

Experiment 4 - ANN Model - Breast Cancer Prediction - Early Stopping & Dropout

Problem Statement:

To build an ANN model for classification problem on breast cancer classification to see the effect of:

- a. Early Stopping
- b. Dropouts

GitHub & Google Colab Links:

GitHub Link: <https://github.com/piyush-gambhir/ncu-lab-manual-and-end-semester-projects/blob/main/NCU-CSL312%20-%20DL%20-%20Lab%20Manual/Experiment%204/Experiment%204.ipynb>

Google Colab Link:



Installing Dependencies

```
In [ ]: ! pip install tabulate numpy pandas matplotlib seaborn
```

```
Requirement already satisfied: tabulate in c:\users\mainp\appdata\local\programs\python\python311\lib\site-packages (0.9.0)
Requirement already satisfied: numpy in c:\users\mainp\appdata\local\programs\python\python311\lib\site-packages (1.26.4)
Requirement already satisfied: pandas in c:\users\mainp\appdata\local\programs\python\python311\lib\site-packages (2.2.2)
Requirement already satisfied: matplotlib in c:\users\mainp\appdata\local\programs\python\python311\lib\site-packages (3.8.4)
Requirement already satisfied: seaborn in c:\users\mainp\appdata\local\programs\python\python311\lib\site-packages (0.13.2)
Requirement already satisfied: python-dateutil>=2.8.2 in c:\users\mainp\appdata\local\programs\python\python311\lib\site-packages (from pandas) (2.9.0.post0)
Requirement already satisfied: pytz>=2020.1 in c:\users\mainp\appdata\local\programs\python\python311\lib\site-packages (from pandas) (2024.1)
Requirement already satisfied: tzdata>=2022.7 in c:\users\mainp\appdata\local\programs\python\python311\lib\site-packages (from pandas) (2024.1)
Requirement already satisfied: contourpy>=1.0.1 in c:\users\mainp\appdata\local\programs\python\python311\lib\site-packages (from matplotlib) (1.2.1)
Requirement already satisfied: cycler>=0.10 in c:\users\mainp\appdata\local\programs\python\python311\lib\site-packages (from matplotlib) (0.12.1)
Requirement already satisfied: fonttools>=4.22.0 in c:\users\mainp\appdata\local\programs\python\python311\lib\site-packages (from matplotlib) (4.51.0)
Requirement already satisfied: kiwisolver>=1.3.1 in c:\users\mainp\appdata\local\programs\python\python311\lib\site-packages (from matplotlib) (1.4.5)
Requirement already satisfied: packaging>=20.0 in c:\users\mainp\appdata\local\programs\python\python311\lib\site-packages (from matplotlib) (24.0)
Requirement already satisfied: pillow>=8 in c:\users\mainp\appdata\local\programs\python\python311\lib\site-packages (from matplotlib) (10.3.0)
Requirement already satisfied: pyparsing>=2.3.1 in c:\users\mainp\appdata\local\programs\python\python311\lib\site-packages (from matplotlib) (3.1.2)
Requirement already satisfied: six>=1.5 in c:\users\mainp\appdata\local\programs\python\python311\lib\site-packages (from python-dateutil>=2.8.2->pandas) (1.16.0)
```

Code

```
In [ ]: import pandas as pd
import numpy as np
import seaborn as sns
import matplotlib.pyplot as plt
from sklearn.model_selection import train_test_split
from sklearn.preprocessing import MinMaxScaler
from tensorflow.keras.models import Sequential
from tensorflow.keras.layers import Dense, Activation, Dropout
from tensorflow.keras.callbacks import EarlyStopping
from sklearn.metrics import classification_report, confusion_matrix
import tensorflow as tf
```

```
In [ ]: # Loading and Initial Data Check
```

```
df = pd.read_csv('cancer_classification.csv')
print(df.head().to_markdown())
```

