s 3ms/step - loss: 0.0833 - accuracy: 0.9800
- val_loss: 0.0825 - val_accuracy: 0.9816
Epoch 153/600
273/273 [=====] - 1s 3ms/step - loss: 0.0812 - accuracy: 0.9798
- val_loss: 0.0825 - val_accuracy: 0.9816
Epoch 154/600
273/273 [=====] - 1s 3ms/step - loss: 0.0798 - accuracy: 0.9804
- val_loss: 0.0840 - val_accuracy: 0.9816
Epoch 155/600
273/273 [=====] - 1s 3ms/step - loss: 0.0782 - accuracy: 0.9812
- val_loss: 0.0839 - val_accuracy: 0.9816
Epoch 156/600
273/273 [=====] - 1s 3ms/step - loss: 0.0875 - accuracy: 0.9769
- val_loss: 0.0833 - val_accuracy: 0.9816
```

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Epoch 157/600
273/273 [=====] - 1s 3ms/step - loss: 0.0754 - accuracy: 0.9811
- val_loss: 0.0832 - val_accuracy: 0.9811
Epoch 158/600
273/273 [=====] - 1s 3ms/step - loss: 0.0751 - accuracy: 0.9822
- val_loss: 0.0878 - val_accuracy: 0.9815
Epoch 159/600
273/273 [=====] - 1s 3ms/step - loss: 0.0770 - accuracy: 0.9816
- val_loss: 0.0856 - val_accuracy: 0.9815
Epoch 160/600
273/273 [=====] - 1s 3ms/step - loss: 0.0806 - accuracy: 0.9806
- val_loss: 0.0836 - val_accuracy: 0.9815
Epoch 161/600
273/273 [=====] - 1s 3ms/step - loss: 0.0754 - accuracy: 0.9809
- val_loss: 0.0833 - val_accuracy: 0.9816
Epoch 162/600
273/273 [=====] - 1s 3ms/step - loss: 0.0762 - accuracy: 0.9811
- val_loss: 0.0850 - val_accuracy: 0.9816
Epoch 163/600
273/273 [=====] - 1s 3ms/step - loss: 0.0783 - accuracy: 0.9807
- val_loss: 0.0843 - val_accuracy: 0.9816
Epoch 164/600
273/273 [=====] - 1s 3ms/step - loss: 0.0788 - accuracy: 0.9808
- val_loss: 0.0841 - val_accuracy: 0.9815
Epoch 165/600
273/273 [=====] - 1s 3ms/step - loss: 0.0788 - accuracy: 0.9805
- val_loss: 0.0831 - val_accuracy: 0.9814
Epoch 166/600
273/273 [=====] - 1s 3ms/step - loss: 0.0726 - accuracy: 0.9820
- val_loss: 0.0890 - val_accuracy: 0.9812
Epoch 167/600
273/273 [=====] - 1s 3ms/step - loss: 0.0847 - accuracy: 0.9790
- val_loss: 0.0861 - val_accuracy: 0.9816
Epoch 168/600
273/273 [=====] - 1s 3ms/step - loss: 0.0756 - accuracy: 0.9814
- val_loss: 0.0831 - val_accuracy: 0.9815
Epoch 169/600
273/273 [=====] - 1s 3ms/step - loss: 0.0786 - accuracy: 0.9798
- val_loss: 0.0846 - val_accuracy: 0.9816
Epoch 170/600
273/273 [=====] - 1s 3ms/step - loss: 0.0839 - accuracy: 0.9787
- val_loss: 0.0866 - val_accuracy: 0.9816
Epoch 171/600
273/273 [=====] - 1s 3ms/step - loss: 0.0738 - accuracy: 0.9822
- val_loss: 0.0838 - val_accuracy: 0.9815
Epoch 172/600
273/273 [=====] - 1s 3ms/step - loss: 0.0863 - accuracy: 0.9779
- val_loss: 0.0832 - val_accuracy: 0.9815
Epoch 173/600
273/273 [=====] - 1s 3ms/step - loss: 0.0877 - accuracy: 0.9772
- val_loss: 0.0840 - val_accuracy: 0.9816
Epoch 174/600
273/273 [=====] - 1s 3ms/step - loss: 0.0849 - accuracy: 0.9783
- val_loss: 0.0835 - val_accuracy: 0.9816
Epoch 175/600
273/273 [=====] - 1s 3ms/step - loss: 0.0732 - accuracy: 0.9814
- val_loss: 0.0846 - val_accuracy: 0.9810
Epoch 176/600
273/273 [=====] - 1s 3ms/step - loss: 0.0878 - accuracy: 0.9777
- val_loss: 0.0836 - val_accuracy: 0.9815
Epoch 177/600
273/273 [=====] - 1s 3ms/step - loss: 0.0717 - accuracy: 0.9825
- val_loss: 0.0865 - val_accuracy: 0.9814
Epoch 178/600
273/273 [=====] - 1s 3ms/step - loss: 0.0878 - accuracy: 0.9782
```

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- val_loss: 0.0870 - val_accuracy: 0.9816
Epoch 179/600
273/273 [=====] - 1s 3ms/step - loss: 0.0804 - accuracy: 0.9793
- val_loss: 0.0838 - val_accuracy: 0.9814
Epoch 180/600
273/273 [=====] - 1s 3ms/step - loss: 0.0775 - accuracy: 0.9794
- val_loss: 0.0844 - val_accuracy: 0.9815
Epoch 181/600
273/273 [=====] - 1s 3ms/step - loss: 0.0776 - accuracy: 0.9800
- val_loss: 0.0831 - val_accuracy: 0.9813
Epoch 182/600
273/273 [=====] - 1s 3ms/step - loss: 0.0732 - accuracy: 0.9820
- val_loss: 0.0856 - val_accuracy: 0.9816
Epoch 183/600
273/273 [=====] - 1s 3ms/step - loss: 0.0791 - accuracy: 0.9798
- val_loss: 0.0843 - val_accuracy: 0.9810
Epoch 184/600
273/273 [=====] - 1s 3ms/step - loss: 0.0779 - accuracy: 0.9797
- val_loss: 0.0873 - val_accuracy: 0.9811
Epoch 185/600
273/273 [=====] - 1s 3ms/step - loss: 0.0773 - accuracy: 0.9813
- val_loss: 0.0839 - val_accuracy: 0.9816
Epoch 186/600
273/273 [=====] - 1s 3ms/step - loss: 0.0843 - accuracy: 0.9791
- val_loss: 0.0836 - val_accuracy: 0.9815
Epoch 187/600
273/273 [=====] - 1s 3ms/step - loss: 0.0818 - accuracy: 0.9789
- val_loss: 0.0850 - val_accuracy: 0.9815
Epoch 188/600
273/273 [=====] - 1s 3ms/step - loss: 0.0753 - accuracy: 0.9817
- val_loss: 0.0838 - val_accuracy: 0.9816
Epoch 189/600
273/273 [=====] - 1s 3ms/step - loss: 0.0819 - accuracy: 0.9785
- val_loss: 0.0843 - val_accuracy: 0.9815
Epoch 190/600
273/273 [=====] - 1s 3ms/step - loss: 0.0694 - accuracy: 0.9832
- val_loss: 0.0845 - val_accuracy: 0.9811
Epoch 191/600
273/273 [=====] - 1s 3ms/step - loss: 0.0776 - accuracy: 0.9804
- val_loss: 0.0846 - val_accuracy: 0.9816
Epoch 192/600
273/273 [=====] - 1s 3ms/step - loss: 0.0788 - accuracy: 0.9804
- val_loss: 0.0854 - val_accuracy: 0.9816
Epoch 193/600
273/273 [=====] - 1s 3ms/step - loss: 0.0811 - accuracy: 0.9797
- val_loss: 0.0856 - val_accuracy: 0.9815
Epoch 194/600
273/273 [=====] - 1s 3ms/step - loss: 0.0748 - accuracy: 0.9810
- val_loss: 0.0852 - val_accuracy: 0.9816
Epoch 195/600
273/273 [=====] - 1s 3ms/step - loss: 0.0746 - accuracy: 0.9819
- val_loss: 0.0862 - val_accuracy: 0.9815
Epoch 196/600
273/273 [=====] - 1s 3ms/step - loss: 0.0737 - accuracy: 0.9809
- val_loss: 0.0841 - val_accuracy: 0.9816
Epoch 197/600
273/273 [=====] - 1s 3ms/step - loss: 0.0749 - accuracy: 0.9817
- val_loss: 0.0843 - val_accuracy: 0.9813
Epoch 198/600
273/273 [=====] - 1s 3ms/step - loss: 0.0827 - accuracy: 0.9800
- val_loss: 0.0848 - val_accuracy: 0.9811
Epoch 199/600
273/273 [=====] - 1s 3ms/step - loss: 0.0789 - accuracy: 0.9799
- val_loss: 0.0844 - val_accuracy: 0.9814
Epoch 200/600
```

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273/273 [=====] - 1s 3ms/step - loss: 0.0806 - accuracy: 0.9779
- val_loss: 0.0846 - val_accuracy: 0.9816
Epoch 201/600
273/273 [=====] - 1s 3ms/step - loss: 0.0819 - accuracy: 0.9790
- val_loss: 0.0839 - val_accuracy: 0.9816
Epoch 202/600
273/273 [=====] - 1s 3ms/step - loss: 0.0869 - accuracy: 0.9781
- val_loss: 0.0853 - val_accuracy: 0.9814
Epoch 203/600
273/273 [=====] - 1s 3ms/step - loss: 0.0725 - accuracy: 0.9813
- val_loss: 0.0867 - val_accuracy: 0.9816
Epoch 204/600
273/273 [=====] - 1s 3ms/step - loss: 0.0754 - accuracy: 0.9813
- val_loss: 0.0844 - val_accuracy: 0.9815
Epoch 205/600
273/273 [=====] - 1s 3ms/step - loss: 0.0810 - accuracy: 0.9789
- val_loss: 0.0854 - val_accuracy: 0.9816
Epoch 206/600
273/273 [=====] - 1s 3ms/step - loss: 0.0809 - accuracy: 0.9792
- val_loss: 0.0853 - val_accuracy: 0.9814
Epoch 207/600
273/273 [=====] - 1s 3ms/step - loss: 0.0751 - accuracy: 0.9803
- val_loss: 0.0862 - val_accuracy: 0.9810
Epoch 208/600
273/273 [=====] - 1s 3ms/step - loss: 0.0734 - accuracy: 0.9819
- val_loss: 0.0855 - val_accuracy: 0.9809
Epoch 209/600
273/273 [=====] - 1s 3ms/step - loss: 0.0790 - accuracy: 0.9797
- val_loss: 0.0846 - val_accuracy: 0.9815
Epoch 210/600
273/273 [=====] - 1s 3ms/step - loss: 0.0798 - accuracy: 0.9795
- val_loss: 0.0928 - val_accuracy: 0.9816
Epoch 211/600
273/273 [=====] - 1s 3ms/step - loss: 0.0741 - accuracy: 0.9813
- val_loss: 0.0882 - val_accuracy: 0.9815
Epoch 212/600
273/273 [=====] - 1s 3ms/step - loss: 0.0837 - accuracy: 0.9776
- val_loss: 0.0872 - val_accuracy: 0.9815
Epoch 213/600
273/273 [=====] - 1s 3ms/step - loss: 0.0795 - accuracy: 0.9802
- val_loss: 0.0861 - val_accuracy: 0.9811
Epoch 214/600
273/273 [=====] - 1s 3ms/step - loss: 0.0751 - accuracy: 0.9816
- val_loss: 0.0848 - val_accuracy: 0.9815
Epoch 215/600
273/273 [=====] - 1s 3ms/step - loss: 0.0794 - accuracy: 0.9788
- val_loss: 0.0868 - val_accuracy: 0.9814
Epoch 216/600
273/273 [=====] - 1s 3ms/step - loss: 0.0796 - accuracy: 0.9805
- val_loss: 0.0865 - val_accuracy: 0.9815
Epoch 217/600
273/273 [=====] - 1s 3ms/step - loss: 0.0827 - accuracy: 0.9787
- val_loss: 0.0886 - val_accuracy: 0.9816
Epoch 218/600
273/273 [=====] - 1s 3ms/step - loss: 0.0692 - accuracy: 0.9826
- val_loss: 0.0873 - val_accuracy: 0.9816
Epoch 219/600
273/273 [=====] - 1s 3ms/step - loss: 0.0825 - accuracy: 0.9792
- val_loss: 0.0884 - val_accuracy: 0.9816
Epoch 220/600
273/273 [=====] - 1s 3ms/step - loss: 0.0801 - accuracy: 0.9800
- val_loss: 0.0867 - val_accuracy: 0.9815
Epoch 221/600
273/273 [=====] - 1s 3ms/step - loss: 0.0800 - accuracy: 0.9793
- val_loss: 0.0875 - val_accuracy: 0.9816
```