	mean radius	mean texture	mean perimeter	mean area	mean smoothness	mean compactness	mean concavity	mean concave points	mean symmetry	mean fractal dimension	radius error	texture error	perimeter error	area error	smoothness error	compactness error	concavity error	concave points error	symmetry error	fractal dimension error	worst radius	worst texture	worst perimeter	worst area	worst smoothness	worst compactness	worst concavity	worst concave points	worst symmetry	worst fractal dimension	benign_0_mal_1
0	17.99	10.38	122.8	1001	0.1184	0.2776	0.3001	0.1471	0.2419	0.07871	1.095	0.9053	0.01587	2019	1	0.04904	0.05373	0.03003	0.006193	25.38	17.33	184.6	0.1622	0.6656	0.7119	0.2654	0.460	0.1189	0		
1	20.57	17.77	132.9	1326	0.08474	0.07864	0.0869	0.07017	0.1812	0.05667	0.5435	0.7339	0.0134	1956	1	0.01308	0.0186	0.01389	0.003532	24.99	23.41	158.8	0.1238	0.1866	0.2416	0.186	0.275	0.08902	0		
2	19.69	21.25	130	1203	0.1096	0.1599	0.1974	0.1279	0.2069	0.05999	0.7456	0.7869	0.02058	1709	3	0.04006	0.03832	0.0225	0.004571	23.57	25.53	152.5	0.1444	0.4245	0.4504	0.243	0.361	0.08758	0		
3	11.42	20.38	77.58	386.1	0.1425	0.2839	0.2414	0.1052	0.2597	0.09744	0.4956	1.156	0.01867	567.7	1	0.07458	0.05661	0.05963	0.009208	14.91	26.5	98.87	0.2098	0.8663	0.6869	0.2575	0.6638	0.173	0		
4	20.29	14.34	135.1	1297	0.1003	0.1328	0.198	0.1043	0.1809	0.05883	0.7572	0.7813	0.01885	1575	4	0.02461	0.05688	0.01756	0.005115	22.54	16.67	152.2	0.1374	0.205	0.4	0.1625	0.236	0.07678	0		

```
In [ ]: # understanding the data
print("Data Info")
print(df.info())

print("/n")

print("Data Description")
print(df.describe().transpose().to_markdown())
```

```
Data Info
<class 'pandas.core.frame.DataFrame'>
RangeIndex: 569 entries, 0 to 568
Data columns (total 31 columns):
#   Column                                Non-Null Count  Dtype
---  -
0   mean radius                          569 non-null    float64
1   mean texture                         569 non-null    float64
2   mean perimeter                      569 non-null    float64
3   mean area                          569 non-null    float64
4   mean smoothness                    569 non-null    float64
5   mean compactness                   569 non-null    float64
6   mean concavity                     569 non-null    float64
7   mean concave points                 569 non-null    float64
8   mean symmetry                      569 non-null    float64
9   mean fractal dimension              569 non-null    float64
10  radius error                       569 non-null    float64
11  texture error                      569 non-null    float64
12  perimeter error                    569 non-null    float64
13  area error                        569 non-null    float64
14  smoothness error                   569 non-null    float64
15  compactness error                  569 non-null    float64
16  concavity error                    569 non-null    float64
17  concave points error               569 non-null    float64
18  symmetry error                     569 non-null    float64
19  fractal dimension error            569 non-null    float64
20  worst radius                       569 non-null    float64
21  worst texture                      569 non-null    float64
22  worst perimeter                    569 non-null    float64
```

```

23 worst area          569 non-null    float64
24 worst smoothness    569 non-null    float64
25 worst compactness   569 non-null    float64
26 worst concavity     569 non-null    float64
27 worst concave points 569 non-null    float64
28 worst symmetry      569 non-null    float64
29 worst fractal dimension 569 non-null    float64
30 benign_0__mal_1     569 non-null    int64

```

dtypes: float64(30), int64(1)