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Epoch 222/600
273/273 [=====] - 1s 4ms/step - loss: 0.0769 - accuracy: 0.9810
- val_loss: 0.0853 - val_accuracy: 0.9815
Epoch 223/600
273/273 [=====] - 1s 3ms/step - loss: 0.0773 - accuracy: 0.9809
- val_loss: 0.0858 - val_accuracy: 0.9814
Epoch 224/600
273/273 [=====] - 1s 3ms/step - loss: 0.0752 - accuracy: 0.9809
- val_loss: 0.0868 - val_accuracy: 0.9815
Epoch 225/600
273/273 [=====] - 1s 3ms/step - loss: 0.0782 - accuracy: 0.9795
- val_loss: 0.0871 - val_accuracy: 0.9815
Epoch 226/600
273/273 [=====] - 1s 3ms/step - loss: 0.0735 - accuracy: 0.9813
- val_loss: 0.0864 - val_accuracy: 0.9815
Epoch 227/600
273/273 [=====] - 1s 3ms/step - loss: 0.0742 - accuracy: 0.9811
- val_loss: 0.0871 - val_accuracy: 0.9815
Epoch 228/600
273/273 [=====] - 1s 3ms/step - loss: 0.0735 - accuracy: 0.9812
- val_loss: 0.0883 - val_accuracy: 0.9810
Epoch 229/600
273/273 [=====] - 1s 4ms/step - loss: 0.0810 - accuracy: 0.9786
- val_loss: 0.0853 - val_accuracy: 0.9815
Epoch 230/600
273/273 [=====] - 1s 3ms/step - loss: 0.0711 - accuracy: 0.9822
- val_loss: 0.0869 - val_accuracy: 0.9815
Epoch 231/600
273/273 [=====] - 1s 3ms/step - loss: 0.0804 - accuracy: 0.9793
- val_loss: 0.0874 - val_accuracy: 0.9814
Epoch 232/600
273/273 [=====] - 1s 3ms/step - loss: 0.0740 - accuracy: 0.9822
- val_loss: 0.0863 - val_accuracy: 0.9815
Epoch 233/600
273/273 [=====] - 1s 3ms/step - loss: 0.0784 - accuracy: 0.9798
- val_loss: 0.0867 - val_accuracy: 0.9815
Epoch 234/600
273/273 [=====] - 1s 3ms/step - loss: 0.0683 - accuracy: 0.9826
- val_loss: 0.0880 - val_accuracy: 0.9813
Epoch 235/600
273/273 [=====] - 1s 3ms/step - loss: 0.0711 - accuracy: 0.9825
- val_loss: 0.0937 - val_accuracy: 0.9799
Epoch 236/600
273/273 [=====] - 1s 3ms/step - loss: 0.0841 - accuracy: 0.9778
- val_loss: 0.0906 - val_accuracy: 0.9816
Epoch 237/600
273/273 [=====] - 1s 3ms/step - loss: 0.0799 - accuracy: 0.9796
- val_loss: 0.0852 - val_accuracy: 0.9814
Epoch 238/600
273/273 [=====] - 1s 3ms/step - loss: 0.0705 - accuracy: 0.9822
- val_loss: 0.0868 - val_accuracy: 0.9814
Epoch 239/600
273/273 [=====] - 1s 3ms/step - loss: 0.0734 - accuracy: 0.9811
- val_loss: 0.0871 - val_accuracy: 0.9812
Epoch 240/600
273/273 [=====] - 1s 3ms/step - loss: 0.0774 - accuracy: 0.9805
- val_loss: 0.0871 - val_accuracy: 0.9814
Epoch 241/600
273/273 [=====] - 1s 3ms/step - loss: 0.0680 - accuracy: 0.9825
- val_loss: 0.0867 - val_accuracy: 0.9815
Epoch 242/600
273/273 [=====] - 1s 3ms/step - loss: 0.0817 - accuracy: 0.9802
- val_loss: 0.0894 - val_accuracy: 0.9810
Epoch 243/600
273/273 [=====] - 1s 3ms/step - loss: 0.0687 - accuracy: 0.9825
```

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- val_loss: 0.0887 - val_accuracy: 0.9814
Epoch 244/600
273/273 [=====] - 1s 3ms/step - loss: 0.0777 - accuracy: 0.9802
- val_loss: 0.0871 - val_accuracy: 0.9814
Epoch 245/600
273/273 [=====] - 1s 3ms/step - loss: 0.0713 - accuracy: 0.9824
- val_loss: 0.0894 - val_accuracy: 0.9813
Epoch 246/600
273/273 [=====] - 1s 3ms/step - loss: 0.0840 - accuracy: 0.9793
- val_loss: 0.0879 - val_accuracy: 0.9814
Epoch 247/600
273/273 [=====] - 1s 3ms/step - loss: 0.0766 - accuracy: 0.9811
- val_loss: 0.0884 - val_accuracy: 0.9812
Epoch 248/600
273/273 [=====] - 1s 3ms/step - loss: 0.0688 - accuracy: 0.9833
- val_loss: 0.0872 - val_accuracy: 0.9813
Epoch 249/600
273/273 [=====] - 1s 3ms/step - loss: 0.0848 - accuracy: 0.9782
- val_loss: 0.0887 - val_accuracy: 0.9815
Epoch 250/600
273/273 [=====] - 1s 3ms/step - loss: 0.0767 - accuracy: 0.9805
- val_loss: 0.0970 - val_accuracy: 0.9793
Epoch 251/600
273/273 [=====] - 1s 3ms/step - loss: 0.0760 - accuracy: 0.9814
- val_loss: 0.0892 - val_accuracy: 0.9816
Epoch 252/600
273/273 [=====] - 1s 3ms/step - loss: 0.0722 - accuracy: 0.9812
- val_loss: 0.0954 - val_accuracy: 0.9801
Epoch 253/600
273/273 [=====] - 1s 3ms/step - loss: 0.0914 - accuracy: 0.9757
- val_loss: 0.0865 - val_accuracy: 0.9815
Epoch 254/600
273/273 [=====] - 1s 3ms/step - loss: 0.0768 - accuracy: 0.9800
- val_loss: 0.0866 - val_accuracy: 0.9813
Epoch 255/600
273/273 [=====] - 1s 3ms/step - loss: 0.0683 - accuracy: 0.9832
- val_loss: 0.0879 - val_accuracy: 0.9815
Epoch 256/600
273/273 [=====] - 1s 3ms/step - loss: 0.0666 - accuracy: 0.9830
- val_loss: 0.0884 - val_accuracy: 0.9813
Epoch 257/600
273/273 [=====] - 1s 3ms/step - loss: 0.0785 - accuracy: 0.9790
- val_loss: 0.0907 - val_accuracy: 0.9815
Epoch 258/600
273/273 [=====] - 1s 3ms/step - loss: 0.0761 - accuracy: 0.9806
- val_loss: 0.0898 - val_accuracy: 0.9815
Epoch 259/600
273/273 [=====] - 1s 3ms/step - loss: 0.0830 - accuracy: 0.9791
- val_loss: 0.0897 - val_accuracy: 0.9813
Epoch 260/600
273/273 [=====] - 1s 3ms/step - loss: 0.0774 - accuracy: 0.9811
- val_loss: 0.0900 - val_accuracy: 0.9812
Epoch 261/600
273/273 [=====] - 1s 3ms/step - loss: 0.0722 - accuracy: 0.9810
- val_loss: 0.0901 - val_accuracy: 0.9812
Epoch 262/600
273/273 [=====] - 1s 3ms/step - loss: 0.0800 - accuracy: 0.9795
- val_loss: 0.0882 - val_accuracy: 0.9814
Epoch 263/600
273/273 [=====] - 1s 4ms/step - loss: 0.0793 - accuracy: 0.9785
- val_loss: 0.0882 - val_accuracy: 0.9815
Epoch 264/600
273/273 [=====] - 1s 3ms/step - loss: 0.0635 - accuracy: 0.9838
- val_loss: 0.0927 - val_accuracy: 0.9814
Epoch 265/600
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273/273 [=====] - 1s 4ms/step - loss: 0.0690 - accuracy: 0.9830
- val_loss: 0.0867 - val_accuracy: 0.9814
Epoch 266/600
273/273 [=====] - 1s 4ms/step - loss: 0.0766 - accuracy: 0.9805
- val_loss: 0.0881 - val_accuracy: 0.9813
Epoch 267/600
273/273 [=====] - 1s 4ms/step - loss: 0.0700 - accuracy: 0.9824
- val_loss: 0.0884 - val_accuracy: 0.9814
Epoch 268/600
273/273 [=====] - 1s 4ms/step - loss: 0.0767 - accuracy: 0.9792
- val_loss: 0.0877 - val_accuracy: 0.9813
Epoch 269/600
273/273 [=====] - 1s 4ms/step - loss: 0.0820 - accuracy: 0.9787
- val_loss: 0.0909 - val_accuracy: 0.9815
Epoch 270/600
273/273 [=====] - 1s 4ms/step - loss: 0.0686 - accuracy: 0.9819
- val_loss: 0.0883 - val_accuracy: 0.9815
Epoch 271/600
273/273 [=====] - 1s 3ms/step - loss: 0.0656 - accuracy: 0.9826
- val_loss: 0.0917 - val_accuracy: 0.9815
Epoch 272/600
273/273 [=====] - 1s 4ms/step - loss: 0.0804 - accuracy: 0.9783
- val_loss: 0.0939 - val_accuracy: 0.9814
Epoch 273/600
273/273 [=====] - 1s 3ms/step - loss: 0.0817 - accuracy: 0.9777
- val_loss: 0.0894 - val_accuracy: 0.9814
Epoch 274/600
273/273 [=====] - 1s 3ms/step - loss: 0.0716 - accuracy: 0.9821
- val_loss: 0.0935 - val_accuracy: 0.9813
Epoch 275/600
273/273 [=====] - 1s 3ms/step - loss: 0.0685 - accuracy: 0.9834
- val_loss: 0.0863 - val_accuracy: 0.9813
Epoch 276/600
273/273 [=====] - 1s 3ms/step - loss: 0.0797 - accuracy: 0.9797
- val_loss: 0.0905 - val_accuracy: 0.9815
Epoch 277/600
273/273 [=====] - 1s 4ms/step - loss: 0.0751 - accuracy: 0.9800
- val_loss: 0.0884 - val_accuracy: 0.9816
Epoch 278/600
273/273 [=====] - 1s 3ms/step - loss: 0.0780 - accuracy: 0.9789
- val_loss: 0.0891 - val_accuracy: 0.9815
Epoch 279/600
273/273 [=====] - 1s 3ms/step - loss: 0.0836 - accuracy: 0.9775
- val_loss: 0.0908 - val_accuracy: 0.9816
Epoch 280/600
273/273 [=====] - 1s 4ms/step - loss: 0.0740 - accuracy: 0.9806
- val_loss: 0.0904 - val_accuracy: 0.9815
Epoch 281/600
273/273 [=====] - 1s 4ms/step - loss: 0.0770 - accuracy: 0.9796
- val_loss: 0.0877 - val_accuracy: 0.9814
Epoch 282/600
273/273 [=====] - 1s 3ms/step - loss: 0.0803 - accuracy: 0.9806
- val_loss: 0.0905 - val_accuracy: 0.9816
Epoch 283/600
273/273 [=====] - 1s 3ms/step - loss: 0.0817 - accuracy: 0.9793
- val_loss: 0.0880 - val_accuracy: 0.9816
Epoch 284/600
273/273 [=====] - 1s 3ms/step - loss: 0.0697 - accuracy: 0.9813
- val_loss: 0.0932 - val_accuracy: 0.9815
Epoch 285/600
273/273 [=====] - 1s 3ms/step - loss: 0.0831 - accuracy: 0.9791
- val_loss: 0.0870 - val_accuracy: 0.9814
Epoch 286/600
273/273 [=====] - 1s 4ms/step - loss: 0.0759 - accuracy: 0.9802
- val_loss: 0.0902 - val_accuracy: 0.9814
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Epoch 287/600
273/273 [=====] - 1s 3ms/step - loss: 0.0734 - accuracy: 0.9808
- val_loss: 0.0930 - val_accuracy: 0.9816
Epoch 288/600
273/273 [=====] - 1s 4ms/step - loss: 0.0790 - accuracy: 0.9804
- val_loss: 0.0900 - val_accuracy: 0.9814
Epoch 289/600
273/273 [=====] - 1s 3ms/step - loss: 0.0801 - accuracy: 0.9777
- val_loss: 0.0931 - val_accuracy: 0.9815
Epoch 290/600
273/273 [=====] - 1s 3ms/step - loss: 0.0754 - accuracy: 0.9803
- val_loss: 0.0894 - val_accuracy: 0.9814
Epoch 291/600
273/273 [=====] - 1s 3ms/step - loss: 0.0762 - accuracy: 0.9803
- val_loss: 0.0903 - val_accuracy: 0.9815
Epoch 292/600
273/273 [=====] - 1s 3ms/step - loss: 0.0816 - accuracy: 0.9794
- val_loss: 0.0938 - val_accuracy: 0.9815
Epoch 293/600
273/273 [=====] - 1s 4ms/step - loss: 0.0732 - accuracy: 0.9805
- val_loss: 0.0904 - val_accuracy: 0.9816
Epoch 294/600
273/273 [=====] - 1s 3ms/step - loss: 0.0646 - accuracy: 0.9834
- val_loss: 0.0883 - val_accuracy: 0.9814
Epoch 295/600
273/273 [=====] - 1s 3ms/step - loss: 0.0772 - accuracy: 0.9794
- val_loss: 0.0882 - val_accuracy: 0.9815
Epoch 296/600
273/273 [=====] - 1s 3ms/step - loss: 0.0721 - accuracy: 0.9805
- val_loss: 0.0936 - val_accuracy: 0.9808
Epoch 297/600
273/273 [=====] - 1s 4ms/step - loss: 0.0814 - accuracy: 0.9784
- val_loss: 0.0901 - val_accuracy: 0.9815
Epoch 298/600
273/273 [=====] - 1s 3ms/step - loss: 0.0714 - accuracy: 0.9815
- val_loss: 0.0938 - val_accuracy: 0.9801
Epoch 299/600
273/273 [=====] - 1s 4ms/step - loss: 0.0733 - accuracy: 0.9805
- val_loss: 0.0932 - val_accuracy: 0.9815
Epoch 300/600
273/273 [=====] - 1s 4ms/step - loss: 0.0778 - accuracy: 0.9795
- val_loss: 0.0926 - val_accuracy: 0.9814
Epoch 301/600
273/273 [=====] - 1s 3ms/step - loss: 0.0754 - accuracy: 0.9805
- val_loss: 0.0910 - val_accuracy: 0.9814
Epoch 302/600
273/273 [=====] - 1s 3ms/step - loss: 0.0704 - accuracy: 0.9823
- val_loss: 0.0899 - val_accuracy: 0.9815
Epoch 303/600
273/273 [=====] - 1s 3ms/step - loss: 0.0815 - accuracy: 0.9780
- val_loss: 0.0940 - val_accuracy: 0.9816
Epoch 304/600
273/273 [=====] - 1s 4ms/step - loss: 0.0782 - accuracy: 0.9790
- val_loss: 0.0935 - val_accuracy: 0.9814
Epoch 305/600
273/273 [=====] - 1s 3ms/step - loss: 0.0790 - accuracy: 0.9801
- val_loss: 0.0902 - val_accuracy: 0.9815
Epoch 306/600
273/273 [=====] - 1s 3ms/step - loss: 0.0788 - accuracy: 0.9802
- val_loss: 0.0920 - val_accuracy: 0.9815
Epoch 307/600
273/273 [=====] - 1s 4ms/step - loss: 0.0743 - accuracy: 0.9816
- val_loss: 0.0931 - val_accuracy: 0.9815
Epoch 308/600
273/273 [=====] - 1s 4ms/step - loss: 0.0794 - accuracy: 0.9789
```

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- val_loss: 0.0884 - val_accuracy: 0.9814
Epoch 309/600
273/273 [=====] - 1s 3ms/step - loss: 0.0862 - accuracy: 0.9771
- val_loss: 0.0924 - val_accuracy: 0.9813
Epoch 310/600
273/273 [=====] - 1s 3ms/step - loss: 0.0753 - accuracy: 0.9801
- val_loss: 0.0918 - val_accuracy: 0.9815
Epoch 311/600
273/273 [=====] - 1s 4ms/step - loss: 0.0700 - accuracy: 0.9827
- val_loss: 0.0904 - val_accuracy: 0.9814
Epoch 312/600
273/273 [=====] - 1s 3ms/step - loss: 0.0752 - accuracy: 0.9800
- val_loss: 0.0897 - val_accuracy: 0.9814
Epoch 313/600
273/273 [=====] - 1s 3ms/step - loss: 0.0839 - accuracy: 0.9772
- val_loss: 0.0887 - val_accuracy: 0.9815
Epoch 314/600
273/273 [=====] - 1s 3ms/step - loss: 0.0748 - accuracy: 0.9808
- val_loss: 0.0947 - val_accuracy: 0.9815
Epoch 315/600
273/273 [=====] - 1s 4ms/step - loss: 0.0772 - accuracy: 0.9798
- val_loss: 0.0901 - val_accuracy: 0.9811
Epoch 316/600
273/273 [=====] - 1s 4ms/step - loss: 0.0801 - accuracy: 0.9790
- val_loss: 0.0898 - val_accuracy: 0.9810
Epoch 317/600
273/273 [=====] - 1s 3ms/step - loss: 0.0781 - accuracy: 0.9794
- val_loss: 0.0990 - val_accuracy: 0.9797
Epoch 318/600
273/273 [=====] - 1s 4ms/step - loss: 0.0721 - accuracy: 0.9817
- val_loss: 0.0931 - val_accuracy: 0.9810
Epoch 319/600
273/273 [=====] - 1s 3ms/step - loss: 0.0754 - accuracy: 0.9801
- val_loss: 0.0913 - val_accuracy: 0.9813
Epoch 320/600
273/273 [=====] - 1s 3ms/step - loss: 0.0764 - accuracy: 0.9784
- val_loss: 0.0965 - val_accuracy: 0.9815
Epoch 321/600
273/273 [=====] - 1s 3ms/step - loss: 0.0706 - accuracy: 0.9817
- val_loss: 0.0949 - val_accuracy: 0.9814
Epoch 322/600
273/273 [=====] - 1s 3ms/step - loss: 0.0816 - accuracy: 0.9777
- val_loss: 0.0946 - val_accuracy: 0.9815
Epoch 323/600
273/273 [=====] - 1s 3ms/step - loss: 0.0748 - accuracy: 0.9798
- val_loss: 0.0917 - val_accuracy: 0.9814
Epoch 324/600
273/273 [=====] - 1s 3ms/step - loss: 0.0689 - accuracy: 0.9820
- val_loss: 0.1034 - val_accuracy: 0.9812
Epoch 325/600
273/273 [=====] - 1s 4ms/step - loss: 0.0903 - accuracy: 0.9779
- val_loss: 0.0970 - val_accuracy: 0.9810
Epoch 326/600
273/273 [=====] - 1s 3ms/step - loss: 0.0682 - accuracy: 0.9823
- val_loss: 0.0943 - val_accuracy: 0.9815
Epoch 327/600
273/273 [=====] - 1s 3ms/step - loss: 0.0677 - accuracy: 0.9814
- val_loss: 0.0942 - val_accuracy: 0.9811
Epoch 328/600
273/273 [=====] - 1s 3ms/step - loss: 0.0734 - accuracy: 0.9809
- val_loss: 0.0921 - val_accuracy: 0.9815
Epoch 329/600
273/273 [=====] - 1s 3ms/step - loss: 0.0695 - accuracy: 0.9816
- val_loss: 0.0902 - val_accuracy: 0.9814
Epoch 330/600
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273/273 [=====] - 1s 4ms/step - loss: 0.0788 - accuracy: 0.9791
- val_loss: 0.0906 - val_accuracy: 0.9812
Epoch 331/600
273/273 [=====] - 1s 3ms/step - loss: 0.0674 - accuracy: 0.9825
- val_loss: 0.0924 - val_accuracy: 0.9814
Epoch 332/600
273/273 [=====] - 1s 4ms/step - loss: 0.0727 - accuracy: 0.9811
- val_loss: 0.0922 - val_accuracy: 0.9810
Epoch 333/600
273/273 [=====] - 1s 3ms/step - loss: 0.0705 - accuracy: 0.9818
- val_loss: 0.0983 - val_accuracy: 0.9812
Epoch 334/600
273/273 [=====] - 1s 3ms/step - loss: 0.0730 - accuracy: 0.9802
- val_loss: 0.0918 - val_accuracy: 0.9812
Epoch 335/600
273/273 [=====] - 1s 4ms/step - loss: 0.0693 - accuracy: 0.9819
- val_loss: 0.0916 - val_accuracy: 0.9811
Epoch 336/600
273/273 [=====] - 1s 4ms/step - loss: 0.0771 - accuracy: 0.9785
- val_loss: 0.0910 - val_accuracy: 0.9811
Epoch 337/600
273/273 [=====] - 1s 3ms/step - loss: 0.0711 - accuracy: 0.9816
- val_loss: 0.0914 - val_accuracy: 0.9810
Epoch 338/600
273/273 [=====] - 1s 3ms/step - loss: 0.0756 - accuracy: 0.9801
- val_loss: 0.0933 - val_accuracy: 0.9814
Epoch 339/600
273/273 [=====] - 1s 3ms/step - loss: 0.0769 - accuracy: 0.9789
- val_loss: 0.0915 - val_accuracy: 0.9811
Epoch 340/600
273/273 [=====] - 1s 3ms/step - loss: 0.0786 - accuracy: 0.9789
- val_loss: 0.0925 - val_accuracy: 0.9810
Epoch 341/600
273/273 [=====] - 1s 3ms/step - loss: 0.0783 - accuracy: 0.9785
- val_loss: 0.0919 - val_accuracy: 0.9814
Epoch 342/600
273/273 [=====] - 1s 3ms/step - loss: 0.0626 - accuracy: 0.9837
- val_loss: 0.0927 - val_accuracy: 0.9807
Epoch 343/600
273/273 [=====] - 1s 4ms/step - loss: 0.0705 - accuracy: 0.9808
- val_loss: 0.0952 - val_accuracy: 0.9811
Epoch 344/600
273/273 [=====] - 1s 3ms/step - loss: 0.0721 - accuracy: 0.9801
- val_loss: 0.0911 - val_accuracy: 0.9815
Epoch 345/600
273/273 [=====] - 1s 3ms/step - loss: 0.0748 - accuracy: 0.9805
- val_loss: 0.0988 - val_accuracy: 0.9815
Epoch 346/600
273/273 [=====] - 1s 3ms/step - loss: 0.0746 - accuracy: 0.9810
- val_loss: 0.1001 - val_accuracy: 0.9815
Epoch 347/600
273/273 [=====] - 1s 4ms/step - loss: 0.0754 - accuracy: 0.9797
- val_loss: 0.0972 - val_accuracy: 0.9814
Epoch 348/600
273/273 [=====] - 1s 3ms/step - loss: 0.0686 - accuracy: 0.9819
- val_loss: 0.0940 - val_accuracy: 0.9812
Epoch 349/600
273/273 [=====] - 1s 3ms/step - loss: 0.0761 - accuracy: 0.9800
- val_loss: 0.0975 - val_accuracy: 0.9815
Epoch 350/600
273/273 [=====] - 1s 3ms/step - loss: 0.0692 - accuracy: 0.9828
- val_loss: 0.0972 - val_accuracy: 0.9804
Epoch 351/600
273/273 [=====] - 1s 3ms/step - loss: 0.0799 - accuracy: 0.9787
- val_loss: 0.0923 - val_accuracy: 0.9813
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Epoch 352/600
273/273 [=====] - 1s 3ms/step - loss: 0.0731 - accuracy: 0.9806
- val_loss: 0.0950 - val_accuracy: 0.9809
Epoch 353/600
273/273 [=====] - 1s 3ms/step - loss: 0.0731 - accuracy: 0.9814
- val_loss: 0.0914 - val_accuracy: 0.9815
Epoch 354/600
273/273 [=====] - 1s 4ms/step - loss: 0.0686 - accuracy: 0.9820
- val_loss: 0.0933 - val_accuracy: 0.9815
Epoch 355/600
273/273 [=====] - 1s 3ms/step - loss: 0.0787 - accuracy: 0.9790
- val_loss: 0.0955 - val_accuracy: 0.9814
Epoch 356/600
273/273 [=====] - 1s 3ms/step - loss: 0.0715 - accuracy: 0.9809
- val_loss: 0.0982 - val_accuracy: 0.9799
Epoch 357/600
273/273 [=====] - 1s 3ms/step - loss: 0.0765 - accuracy: 0.9801
- val_loss: 0.0978 - val_accuracy: 0.9808
Epoch 358/600
273/273 [=====] - 1s 3ms/step - loss: 0.0730 - accuracy: 0.9803
- val_loss: 0.0946 - val_accuracy: 0.9813
Epoch 359/600
273/273 [=====] - 1s 4ms/step - loss: 0.0712 - accuracy: 0.9804
- val_loss: 0.0943 - val_accuracy: 0.9798
Epoch 360/600
273/273 [=====] - 1s 3ms/step - loss: 0.0716 - accuracy: 0.9810
- val_loss: 0.0973 - val_accuracy: 0.9810
Epoch 361/600
273/273 [=====] - 1s 3ms/step - loss: 0.0645 - accuracy: 0.9837
- val_loss: 0.1040 - val_accuracy: 0.9810
Epoch 362/600
273/273 [=====] - 1s 3ms/step - loss: 0.0731 - accuracy: 0.9813
- val_loss: 0.0942 - val_accuracy: 0.9808
Epoch 363/600
273/273 [=====] - 1s 3ms/step - loss: 0.0717 - accuracy: 0.9817
- val_loss: 0.0953 - val_accuracy: 0.9812
Epoch 364/600
273/273 [=====] - 1s 3ms/step - loss: 0.0758 - accuracy: 0.9783
- val_loss: 0.0986 - val_accuracy: 0.9809
Epoch 365/600
273/273 [=====] - 1s 3ms/step - loss: 0.0602 - accuracy: 0.9848
- val_loss: 0.1022 - val_accuracy: 0.9807
Epoch 366/600
273/273 [=====] - 1s 3ms/step - loss: 0.0687 - accuracy: 0.9826
- val_loss: 0.0973 - val_accuracy: 0.9801
Epoch 367/600
273/273 [=====] - 1s 4ms/step - loss: 0.0747 - accuracy: 0.9816
- val_loss: 0.0952 - val_accuracy: 0.9811
Epoch 368/600
273/273 [=====] - 1s 3ms/step - loss: 0.0724 - accuracy: 0.9811
- val_loss: 0.0951 - val_accuracy: 0.9811
Epoch 369/600
273/273 [=====] - 1s 3ms/step - loss: 0.0746 - accuracy: 0.9803
- val_loss: 0.0899 - val_accuracy: 0.9813
Epoch 370/600
273/273 [=====] - 1s 3ms/step - loss: 0.0714 - accuracy: 0.9805
- val_loss: 0.0959 - val_accuracy: 0.9810
Epoch 371/600
273/273 [=====] - 1s 4ms/step - loss: 0.0775 - accuracy: 0.9785
- val_loss: 0.1006 - val_accuracy: 0.9814
Epoch 372/600
273/273 [=====] - 1s 3ms/step - loss: 0.0701 - accuracy: 0.9829
- val_loss: 0.0970 - val_accuracy: 0.9813
Epoch 373/600
273/273 [=====] - 1s 4ms/step - loss: 0.0740 - accuracy: 0.9793
```

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- val_loss: 0.0970 - val_accuracy: 0.9815
Epoch 374/600
273/273 [=====] - 1s 3ms/step - loss: 0.0731 - accuracy: 0.9802
- val_loss: 0.1010 - val_accuracy: 0.9812
Epoch 375/600
273/273 [=====] - 1s 3ms/step - loss: 0.0734 - accuracy: 0.9814
- val_loss: 0.0944 - val_accuracy: 0.9815
Epoch 376/600
273/273 [=====] - 1s 3ms/step - loss: 0.0819 - accuracy: 0.9793
- val_loss: 0.0974 - val_accuracy: 0.9815
Epoch 377/600
273/273 [=====] - 1s 3ms/step - loss: 0.0684 - accuracy: 0.9819
- val_loss: 0.0998 - val_accuracy: 0.9809
Epoch 378/600
273/273 [=====] - 1s 4ms/step - loss: 0.0796 - accuracy: 0.9795
- val_loss: 0.1066 - val_accuracy: 0.9812
Epoch 379/600
273/273 [=====] - 1s 3ms/step - loss: 0.0827 - accuracy: 0.9790
- val_loss: 0.0960 - val_accuracy: 0.9806
Epoch 380/600
273/273 [=====] - 1s 3ms/step - loss: 0.0723 - accuracy: 0.9809
- val_loss: 0.0975 - val_accuracy: 0.9811
Epoch 381/600
273/273 [=====] - 1s 4ms/step - loss: 0.0733 - accuracy: 0.9817
- val_loss: 0.0938 - val_accuracy: 0.9804
Epoch 382/600
273/273 [=====] - 1s 3ms/step - loss: 0.0713 - accuracy: 0.9815
- val_loss: 0.0948 - val_accuracy: 0.9810
Epoch 383/600
273/273 [=====] - 1s 3ms/step - loss: 0.0743 - accuracy: 0.9797
- val_loss: 0.0954 - val_accuracy: 0.9808
Epoch 384/600
273/273 [=====] - 1s 3ms/step - loss: 0.0712 - accuracy: 0.9819
- val_loss: 0.0971 - val_accuracy: 0.9790
Epoch 385/600
273/273 [=====] - 1s 3ms/step - loss: 0.0706 - accuracy: 0.9808
- val_loss: 0.0964 - val_accuracy: 0.9809
Epoch 386/600
273/273 [=====] - 1s 3ms/step - loss: 0.0663 - accuracy: 0.9820
- val_loss: 0.0951 - val_accuracy: 0.9811
Epoch 387/600
273/273 [=====] - 1s 4ms/step - loss: 0.0728 - accuracy: 0.9798
- val_loss: 0.0935 - val_accuracy: 0.9815
Epoch 388/600
273/273 [=====] - 1s 3ms/step - loss: 0.0644 - accuracy: 0.9839
- val_loss: 0.0980 - val_accuracy: 0.9810
Epoch 389/600
273/273 [=====] - 1s 3ms/step - loss: 0.0742 - accuracy: 0.9811
- val_loss: 0.0956 - val_accuracy: 0.9814
Epoch 390/600
273/273 [=====] - 1s 3ms/step - loss: 0.0833 - accuracy: 0.9758
- val_loss: 0.0948 - val_accuracy: 0.9803
Epoch 391/600
273/273 [=====] - 1s 4ms/step - loss: 0.0722 - accuracy: 0.9818
- val_loss: 0.0991 - val_accuracy: 0.9808
Epoch 392/600
273/273 [=====] - 1s 3ms/step - loss: 0.0681 - accuracy: 0.9820
- val_loss: 0.0959 - val_accuracy: 0.9803
Epoch 393/600
273/273 [=====] - 1s 4ms/step - loss: 0.0781 - accuracy: 0.9797
- val_loss: 0.0983 - val_accuracy: 0.9810
Epoch 394/600
273/273 [=====] - 1s 3ms/step - loss: 0.0736 - accuracy: 0.9801
- val_loss: 0.0985 - val_accuracy: 0.9814
Epoch 395/600