memory usage: 137.9 KB

None

/n

Data Description

	count	mean	std	min	25%	50%	75%	max
mean radius	569	14.1273	3.52405	6.981	11.7	13.37	15	
.78 28.11								
mean texture	569	19.2896	4.30104	9.71	16.17	18.84	21	
.8 39.28								
mean perimeter	569	91.969	24.299	43.79	75.17	86.24	104	
.1 188.5								
mean area	569	654.889	351.914	143.5	420.3	551.1	782	
.7 2501								
mean smoothness	569	0.0963603	0.0140641	0.05263	0.08637	0.09587	0	
.1053 0.1634								
mean compactness	569	0.104341	0.0528128	0.01938	0.06492	0.09263	0	
.1304 0.3454								
mean concavity	569	0.0887993	0.0797198	0	0.02956	0.06154	0	
.1307 0.4268								
mean concave points	569	0.0489191	0.0388028	0	0.02031	0.0335	0	
.074 0.2012								
mean symmetry	569	0.181162	0.0274143	0.106	0.1619	0.1792	0	
.1957 0.304								
mean fractal dimension	569	0.0627976	0.00706036	0.04996	0.0577	0.06154	0	
.06612 0.09744								
radius error	569	0.405172	0.277313	0.1115	0.2324	0.3242	0	
.4789 2.873								
texture error	569	1.21685	0.551648	0.3602	0.8339	1.108	1	
.474 4.885								
perimeter error	569	2.86606	2.02185	0.757	1.606	2.287	3	
.357 21.98								
area error	569	40.3371	45.491	6.802	17.85	24.53	45	
.19 542.2								
smoothness error	569	0.00704098	0.00300252	0.001713	0.005169	0.00638	0	
.008146 0.03113								
compactness error	569	0.0254781	0.0179082	0.002252	0.01308	0.02045	0	
.03245 0.1354								
concavity error	569	0.0318937	0.0301861	0	0.01509	0.02589	0	
.04205 0.396								
concave points error	569	0.0117961	0.00617029	0	0.007638	0.01093	0	
.01471 0.05279								
symmetry error	569	0.0205423	0.00826637	0.007882	0.01516	0.01873	0	
.02348 0.07895								
fractal dimension error	569	0.0037949	0.00264607	0.0008948	0.002248	0.003187	0	