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273/273 [=====] - 1s 4ms/step - loss: 0.0622 - accuracy: 0.9846
- val_loss: 0.0977 - val_accuracy: 0.9810
Epoch 396/600
273/273 [=====] - 1s 3ms/step - loss: 0.0712 - accuracy: 0.9816
- val_loss: 0.0964 - val_accuracy: 0.9807
Epoch 397/600
273/273 [=====] - 1s 3ms/step - loss: 0.0644 - accuracy: 0.9816
- val_loss: 0.0893 - val_accuracy: 0.9807
Epoch 398/600
273/273 [=====] - 1s 4ms/step - loss: 0.0774 - accuracy: 0.9803
- val_loss: 0.0896 - val_accuracy: 0.9813
Epoch 399/600
273/273 [=====] - 1s 4ms/step - loss: 0.0755 - accuracy: 0.9805
- val_loss: 0.0912 - val_accuracy: 0.9810
Epoch 400/600
273/273 [=====] - 1s 3ms/step - loss: 0.0750 - accuracy: 0.9801
- val_loss: 0.0963 - val_accuracy: 0.9804
Epoch 401/600
273/273 [=====] - 1s 3ms/step - loss: 0.0733 - accuracy: 0.9812
- val_loss: 0.0930 - val_accuracy: 0.9809
Epoch 402/600
273/273 [=====] - 1s 3ms/step - loss: 0.0773 - accuracy: 0.9796
- val_loss: 0.0989 - val_accuracy: 0.9782
Epoch 403/600
273/273 [=====] - 1s 3ms/step - loss: 0.0749 - accuracy: 0.9787
- val_loss: 0.0940 - val_accuracy: 0.9804
Epoch 404/600
273/273 [=====] - 1s 3ms/step - loss: 0.0735 - accuracy: 0.9802
- val_loss: 0.0961 - val_accuracy: 0.9802
Epoch 405/600
273/273 [=====] - 1s 3ms/step - loss: 0.0671 - accuracy: 0.9820
- val_loss: 0.0911 - val_accuracy: 0.9805
Epoch 406/600
273/273 [=====] - 1s 3ms/step - loss: 0.0766 - accuracy: 0.9789
- val_loss: 0.0947 - val_accuracy: 0.9804
Epoch 407/600
273/273 [=====] - 1s 4ms/step - loss: 0.0730 - accuracy: 0.9808
- val_loss: 0.0933 - val_accuracy: 0.9814
Epoch 408/600
273/273 [=====] - 1s 3ms/step - loss: 0.0771 - accuracy: 0.9799
- val_loss: 0.0953 - val_accuracy: 0.9806
Epoch 409/600
273/273 [=====] - 1s 3ms/step - loss: 0.0798 - accuracy: 0.9789
- val_loss: 0.0993 - val_accuracy: 0.9803
Epoch 410/600
273/273 [=====] - 1s 3ms/step - loss: 0.0642 - accuracy: 0.9830
- val_loss: 0.0980 - val_accuracy: 0.9809
Epoch 411/600
273/273 [=====] - 1s 4ms/step - loss: 0.0763 - accuracy: 0.9781
- val_loss: 0.0974 - val_accuracy: 0.9803
Epoch 412/600
273/273 [=====] - 1s 3ms/step - loss: 0.0697 - accuracy: 0.9811
- val_loss: 0.0969 - val_accuracy: 0.9812
Epoch 413/600
273/273 [=====] - 1s 3ms/step - loss: 0.0724 - accuracy: 0.9794
- val_loss: 0.0997 - val_accuracy: 0.9809
Epoch 414/600
273/273 [=====] - 1s 3ms/step - loss: 0.0723 - accuracy: 0.9807
- val_loss: 0.1090 - val_accuracy: 0.9805
Epoch 415/600
273/273 [=====] - 1s 3ms/step - loss: 0.0809 - accuracy: 0.9797
- val_loss: 0.0961 - val_accuracy: 0.9797
Epoch 416/600
273/273 [=====] - 1s 3ms/step - loss: 0.0703 - accuracy: 0.9817
- val_loss: 0.0994 - val_accuracy: 0.9806
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Epoch 417/600
273/273 [=====] - 1s 3ms/step - loss: 0.0835 - accuracy: 0.9758
- val_loss: 0.1002 - val_accuracy: 0.9806
Epoch 418/600
273/273 [=====] - 1s 3ms/step - loss: 0.0626 - accuracy: 0.9833
- val_loss: 0.1003 - val_accuracy: 0.9809
Epoch 419/600
273/273 [=====] - 1s 3ms/step - loss: 0.0716 - accuracy: 0.9805
- val_loss: 0.0985 - val_accuracy: 0.9803
Epoch 420/600
273/273 [=====] - 1s 3ms/step - loss: 0.0756 - accuracy: 0.9797
- val_loss: 0.1030 - val_accuracy: 0.9810
Epoch 421/600
273/273 [=====] - 1s 3ms/step - loss: 0.0631 - accuracy: 0.9841
- val_loss: 0.0993 - val_accuracy: 0.9809
Epoch 422/600
273/273 [=====] - 1s 4ms/step - loss: 0.0786 - accuracy: 0.9785
- val_loss: 0.1039 - val_accuracy: 0.9809
Epoch 423/600
273/273 [=====] - 1s 3ms/step - loss: 0.0764 - accuracy: 0.9801
- val_loss: 0.1002 - val_accuracy: 0.9808
Epoch 424/600
273/273 [=====] - 1s 4ms/step - loss: 0.0694 - accuracy: 0.9807
- val_loss: 0.1070 - val_accuracy: 0.9795
Epoch 425/600
273/273 [=====] - 1s 3ms/step - loss: 0.0690 - accuracy: 0.9814
- val_loss: 0.1197 - val_accuracy: 0.9811
Epoch 426/600
273/273 [=====] - 1s 3ms/step - loss: 0.0805 - accuracy: 0.9794
- val_loss: 0.1016 - val_accuracy: 0.9811
Epoch 427/600
273/273 [=====] - 1s 3ms/step - loss: 0.0701 - accuracy: 0.9821
- val_loss: 0.1006 - val_accuracy: 0.9812
Epoch 428/600
273/273 [=====] - 1s 4ms/step - loss: 0.0792 - accuracy: 0.9784
- val_loss: 0.1060 - val_accuracy: 0.9809
Epoch 429/600
273/273 [=====] - 1s 3ms/step - loss: 0.0695 - accuracy: 0.9807
- val_loss: 0.1035 - val_accuracy: 0.9809
Epoch 430/600
273/273 [=====] - 1s 3ms/step - loss: 0.0741 - accuracy: 0.9792
- val_loss: 0.1118 - val_accuracy: 0.9802
Epoch 431/600
273/273 [=====] - 1s 3ms/step - loss: 0.0770 - accuracy: 0.9786
- val_loss: 0.1050 - val_accuracy: 0.9808
Epoch 432/600
273/273 [=====] - 1s 3ms/step - loss: 0.0700 - accuracy: 0.9824
- val_loss: 0.1004 - val_accuracy: 0.9792
Epoch 433/600
273/273 [=====] - 1s 3ms/step - loss: 0.0807 - accuracy: 0.9791
- val_loss: 0.0981 - val_accuracy: 0.9802
Epoch 434/600
273/273 [=====] - 1s 3ms/step - loss: 0.0622 - accuracy: 0.9835
- val_loss: 0.0992 - val_accuracy: 0.9809
Epoch 435/600
273/273 [=====] - 1s 3ms/step - loss: 0.0674 - accuracy: 0.9821
- val_loss: 0.1056 - val_accuracy: 0.9805
Epoch 436/600
273/273 [=====] - 1s 3ms/step - loss: 0.0608 - accuracy: 0.9831
- val_loss: 0.1072 - val_accuracy: 0.9797
Epoch 437/600
273/273 [=====] - 1s 3ms/step - loss: 0.0712 - accuracy: 0.9806
- val_loss: 0.1089 - val_accuracy: 0.9803
Epoch 438/600
273/273 [=====] - 1s 3ms/step - loss: 0.0728 - accuracy: 0.9803
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- val_loss: 0.0960 - val_accuracy: 0.9809
Epoch 439/600
273/273 [=====] - 1s 3ms/step - loss: 0.0660 - accuracy: 0.9833
- val_loss: 0.1032 - val_accuracy: 0.9809
Epoch 440/600
273/273 [=====] - 1s 4ms/step - loss: 0.0689 - accuracy: 0.9804
- val_loss: 0.1037 - val_accuracy: 0.9814
Epoch 441/600
273/273 [=====] - 1s 4ms/step - loss: 0.0793 - accuracy: 0.9784
- val_loss: 0.1005 - val_accuracy: 0.9808
Epoch 442/600
273/273 [=====] - 1s 4ms/step - loss: 0.0730 - accuracy: 0.9804
- val_loss: 0.1019 - val_accuracy: 0.9812
Epoch 443/600
273/273 [=====] - 1s 3ms/step - loss: 0.0666 - accuracy: 0.9835
- val_loss: 0.1025 - val_accuracy: 0.9812
Epoch 444/600
273/273 [=====] - 1s 3ms/step - loss: 0.0691 - accuracy: 0.9816
- val_loss: 0.0986 - val_accuracy: 0.9808
Epoch 445/600
273/273 [=====] - 1s 4ms/step - loss: 0.0757 - accuracy: 0.9807
- val_loss: 0.1010 - val_accuracy: 0.9792
Epoch 446/600
273/273 [=====] - 1s 4ms/step - loss: 0.0688 - accuracy: 0.9815
- val_loss: 0.1062 - val_accuracy: 0.9813
Epoch 447/600
273/273 [=====] - 1s 4ms/step - loss: 0.0710 - accuracy: 0.9804
- val_loss: 0.1039 - val_accuracy: 0.9797
Epoch 448/600
273/273 [=====] - 1s 4ms/step - loss: 0.0674 - accuracy: 0.9824
- val_loss: 0.1054 - val_accuracy: 0.9808
Epoch 449/600
273/273 [=====] - 1s 4ms/step - loss: 0.0673 - accuracy: 0.9818
- val_loss: 0.0994 - val_accuracy: 0.9806
Epoch 450/600
273/273 [=====] - 1s 4ms/step - loss: 0.0636 - accuracy: 0.9824
- val_loss: 0.1074 - val_accuracy: 0.9808
Epoch 451/600
273/273 [=====] - 1s 4ms/step - loss: 0.0700 - accuracy: 0.9815
- val_loss: 0.0963 - val_accuracy: 0.9810
Epoch 452/600
273/273 [=====] - 1s 4ms/step - loss: 0.0677 - accuracy: 0.9820
- val_loss: 0.1005 - val_accuracy: 0.9810
Epoch 453/600
273/273 [=====] - 1s 4ms/step - loss: 0.0723 - accuracy: 0.9793
- val_loss: 0.1000 - val_accuracy: 0.9808
Epoch 454/600
273/273 [=====] - 1s 4ms/step - loss: 0.0778 - accuracy: 0.9786
- val_loss: 0.1152 - val_accuracy: 0.9812
Epoch 455/600
273/273 [=====] - 1s 4ms/step - loss: 0.0697 - accuracy: 0.9816
- val_loss: 0.1021 - val_accuracy: 0.9812
Epoch 456/600
273/273 [=====] - 1s 4ms/step - loss: 0.0764 - accuracy: 0.9794
- val_loss: 0.1080 - val_accuracy: 0.9812
Epoch 457/600
273/273 [=====] - 1s 4ms/step - loss: 0.0687 - accuracy: 0.9820
- val_loss: 0.1092 - val_accuracy: 0.9800
Epoch 458/600
273/273 [=====] - 1s 4ms/step - loss: 0.0711 - accuracy: 0.9807
- val_loss: 0.1042 - val_accuracy: 0.9803
Epoch 459/600
273/273 [=====] - 1s 4ms/step - loss: 0.0770 - accuracy: 0.9790
- val_loss: 0.1018 - val_accuracy: 0.9810
Epoch 460/600
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273/273 [=====] - 1s 4ms/step - loss: 0.0629 - accuracy: 0.9840
- val_loss: 0.1060 - val_accuracy: 0.9811
Epoch 461/600
273/273 [=====] - 1s 4ms/step - loss: 0.0793 - accuracy: 0.9797
- val_loss: 0.1045 - val_accuracy: 0.9803
Epoch 462/600
273/273 [=====] - 1s 4ms/step - loss: 0.0667 - accuracy: 0.9816
- val_loss: 0.1040 - val_accuracy: 0.9810
Epoch 463/600
273/273 [=====] - 1s 4ms/step - loss: 0.0676 - accuracy: 0.9822
- val_loss: 0.1093 - val_accuracy: 0.9790
Epoch 464/600
273/273 [=====] - 1s 4ms/step - loss: 0.0761 - accuracy: 0.9788
- val_loss: 0.0942 - val_accuracy: 0.9804
Epoch 465/600
273/273 [=====] - 1s 4ms/step - loss: 0.0807 - accuracy: 0.9782
- val_loss: 0.1080 - val_accuracy: 0.9814
Epoch 466/600
273/273 [=====] - 1s 4ms/step - loss: 0.0705 - accuracy: 0.9795
- val_loss: 0.1173 - val_accuracy: 0.9811
Epoch 467/600
273/273 [=====] - 1s 4ms/step - loss: 0.0680 - accuracy: 0.9832
- val_loss: 0.1030 - val_accuracy: 0.9800
Epoch 468/600
273/273 [=====] - 1s 3ms/step - loss: 0.0748 - accuracy: 0.9800
- val_loss: 0.1041 - val_accuracy: 0.9804
Epoch 469/600
273/273 [=====] - 1s 3ms/step - loss: 0.0711 - accuracy: 0.9824
- val_loss: 0.1040 - val_accuracy: 0.9809
Epoch 470/600
273/273 [=====] - 1s 4ms/step - loss: 0.0709 - accuracy: 0.9810
- val_loss: 0.1064 - val_accuracy: 0.9790
Epoch 471/600
273/273 [=====] - 1s 4ms/step - loss: 0.0770 - accuracy: 0.9788
- val_loss: 0.1038 - val_accuracy: 0.9809
Epoch 472/600
273/273 [=====] - 1s 4ms/step - loss: 0.0659 - accuracy: 0.9826
- val_loss: 0.1079 - val_accuracy: 0.9809
Epoch 473/600
273/273 [=====] - 1s 4ms/step - loss: 0.0666 - accuracy: 0.9825
- val_loss: 0.0991 - val_accuracy: 0.9807
Epoch 474/600
273/273 [=====] - 1s 4ms/step - loss: 0.0756 - accuracy: 0.9780
- val_loss: 0.1046 - val_accuracy: 0.9800
Epoch 475/600
273/273 [=====] - 1s 3ms/step - loss: 0.0670 - accuracy: 0.9826
- val_loss: 0.1064 - val_accuracy: 0.9804
Epoch 476/600
273/273 [=====] - 1s 4ms/step - loss: 0.0686 - accuracy: 0.9820
- val_loss: 0.1059 - val_accuracy: 0.9812
Epoch 477/600
273/273 [=====] - 1s 3ms/step - loss: 0.0729 - accuracy: 0.9811
- val_loss: 0.1066 - val_accuracy: 0.9809
Epoch 478/600
273/273 [=====] - 1s 3ms/step - loss: 0.0700 - accuracy: 0.9819
- val_loss: 0.1068 - val_accuracy: 0.9805
Epoch 479/600
273/273 [=====] - 1s 4ms/step - loss: 0.0693 - accuracy: 0.9813
- val_loss: 0.1035 - val_accuracy: 0.9810
Epoch 480/600
273/273 [=====] - 1s 4ms/step - loss: 0.0777 - accuracy: 0.9791
- val_loss: 0.1170 - val_accuracy: 0.9798
Epoch 481/600
273/273 [=====] - 1s 4ms/step - loss: 0.0691 - accuracy: 0.9806
- val_loss: 0.1105 - val_accuracy: 0.9811
```

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Epoch 482/600
273/273 [=====] - 1s 4ms/step - loss: 0.0664 - accuracy: 0.9825
- val_loss: 0.1055 - val_accuracy: 0.9806
Epoch 483/600
273/273 [=====] - 1s 4ms/step - loss: 0.0650 - accuracy: 0.9825
- val_loss: 0.1038 - val_accuracy: 0.9803
Epoch 484/600
273/273 [=====] - 1s 3ms/step - loss: 0.0676 - accuracy: 0.9815
- val_loss: 0.1056 - val_accuracy: 0.9809
Epoch 485/600
273/273 [=====] - 1s 3ms/step - loss: 0.0716 - accuracy: 0.9807
- val_loss: 0.1102 - val_accuracy: 0.9810
Epoch 486/600
273/273 [=====] - 1s 4ms/step - loss: 0.0749 - accuracy: 0.9802
- val_loss: 0.1015 - val_accuracy: 0.9805
Epoch 487/600
273/273 [=====] - 1s 3ms/step - loss: 0.0670 - accuracy: 0.9829
- val_loss: 0.1104 - val_accuracy: 0.9810
Epoch 488/600
273/273 [=====] - 1s 4ms/step - loss: 0.0718 - accuracy: 0.9811
- val_loss: 0.1084 - val_accuracy: 0.9812
Epoch 489/600
273/273 [=====] - 1s 4ms/step - loss: 0.0695 - accuracy: 0.9805
- val_loss: 0.1093 - val_accuracy: 0.9806
Epoch 490/600
273/273 [=====] - 1s 3ms/step - loss: 0.0686 - accuracy: 0.9821
- val_loss: 0.1007 - val_accuracy: 0.9799
Epoch 491/600
273/273 [=====] - 1s 3ms/step - loss: 0.0684 - accuracy: 0.9827
- val_loss: 0.1109 - val_accuracy: 0.9806
Epoch 492/600
273/273 [=====] - 1s 3ms/step - loss: 0.0707 - accuracy: 0.9828
- val_loss: 0.1040 - val_accuracy: 0.9812
Epoch 493/600
273/273 [=====] - 1s 4ms/step - loss: 0.0721 - accuracy: 0.9794
- val_loss: 0.1125 - val_accuracy: 0.9807
Epoch 494/600
273/273 [=====] - 1s 3ms/step - loss: 0.0671 - accuracy: 0.9825
- val_loss: 0.0978 - val_accuracy: 0.9808
Epoch 495/600
273/273 [=====] - 1s 3ms/step - loss: 0.0772 - accuracy: 0.9798
- val_loss: 0.1043 - val_accuracy: 0.9800
Epoch 496/600
273/273 [=====] - 1s 3ms/step - loss: 0.0629 - accuracy: 0.9837
- val_loss: 0.1043 - val_accuracy: 0.9806
Epoch 497/600
273/273 [=====] - 1s 4ms/step - loss: 0.0676 - accuracy: 0.9821
- val_loss: 0.1034 - val_accuracy: 0.9803
Epoch 498/600
273/273 [=====] - 1s 4ms/step - loss: 0.0667 - accuracy: 0.9809
- val_loss: 0.1047 - val_accuracy: 0.9809
Epoch 499/600
273/273 [=====] - 1s 4ms/step - loss: 0.0667 - accuracy: 0.9836
- val_loss: 0.1074 - val_accuracy: 0.9802
Epoch 500/600
273/273 [=====] - 1s 3ms/step - loss: 0.0780 - accuracy: 0.9790
- val_loss: 0.1130 - val_accuracy: 0.9814
Epoch 501/600
273/273 [=====] - 1s 4ms/step - loss: 0.0698 - accuracy: 0.9816
- val_loss: 0.1017 - val_accuracy: 0.9801
Epoch 502/600
273/273 [=====] - 1s 4ms/step - loss: 0.0671 - accuracy: 0.9814
- val_loss: 0.1013 - val_accuracy: 0.9805
Epoch 503/600
273/273 [=====] - 1s 4ms/step - loss: 0.0651 - accuracy: 0.9837
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- val_loss: 0.1064 - val_accuracy: 0.9800
Epoch 504/600
273/273 [=====] - 1s 4ms/step - loss: 0.0690 - accuracy: 0.9809
- val_loss: 0.1031 - val_accuracy: 0.9799
Epoch 505/600
273/273 [=====] - 1s 4ms/step - loss: 0.0705 - accuracy: 0.9813
- val_loss: 0.1021 - val_accuracy: 0.9800
Epoch 506/600
273/273 [=====] - 1s 3ms/step - loss: 0.0685 - accuracy: 0.9812
- val_loss: 0.1073 - val_accuracy: 0.9812
Epoch 507/600
273/273 [=====] - 1s 3ms/step - loss: 0.0685 - accuracy: 0.9807
- val_loss: 0.1052 - val_accuracy: 0.9802
Epoch 508/600
273/273 [=====] - 1s 3ms/step - loss: 0.0712 - accuracy: 0.9809
- val_loss: 0.1039 - val_accuracy: 0.9810
Epoch 509/600
273/273 [=====] - 1s 4ms/step - loss: 0.0628 - accuracy: 0.9839
- val_loss: 0.1014 - val_accuracy: 0.9813
Epoch 510/600
273/273 [=====] - 1s 3ms/step - loss: 0.0765 - accuracy: 0.9773
- val_loss: 0.1045 - val_accuracy: 0.9810
Epoch 511/600
273/273 [=====] - 1s 3ms/step - loss: 0.0760 - accuracy: 0.9794
- val_loss: 0.1072 - val_accuracy: 0.9805
Epoch 512/600
273/273 [=====] - 1s 3ms/step - loss: 0.0675 - accuracy: 0.9827
- val_loss: 0.1244 - val_accuracy: 0.9802
Epoch 513/600
273/273 [=====] - 1s 4ms/step - loss: 0.0770 - accuracy: 0.9795
- val_loss: 0.1024 - val_accuracy: 0.9800
Epoch 514/600
273/273 [=====] - 1s 4ms/step - loss: 0.0623 - accuracy: 0.9842
- val_loss: 0.1024 - val_accuracy: 0.9809
Epoch 515/600
273/273 [=====] - 1s 3ms/step - loss: 0.0685 - accuracy: 0.9816
- val_loss: 0.1113 - val_accuracy: 0.9811
Epoch 516/600
273/273 [=====] - 1s 3ms/step - loss: 0.0622 - accuracy: 0.9836
- val_loss: 0.1056 - val_accuracy: 0.9811
Epoch 517/600
273/273 [=====] - 1s 4ms/step - loss: 0.0693 - accuracy: 0.9812
- val_loss: 0.0974 - val_accuracy: 0.9806
Epoch 518/600
273/273 [=====] - 1s 4ms/step - loss: 0.0690 - accuracy: 0.9818
- val_loss: 0.1061 - val_accuracy: 0.9798
Epoch 519/600
273/273 [=====] - 1s 4ms/step - loss: 0.0741 - accuracy: 0.9804
- val_loss: 0.1020 - val_accuracy: 0.9803
Epoch 520/600
273/273 [=====] - 1s 3ms/step - loss: 0.0715 - accuracy: 0.9804
- val_loss: 0.1063 - val_accuracy: 0.9805
Epoch 521/600
273/273 [=====] - 1s 4ms/step - loss: 0.0592 - accuracy: 0.9847
- val_loss: 0.1024 - val_accuracy: 0.9807
Epoch 522/600
273/273 [=====] - 1s 4ms/step - loss: 0.0713 - accuracy: 0.9809
- val_loss: 0.1073 - val_accuracy: 0.9802
Epoch 523/600
273/273 [=====] - 1s 4ms/step - loss: 0.0674 - accuracy: 0.9819
- val_loss: 0.1052 - val_accuracy: 0.9807
Epoch 524/600
273/273 [=====] - 1s 4ms/step - loss: 0.0708 - accuracy: 0.9809
- val_loss: 0.1117 - val_accuracy: 0.9804
Epoch 525/600
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273/273 [=====] - 1s 4ms/step - loss: 0.0804 - accuracy: 0.9780
- val_loss: 0.1063 - val_accuracy: 0.9798
Epoch 526/600
273/273 [=====] - 1s 4ms/step - loss: 0.0715 - accuracy: 0.9811
- val_loss: 0.1150 - val_accuracy: 0.9807
Epoch 527/600
273/273 [=====] - 1s 3ms/step - loss: 0.0773 - accuracy: 0.9791
- val_loss: 0.1016 - val_accuracy: 0.9811
Epoch 528/600
273/273 [=====] - 1s 4ms/step - loss: 0.0802 - accuracy: 0.9773
- val_loss: 0.1024 - val_accuracy: 0.9807
Epoch 529/600
273/273 [=====] - 1s 4ms/step - loss: 0.0722 - accuracy: 0.9799
- val_loss: 0.1137 - val_accuracy: 0.9804
Epoch 530/600
273/273 [=====] - 1s 4ms/step - loss: 0.0697 - accuracy: 0.9812
- val_loss: 0.1122 - val_accuracy: 0.9810
Epoch 531/600
273/273 [=====] - 1s 4ms/step - loss: 0.0663 - accuracy: 0.9811
- val_loss: 0.1114 - val_accuracy: 0.9804
Epoch 532/600
273/273 [=====] - 1s 4ms/step - loss: 0.0705 - accuracy: 0.9798
- val_loss: 0.1137 - val_accuracy: 0.9806
Epoch 533/600
273/273 [=====] - 1s 4ms/step - loss: 0.0639 - accuracy: 0.9827
- val_loss: 0.1173 - val_accuracy: 0.9771
Epoch 534/600
273/273 [=====] - 1s 3ms/step - loss: 0.0734 - accuracy: 0.9796
- val_loss: 0.1176 - val_accuracy: 0.9802
Epoch 535/600
273/273 [=====] - 1s 4ms/step - loss: 0.0722 - accuracy: 0.9819
- val_loss: 0.1084 - val_accuracy: 0.9805
Epoch 536/600
273/273 [=====] - 1s 4ms/step - loss: 0.0637 - accuracy: 0.9832
- val_loss: 0.1131 - val_accuracy: 0.9803
Epoch 537/600
273/273 [=====] - 1s 4ms/step - loss: 0.0797 - accuracy: 0.9773
- val_loss: 0.1131 - val_accuracy: 0.9803
Epoch 538/600
273/273 [=====] - 1s 4ms/step - loss: 0.0704 - accuracy: 0.9812
- val_loss: 0.1082 - val_accuracy: 0.9799
Epoch 539/600
273/273 [=====] - 1s 4ms/step - loss: 0.0730 - accuracy: 0.9805
- val_loss: 0.1057 - val_accuracy: 0.9803
Epoch 540/600
273/273 [=====] - 1s 4ms/step - loss: 0.0722 - accuracy: 0.9809
- val_loss: 0.1093 - val_accuracy: 0.9801
Epoch 541/600
273/273 [=====] - 1s 4ms/step - loss: 0.0669 - accuracy: 0.9817
- val_loss: 0.1106 - val_accuracy: 0.9798
Epoch 542/600
273/273 [=====] - 1s 4ms/step - loss: 0.0692 - accuracy: 0.9808
- val_loss: 0.1074 - val_accuracy: 0.9803
Epoch 543/600
273/273 [=====] - 1s 4ms/step - loss: 0.0720 - accuracy: 0.9797
- val_loss: 0.1136 - val_accuracy: 0.9800
Epoch 544/600
273/273 [=====] - 1s 4ms/step - loss: 0.0731 - accuracy: 0.9798
- val_loss: 0.1079 - val_accuracy: 0.9807
Epoch 545/600
273/273 [=====] - 1s 3ms/step - loss: 0.0656 - accuracy: 0.9822
- val_loss: 0.1130 - val_accuracy: 0.9803
Epoch 546/600
273/273 [=====] - 1s 4ms/step - loss: 0.0663 - accuracy: 0.9828
- val_loss: 0.1021 - val_accuracy: 0.9804
```