.004558 0.02984								
worst radius	569	16.2692	4.83324	7.93	13.01	14.97	18	
.79 36.04								
worst texture	569	25.6772	6.14626	12.02	21.08	25.41	29	
.72 49.54								
worst perimeter	569	107.261	33.6025	50.41	84.11	97.66	125	
.4 251.2								
worst area	569	880.583	569.357	185.2	515.3	686.5	1084	
4254								
worst smoothness	569	0.132369	0.0228324	0.07117	0.1166	0.1313	0	
.146 0.2226								
worst compactness	569	0.254265	0.157336	0.02729	0.1472	0.2119	0	
.3391 1.058								
worst concavity	569	0.272188	0.208624	0	0.1145	0.2267	0	
.3829 1.252								
worst concave points	569	0.114606	0.0657323	0	0.06493	0.09993	0	
.1614 0.291								
worst symmetry	569	0.290076	0.0618675	0.1565	0.2504	0.2822	0	
.3179 0.6638								
worst fractal dimension	569	0.0839458	0.0180613	0.05504	0.07146	0.08004	0	
.09208 0.2075								
benign_0__mal_1	569	0.627417	0.483918	0	0	1	1	
1								

```

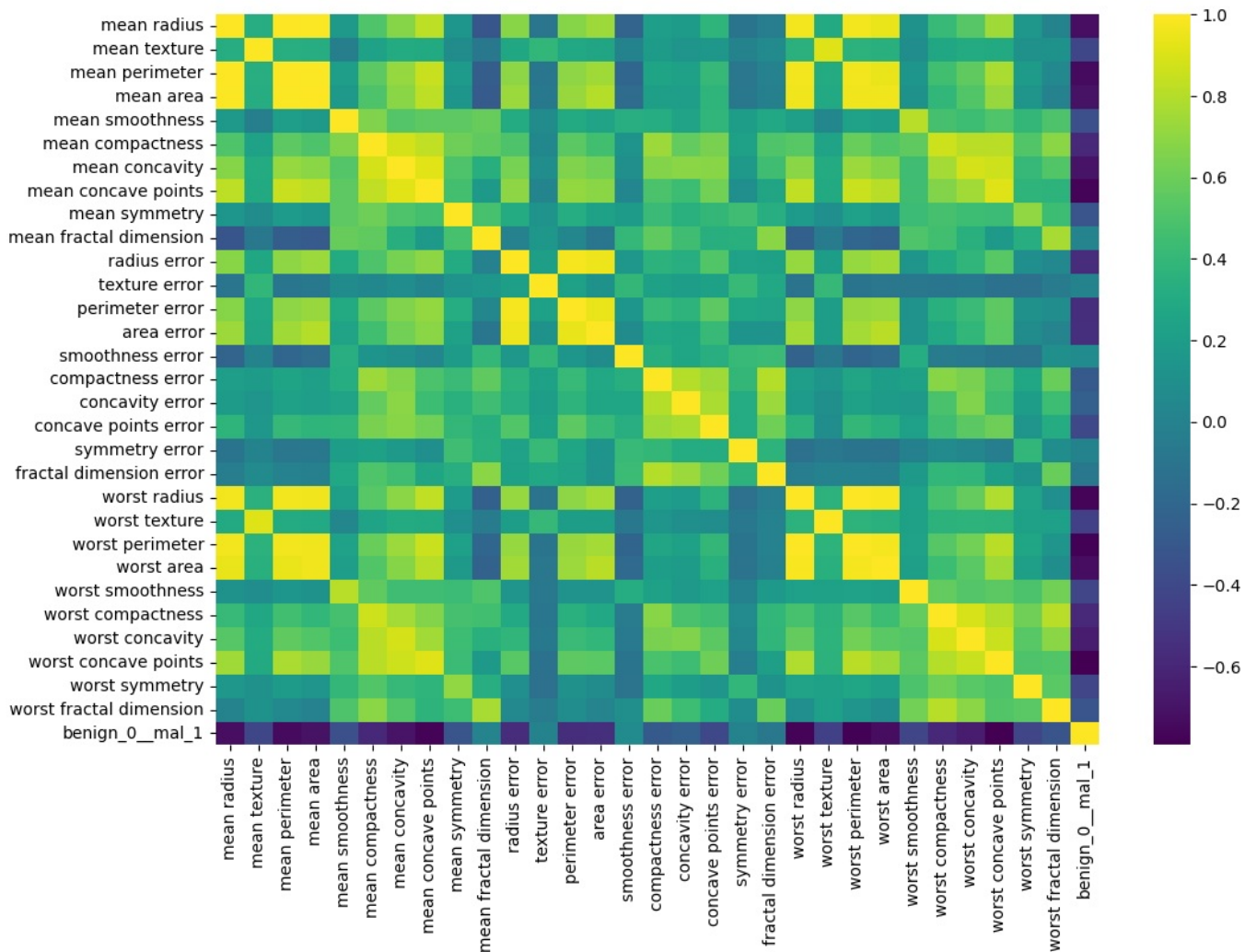
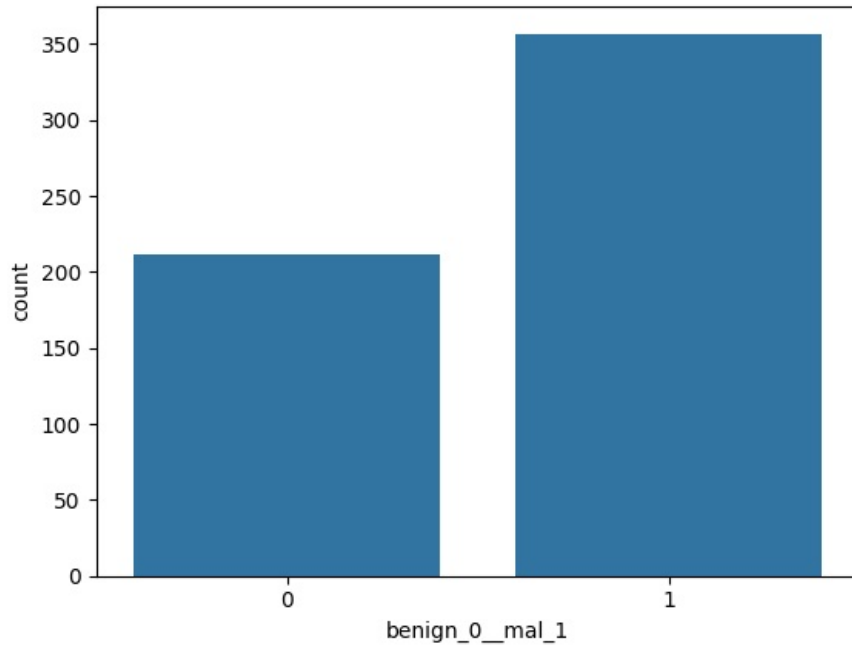
In [ ]: # Exploratory Data Analysis (EDA)
# Distribution of Target Variable
sns.countplot(x='benign_0__mal_1', data=df)

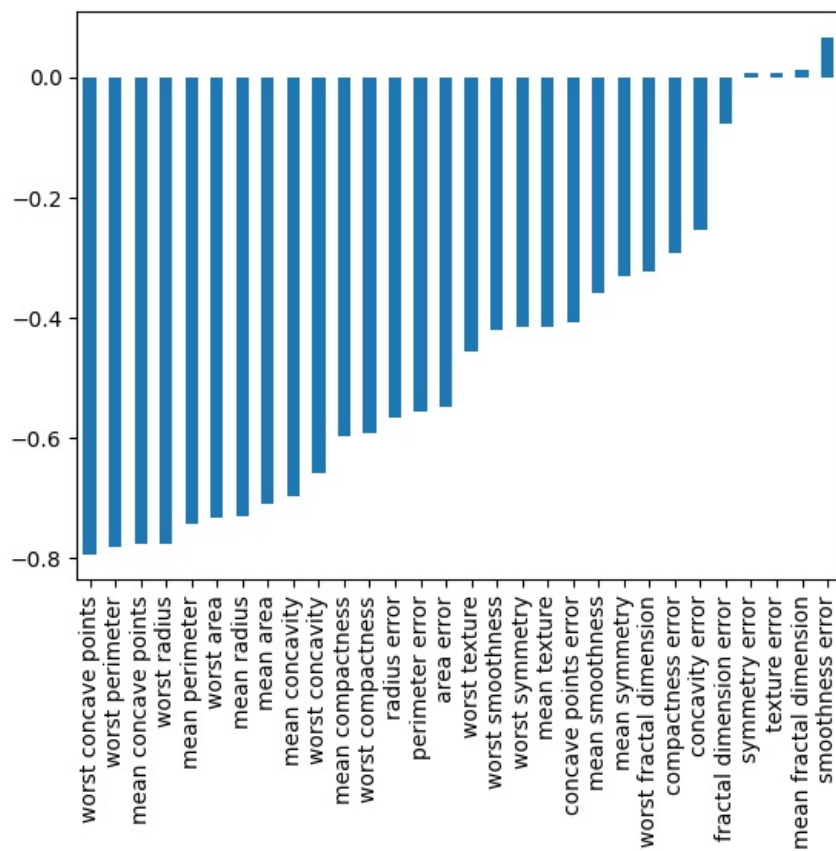
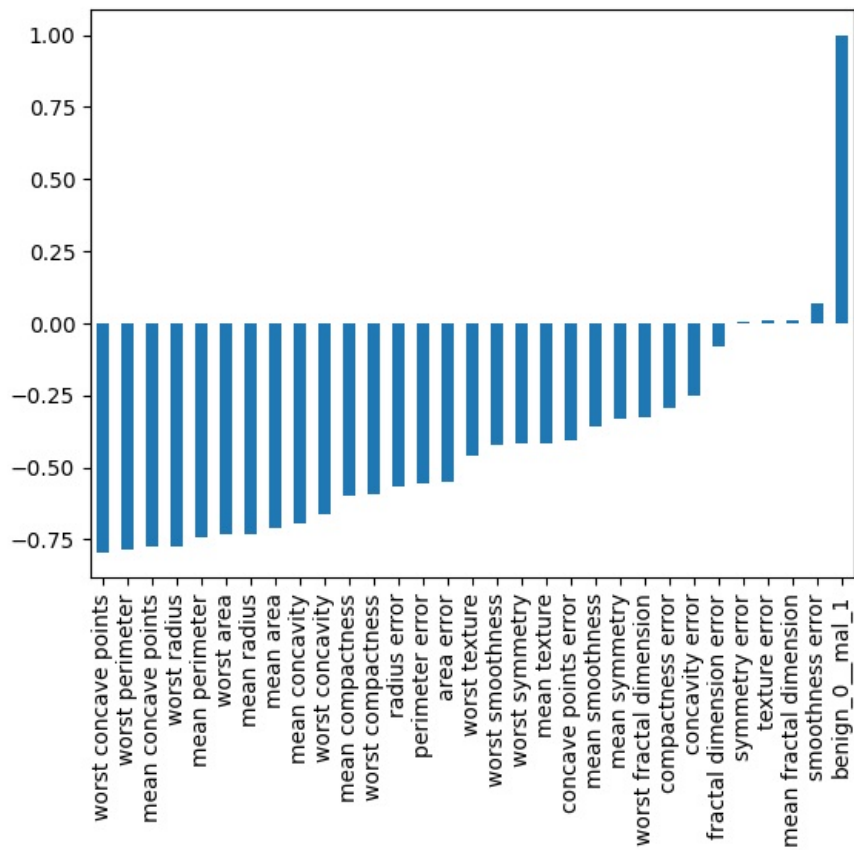
```

```
plt.show()

# Correlation Heatmap
plt.figure(figsize=(12, 8))
sns.heatmap(df.corr(), annot=False, cmap='viridis')
plt.show()

# Correlation with Target Variable
df.corr()['benign_0__mal_1'].sort_values().plot(kind='bar')
plt.show()
df.corr()['benign_0__mal_1'][::-1].sort_values().plot(kind='bar')
plt.show()
```





```
In [ ]: # Train Test Split
X = df.drop('benign_0_mal_1', axis=1).values
y = df['benign_0_mal_1'].values
X_train, X_test, y_train, y_test = train_test_split(
    X, y, test_size=0.25, random_state=101)
```



























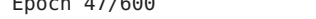

```
In [ ]: # Scaling Data
scaler = MinMaxScaler()
X_train = scaler.fit_transform(X_train)
X_test = scaler.transform(X_test)
```


```
In [ ]: # Creating the Model
model = Sequential([
    Dense(units=30, activation='relu'),
    Dense(units=15, activation='relu'),
    Dense(units=1, activation='sigmoid')
])
model.compile(loss='binary_crossentropy',
              optimizer='adam', metrics=['accuracy'])


# Training the Model - Example One: Overfitting
model.fit(x=X_train, y=y_train, epochs=600,
          validation_data=(X_test, y_test), verbose=1)
model_loss = pd.DataFrame(model.history.history)
model_loss.plot()
plt.show()


# Example Two: Early Stopping to prevent overfitting
# Resetting the model
model = Sequential([
    Dense(units=30, activation='relu'),
    Dense(units=15, activation='relu'),
    Dense(units=1, activation='sigmoid')
])
model.compile(loss='binary_crossentropy', optimizer='adam')
```


```
Epoch 1/600
14/14 ————— 1s 14ms/step - accuracy: 0.3566 - loss: 0.7173 - val_accuracy: 0.3916 - val_loss: 0.6914
Epoch 2/600
14/14 ————— 0s 3ms/step - accuracy: 0.4457 - loss: 0.6814 - val_accuracy: 0.6853 - val_loss: 0.6586
Epoch 3/600
14/14 ————— 0s 3ms/step - accuracy: 0.7696 - loss: 0.6496 - val_accuracy: 0.8741 - val_loss: 0.6198
Epoch 4/600
14/14 ————— 0s 3ms/step - accuracy: 0.8958 - loss: 0.6044 - val_accuracy: 0.9091 - val_loss: 0.5714
Epoch 5/600
14/14 ————— 0s 3ms/step - accuracy: 0.8730 - loss: 0.5571 - val_accuracy: 0.9161 - val_loss: 0.5208
Epoch 6/600
14/14 ————— 0s 3ms/step - accuracy: 0.8814 - loss: 0.5056 - val_accuracy: 0.8811 - val_loss: 0.4689
Epoch 7/600
14/14 ————— 0s 3ms/step - accuracy: 0.8947 - loss: 0.4614 - val_accuracy: 0.9161 - val_loss: 0.4229
Epoch 8/600
14/14 ————— 0s 3ms/step - accuracy: 0.8992 - loss: 0.4102 - val_accuracy: 0.9021 - val_loss: 0.3729
Epoch 9/600
14/14 ————— 0s 3ms/step - accuracy: 0.8809 - loss: 0.3784 - val_accuracy: 0.9231 - val_loss: 0.3341
Epoch 10/600
14/14 ————— 0s 3ms/step - accuracy: 0.9268 - loss: 0.3122 - val_accuracy: 0.9161 - val_loss: 0.2966
Epoch 11/600
14/14 ————— 0s 3ms/step - accuracy: 0.9048 - loss: 0.2924 - val_accuracy: 0.9371 - val_loss: 0.2700
Epoch 12/600
14/14 ————— 0s 3ms/step - accuracy: 0.9191 - loss: 0.2617 - val_accuracy: 0.9510 - val_loss: 0.2435
Epoch 13/600
14/14 ————— 0s 6ms/step - accuracy: 0.9234 - loss: 0.2497 - val_accuracy: 0.9580 - val_loss: 0.2219
Epoch 14/600
14/14 ————— 0s 3ms/step - accuracy: 0.9172 - loss: 0.2294 - val_accuracy: 0.9441 - val_loss: 0.2064
Epoch 15/600
14/14 ————— 0s 3ms/step - accuracy: 0.9234 - loss: 0.2203 - val_accuracy: 0.9371 - val_loss: 0.1945
Epoch 16/600
14/14 ————— 0s 3ms/step - accuracy: 0.9441 - loss: 0.1796 - val_accuracy: 0.9371 - val_loss: 0.1842
Epoch 17/600
14/14 ————— 0s 3ms/step - accuracy: 0.9190 - loss: 0.2000 - val_accuracy: 0.9510 - val_loss: 0.1743
Epoch 18/600
14/14 ————— 0s 4ms/step - accuracy: 0.9382 - loss: 0.1801 - val_accuracy: 0.9580 - val_loss: 0.1654
Epoch 19/600
14/14 ————— 0s 3ms/step - accuracy: 0.9537 - loss: 0.1421 - val_accuracy: 0.9650 - val_loss: 0.1584
Epoch 20/600
```