```
Epoch 547/600
273/273 [=====] - 1s 3ms/step - loss: 0.0649 - accuracy: 0.9827
- val_loss: 0.1029 - val_accuracy: 0.9805
Epoch 548/600
273/273 [=====] - 1s 3ms/step - loss: 0.0664 - accuracy: 0.9820
- val_loss: 0.1080 - val_accuracy: 0.9805
Epoch 549/600
273/273 [=====] - 1s 4ms/step - loss: 0.0696 - accuracy: 0.9805
- val_loss: 0.1054 - val_accuracy: 0.9803
Epoch 550/600
273/273 [=====] - 1s 4ms/step - loss: 0.0692 - accuracy: 0.9814
- val_loss: 0.1093 - val_accuracy: 0.9800
Epoch 551/600
273/273 [=====] - 1s 4ms/step - loss: 0.0640 - accuracy: 0.9832
- val_loss: 0.1084 - val_accuracy: 0.9808
Epoch 552/600
273/273 [=====] - 1s 4ms/step - loss: 0.0659 - accuracy: 0.9822
- val_loss: 0.1084 - val_accuracy: 0.9800
Epoch 553/600
273/273 [=====] - 1s 3ms/step - loss: 0.0790 - accuracy: 0.9787
- val_loss: 0.1053 - val_accuracy: 0.9812
Epoch 554/600
273/273 [=====] - 1s 4ms/step - loss: 0.0693 - accuracy: 0.9808
- val_loss: 0.1048 - val_accuracy: 0.9806
Epoch 555/600
273/273 [=====] - 1s 4ms/step - loss: 0.0744 - accuracy: 0.9794
- val_loss: 0.1114 - val_accuracy: 0.9807
Epoch 556/600
273/273 [=====] - 1s 4ms/step - loss: 0.0671 - accuracy: 0.9816
- val_loss: 0.1088 - val_accuracy: 0.9801
Epoch 557/600
273/273 [=====] - 1s 4ms/step - loss: 0.0685 - accuracy: 0.9823
- val_loss: 0.1113 - val_accuracy: 0.9805
Epoch 558/600
273/273 [=====] - 1s 4ms/step - loss: 0.0674 - accuracy: 0.9823
- val_loss: 0.1123 - val_accuracy: 0.9805
Epoch 559/600
273/273 [=====] - 1s 4ms/step - loss: 0.0738 - accuracy: 0.9791
- val_loss: 0.1051 - val_accuracy: 0.9812
Epoch 560/600
273/273 [=====] - 1s 4ms/step - loss: 0.0681 - accuracy: 0.9817
- val_loss: 0.1072 - val_accuracy: 0.9807
Epoch 561/600
273/273 [=====] - 1s 4ms/step - loss: 0.0678 - accuracy: 0.9807
- val_loss: 0.1026 - val_accuracy: 0.9807
Epoch 562/600
273/273 [=====] - 1s 4ms/step - loss: 0.0692 - accuracy: 0.9823
- val_loss: 0.1126 - val_accuracy: 0.9808
Epoch 563/600
273/273 [=====] - 1s 4ms/step - loss: 0.0595 - accuracy: 0.9842
- val_loss: 0.1109 - val_accuracy: 0.9809
Epoch 564/600
273/273 [=====] - 1s 3ms/step - loss: 0.0692 - accuracy: 0.9802
- val_loss: 0.1080 - val_accuracy: 0.9812
Epoch 565/600
273/273 [=====] - 1s 4ms/step - loss: 0.0749 - accuracy: 0.9796
- val_loss: 0.1162 - val_accuracy: 0.9801
Epoch 566/600
273/273 [=====] - 1s 4ms/step - loss: 0.0633 - accuracy: 0.9819
- val_loss: 0.1212 - val_accuracy: 0.9799
Epoch 567/600
273/273 [=====] - 1s 4ms/step - loss: 0.0740 - accuracy: 0.9796
- val_loss: 0.1201 - val_accuracy: 0.9808
Epoch 568/600
273/273 [=====] - 1s 4ms/step - loss: 0.0665 - accuracy: 0.9825
```

```
- val_loss: 0.1113 - val_accuracy: 0.9801
Epoch 569/600
273/273 [=====] - 1s 4ms/step - loss: 0.0704 - accuracy: 0.9801
- val_loss: 0.1077 - val_accuracy: 0.9809
Epoch 570/600
273/273 [=====] - 1s 4ms/step - loss: 0.0703 - accuracy: 0.9813
- val_loss: 0.1112 - val_accuracy: 0.9803
Epoch 571/600
273/273 [=====] - 1s 4ms/step - loss: 0.0612 - accuracy: 0.9838
- val_loss: 0.1112 - val_accuracy: 0.9803
Epoch 572/600
273/273 [=====] - 1s 4ms/step - loss: 0.0741 - accuracy: 0.9804
- val_loss: 0.1125 - val_accuracy: 0.9805
Epoch 573/600
273/273 [=====] - 1s 4ms/step - loss: 0.0647 - accuracy: 0.9830
- val_loss: 0.1223 - val_accuracy: 0.9804
Epoch 574/600
273/273 [=====] - 1s 4ms/step - loss: 0.0671 - accuracy: 0.9820
- val_loss: 0.1176 - val_accuracy: 0.9802
Epoch 575/600
273/273 [=====] - 1s 4ms/step - loss: 0.0611 - accuracy: 0.9838
- val_loss: 0.1206 - val_accuracy: 0.9806
Epoch 576/600
273/273 [=====] - 1s 4ms/step - loss: 0.0727 - accuracy: 0.9808
- val_loss: 0.1207 - val_accuracy: 0.9808
Epoch 577/600
273/273 [=====] - 1s 4ms/step - loss: 0.0674 - accuracy: 0.9820
- val_loss: 0.1159 - val_accuracy: 0.9808
Epoch 578/600
273/273 [=====] - 1s 4ms/step - loss: 0.0610 - accuracy: 0.9830
- val_loss: 0.1182 - val_accuracy: 0.9800
Epoch 579/600
273/273 [=====] - 1s 4ms/step - loss: 0.0686 - accuracy: 0.9822
- val_loss: 0.1196 - val_accuracy: 0.9772
Epoch 580/600
273/273 [=====] - 1s 4ms/step - loss: 0.0665 - accuracy: 0.9820
- val_loss: 0.1120 - val_accuracy: 0.9792
Epoch 581/600
273/273 [=====] - 1s 4ms/step - loss: 0.0748 - accuracy: 0.9799
- val_loss: 0.1069 - val_accuracy: 0.9806
Epoch 582/600
273/273 [=====] - 1s 4ms/step - loss: 0.0793 - accuracy: 0.9794
- val_loss: 0.1088 - val_accuracy: 0.9805
Epoch 583/600
273/273 [=====] - 1s 4ms/step - loss: 0.0701 - accuracy: 0.9810
- val_loss: 0.1109 - val_accuracy: 0.9799
Epoch 584/600
273/273 [=====] - 1s 4ms/step - loss: 0.0679 - accuracy: 0.9819
- val_loss: 0.1114 - val_accuracy: 0.9810
Epoch 585/600
273/273 [=====] - 1s 4ms/step - loss: 0.0573 - accuracy: 0.9842
- val_loss: 0.1099 - val_accuracy: 0.9806
Epoch 586/600
273/273 [=====] - 1s 4ms/step - loss: 0.0691 - accuracy: 0.9814
- val_loss: 0.1076 - val_accuracy: 0.9810
Epoch 587/600
273/273 [=====] - 1s 4ms/step - loss: 0.0713 - accuracy: 0.9802
- val_loss: 0.1209 - val_accuracy: 0.9808
Epoch 588/600
273/273 [=====] - 1s 4ms/step - loss: 0.0641 - accuracy: 0.9833
- val_loss: 0.1175 - val_accuracy: 0.9791
Epoch 589/600
273/273 [=====] - 1s 4ms/step - loss: 0.0641 - accuracy: 0.9823
- val_loss: 0.1180 - val_accuracy: 0.9808
Epoch 590/600
```