14/14  0s 3ms/step - accuracy: 0.9386 - loss: 0.1522 - val_accuracy: 0.9650 - val_loss: 0.1524
Epoch 21/600
14/14  0s 3ms/step - accuracy: 0.9402 - loss: 0.1336 - val_accuracy: 0.9580 - val_loss: 0.1506
Epoch 22/600
14/14  0s 3ms/step - accuracy: 0.9559 - loss: 0.1315 - val_accuracy: 0.9650 - val_loss: 0.1435
Epoch 23/600
14/14  0s 3ms/step - accuracy: 0.9603 - loss: 0.1373 - val_accuracy: 0.9720 - val_loss: 0.1385
Epoch 24/600
14/14  0s 3ms/step - accuracy: 0.9376 - loss: 0.1350 - val_accuracy: 0.9650 - val_loss: 0.1367
Epoch 25/600
14/14  0s 3ms/step - accuracy: 0.9499 - loss: 0.1530 - val_accuracy: 0.9580 - val_loss: 0.1342
Epoch 26/600
14/14  0s 3ms/step - accuracy: 0.9610 - loss: 0.1195 - val_accuracy: 0.9510 - val_loss: 0.1319
Epoch 27/600
14/14  0s 3ms/step - accuracy: 0.9708 - loss: 0.1303 - val_accuracy: 0.9510 - val_loss: 0.1301
Epoch 28/600
14/14  0s 3ms/step - accuracy: 0.9767 - loss: 0.0939 - val_accuracy: 0.9580 - val_loss: 0.1287
Epoch 29/600
14/14  0s 3ms/step - accuracy: 0.9822 - loss: 0.1014 - val_accuracy: 0.9650 - val_loss: 0.1260
Epoch 30/600
14/14  0s 3ms/step - accuracy: 0.9567 - loss: 0.1128 - val_accuracy: 0.9650 - val_loss: 0.1294
Epoch 31/600
14/14  0s 3ms/step - accuracy: 0.9801 - loss: 0.1067 - val_accuracy: 0.9650 - val_loss: 0.1226
Epoch 32/600
14/14  0s 4ms/step - accuracy: 0.9868 - loss: 0.0860 - val_accuracy: 0.9650 - val_loss: 0.1232
Epoch 33/600
14/14  0s 3ms/step - accuracy: 0.9846 - loss: 0.0875 - val_accuracy: 0.9650 - val_loss: 0.1196
Epoch 34/600
14/14  0s 4ms/step - accuracy: 0.9854 - loss: 0.1020 - val_accuracy: 0.9650 - val_loss: 0.1261
Epoch 35/600
14/14  0s 3ms/step - accuracy: 0.9762 - loss: 0.0943 - val_accuracy: 0.9720 - val_loss: 0.1167
Epoch 36/600
14/14  0s 6ms/step - accuracy: 0.9832 - loss: 0.0779 - val_accuracy: 0.9650 - val_loss: 0.1210
Epoch 37/600
14/14  0s 3ms/step - accuracy: 0.9845 - loss: 0.0794 - val_accuracy: 0.9650 - val_loss: 0.1189
Epoch 38/600
14/14  0s 4ms/step - accuracy: 0.9830 - loss: 0.0779 - val_accuracy: 0.9650 - val_loss: 0.1187
Epoch 39/600
14/14  0s 3ms/step - accuracy: 0.9749 - loss: 0.0868 - val_accuracy: 0.9650 - val_loss: 0.1162
Epoch 40/600
14/14  0s 4ms/step - accuracy: 0.9805 - loss: 0.0762 - val_accuracy: 0.9650 - val_loss: 0.1174
Epoch 41/600
14/14  0s 4ms/step - accuracy: 0.9847 - loss: 0.0722 - val_accuracy: 0.9650 - val_loss: 0.1186
Epoch 42/600
14/14  0s 4ms/step - accuracy: 0.9743 - loss: 0.0877 - val_accuracy: 0.9860 - val_loss: 0.1122
Epoch 43/600
14/14  0s 4ms/step - accuracy: 0.9775 - loss: 0.0749 - val_accuracy: 0.9650 - val_loss: 0.1159
Epoch 44/600
14/14  0s 3ms/step - accuracy: 0.9831 - loss: 0.0798 - val_accuracy: 0.9860 - val_loss: 0.1104
Epoch 45/600
14/14  0s 3ms/step - accuracy: 0.9716 - loss: 0.0869 - val_accuracy: 0.9790 - val_loss: 0.1107
Epoch 46/600
14/14  0s 3ms/step - accuracy: 0.9880 - loss: 0.0629 - val_accuracy: 0.9650 - val_loss: 0.1176
Epoch 47/600
14/14  0s 3ms/step - accuracy: 0.9780 - loss: 0.0775 - val_accuracy: 0.9650 - val_loss: 0.1132


Epoch 48/600
14/14  0s 3ms/step - accuracy: 0.9709 - loss: 0.0884 - val_accuracy: 0.9860 - val_loss: 0.1096


Epoch 49/600
14/14  0s 3ms/step - accuracy: 0.9898 - loss: 0.0518 - val_accuracy: 0.9650 - val_loss: 0.1162


Epoch 50/600
14/14  0s 4ms/step - accuracy: 0.9773 - loss: 0.0804 - val_accuracy: 0.9650 - val_loss: 0.1127


Epoch 51/600
14/14  0s 3ms/step - accuracy: 0.9723 - loss: 0.0816 - val_accuracy: 0.9650 - val_loss: 0.1114


Epoch 52/600
14/14  0s 4ms/step - accuracy: 0.9805 - loss: 0.0617 - val_accuracy: 0.9650 - val_loss: 0.1197


Epoch 53/600
14/14  0s 3ms/step - accuracy: 0.9785 - loss: 0.0648 - val_accuracy: 0.9860 - val_loss: 0.1083


Epoch 54/600
14/14  0s 3ms/step - accuracy: 0.9832 - loss: 0.0534 - val_accuracy: 0.9650 - val_loss: 0.1141


Epoch 55/600
14/14  0s 5ms/step - accuracy: 0.9700 - loss: 0.0763 - val_accuracy: 0.9650 - val_loss: 0.1131


Epoch 56/600
14/14  0s 4ms/step - accuracy: 0.9796 - loss: 0.0655 - val_accuracy: 0.9790 - val_loss: 0.1087


Epoch 57/600
14/14  0s 3ms/step - accuracy: 0.9644 - loss: 0.0727 - val_accuracy: 0.9650 - val_loss: 0.1131


Epoch 58/600
14/14  0s 3ms/step - accuracy: 0.9846 - loss: 0.0643 - val_accuracy: 0.9650 - val_loss: 0.1095


Epoch 59/600
14/14  0s 3ms/step - accuracy: 0.9702 - loss: 0.0871 - val_accuracy: 0.9650 - val_loss: 0.1117


Epoch 60/600
14/14  0s 3ms/step - accuracy: 0.9849 - loss: 0.0562 - val_accuracy: 0.9650 - val_loss: 0.1108


Epoch 61/600
14/14  0s 4ms/step - accuracy: 0.9925 - loss: 0.0466 - val_accuracy: 0.9720 - val_loss: 0.1128


Epoch 62/600
14/14  0s 3ms/step - accuracy: 0.9806 - loss: 0.0591 - val_accuracy: 0.9650 - val_loss: 0.1108


Epoch 63/600
14/14  0s 4ms/step - accuracy: 0.9833 - loss: 0.0600 - val_accuracy: 0.9650 - val_loss: 0.1147


Epoch 64/600
14/14  0s 5ms/step - accuracy: 0.9912 - loss: 0.0482 - val_accuracy: 0.9650 - val_loss: 0.1126

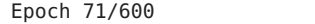
Epoch 65/600
14/14  0s 3ms/step - accuracy: 0.9651 - loss: 0.0828 - val_accuracy: 0.9650 - val_loss: 0.1124


Epoch 66/600
14/14  0s 3ms/step - accuracy: 0.9777 - loss: 0.0620 - val_accuracy: 0.9650 - val_loss: 0.1098


Epoch 67/600
14/14  0s 3ms/step - accuracy: 0.9768 - loss: 0.0583 - val_accuracy: 0.9650 - val_loss: 0.1150

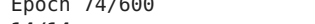
Epoch 68/600
14/14  0s 4ms/step - accuracy: 0.9748 - loss: 0.0704 - val_accuracy: 0.9650 - val_loss: 0.1112