```

273/273 [=====] - 1s 3ms/step - loss: 0.0677 - accuracy: 0.9823
- val_loss: 0.1176 - val_accuracy: 0.9791
Epoch 591/600
273/273 [=====] - 1s 4ms/step - loss: 0.0592 - accuracy: 0.9846
- val_loss: 0.1309 - val_accuracy: 0.9802
Epoch 592/600
273/273 [=====] - 1s 4ms/step - loss: 0.0598 - accuracy: 0.9839
- val_loss: 0.0995 - val_accuracy: 0.9797
Epoch 593/600
273/273 [=====] - 1s 4ms/step - loss: 0.0708 - accuracy: 0.9799
- val_loss: 0.1063 - val_accuracy: 0.9800
Epoch 594/600
273/273 [=====] - 1s 4ms/step - loss: 0.0692 - accuracy: 0.9820
- val_loss: 0.1166 - val_accuracy: 0.9808
Epoch 595/600
273/273 [=====] - 1s 4ms/step - loss: 0.0597 - accuracy: 0.9842
- val_loss: 0.1175 - val_accuracy: 0.9804
Epoch 596/600
273/273 [=====] - 1s 4ms/step - loss: 0.0640 - accuracy: 0.9820
- val_loss: 0.1158 - val_accuracy: 0.9805
Epoch 597/600
273/273 [=====] - 1s 4ms/step - loss: 0.0713 - accuracy: 0.9803
- val_loss: 0.1141 - val_accuracy: 0.9805
Epoch 598/600
273/273 [=====] - 1s 4ms/step - loss: 0.0632 - accuracy: 0.9836
- val_loss: 0.1136 - val_accuracy: 0.9803
Epoch 599/600
273/273 [=====] - 1s 4ms/step - loss: 0.0638 - accuracy: 0.9825
- val_loss: 0.1322 - val_accuracy: 0.9806
Epoch 600/600
273/273 [=====] - 1s 4ms/step - loss: 0.0669 - accuracy: 0.9827
- val_loss: 0.1083 - val_accuracy: 0.9808

```

Out[85]: <tensorflow.python.keras.callbacks.History at 0x7f721f276750>

```
In [94]: predictions = ann_model.predict(x_test)[: ,0]
         predictions[0:10]
```

Out[94]: array([5.1400346e-01, 6.3963707e-10, 2.3623914e-02, 8.3117070e-29,  
5.2477092e-02, 9.6591539e-06, 9.7921491e-04, 2.3538500e-02,  
8.6560249e-03, 6.8458521e-06], dtype=float32)

```
In [100... predictions = np.round(ann_model.predict(x_test)[: ,0])
         predictions[0:10]
```

Out[100... array([1., 0., 0., 0., 0., 0., 0., 0., 0., 0.], dtype=float32)

## CONFUSION MATRIX AND CLASIFICATION REPORT TO EVALUATE PERFORMANCE

```
In [89]: from sklearn.metrics import classification_report , confusion_matrix
```

```
In [102... print(classification_report(y_test,predictions))
```

	precision	recall	f1-score	support
0	0.98	1.00	0.99	19970
1	0.11	0.01	0.01	375
accuracy			0.98	20345
macro avg	0.54	0.50	0.50	20345
weighted avg	0.97	0.98	0.97	20345

```
In [103... print(confusion_matrix(y_test,predictions))
```

```
[[19953   17]  
 [   373    2]]
```

```
In [ ]:
```