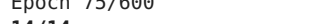
Epoch 69/600
14/14  0s 3ms/step - accuracy: 0.9823 - loss: 0.0652 - val_accuracy: 0.9650 - val_loss: 0.1139


Epoch 70/600
14/14  0s 4ms/step - accuracy: 0.9832 - loss: 0.0468 - val_accuracy: 0.9650 - val_loss: 0.1080




























Epoch 71/600
14/14  0s 3ms/step - accuracy: 0.9873 - loss: 0.0518 - val_accuracy: 0.9650 - val_loss: 0.1134





























Epoch 72/600
14/14  0s 4ms/step - accuracy: 0.9900 - loss: 0.0477 - val_accuracy: 0.9650 - val_loss: 0.1083


Epoch 73/600
14/14  0s 3ms/step - accuracy: 0.9798 - loss: 0.0570 - val_accuracy: 0.9650 - val_loss: 0.1089


Epoch 74/600
14/14  0s 3ms/step - accuracy: 0.9851 - loss: 0.0474 - val_accuracy: 0.9650 - val_loss: 0.1153


Epoch 75/600
14/14  0s 3ms/step - accuracy: 0.9828 - loss: 0.0575 - val_accuracy: 0.9650 - val_loss: 0.11


01
Epoch 76/600
14/14  0s 3ms/step - accuracy: 0.9835 - loss: 0.0431 - val_accuracy: 0.9650 - val_loss: 0.12
46
Epoch 77/600
14/14  0s 4ms/step - accuracy: 0.9760 - loss: 0.0605 - val_accuracy: 0.9650 - val_loss: 0.10
82
Epoch 78/600
14/14  0s 3ms/step - accuracy: 0.9784 - loss: 0.0620 - val_accuracy: 0.9650 - val_loss: 0.11
40
Epoch 79/600
14/14  0s 4ms/step - accuracy: 0.9920 - loss: 0.0434 - val_accuracy: 0.9650 - val_loss: 0.11
02
Epoch 80/600
14/14  0s 3ms/step - accuracy: 0.9815 - loss: 0.0545 - val_accuracy: 0.9650 - val_loss: 0.11
21
Epoch 81/600
14/14  0s 5ms/step - accuracy: 0.9803 - loss: 0.0580 - val_accuracy: 0.9650 - val_loss: 0.10
83
Epoch 82/600
14/14  0s 4ms/step - accuracy: 0.9872 - loss: 0.0435 - val_accuracy: 0.9650 - val_loss: 0.10
96
Epoch 83/600
14/14  0s 3ms/step - accuracy: 0.9867 - loss: 0.0567 - val_accuracy: 0.9650 - val_loss: 0.10
92
Epoch 84/600
14/14  0s 3ms/step - accuracy: 0.9790 - loss: 0.0600 - val_accuracy: 0.9720 - val_loss: 0.10
75
Epoch 85/600
14/14  0s 3ms/step - accuracy: 0.9813 - loss: 0.0439 - val_accuracy: 0.9650 - val_loss: 0.11
04
Epoch 86/600
14/14  0s 3ms/step - accuracy: 0.9931 - loss: 0.0397 - val_accuracy: 0.9650 - val_loss: 0.11
24
Epoch 87/600
14/14  0s 3ms/step - accuracy: 0.9924 - loss: 0.0352 - val_accuracy: 0.9650 - val_loss: 0.11
00
Epoch 88/600
14/14  0s 4ms/step - accuracy: 0.9817 - loss: 0.0588 - val_accuracy: 0.9650 - val_loss: 0.11
02
Epoch 89/600
14/14  0s 4ms/step - accuracy: 0.9844 - loss: 0.0495 - val_accuracy: 0.9650 - val_loss: 0.11
04
Epoch 90/600
14/14  0s 4ms/step - accuracy: 0.9732 - loss: 0.0742 - val_accuracy: 0.9650 - val_loss: 0.10
97
Epoch 91/600
14/14  0s 4ms/step - accuracy: 0.9755 - loss: 0.0593 - val_accuracy: 0.9720 - val_loss: 0.10
87
Epoch 92/600
14/14  0s 3ms/step - accuracy: 0.9771 - loss: 0.0491 - val_accuracy: 0.9650 - val_loss: 0.10
95
Epoch 93/600
14/14  0s 3ms/step - accuracy: 0.9898 - loss: 0.0432 - val_accuracy: 0.9650 - val_loss: 0.12
08
Epoch 94/600
14/14  0s 3ms/step - accuracy: 0.9901 - loss: 0.0425 - val_accuracy: 0.9650 - val_loss: 0.10
84
Epoch 95/600
14/14  0s 3ms/step - accuracy: 0.9794 - loss: 0.0653 - val_accuracy: 0.9650 - val_loss: 0.10
88
Epoch 96/600
14/14  0s 4ms/step - accuracy: 0.9860 - loss: 0.0438 - val_accuracy: 0.9650 - val_loss: 0.11
40
Epoch 97/600
14/14  0s 4ms/step - accuracy: 0.9877 - loss: 0.0494 - val_accuracy: 0.9650 - val_loss: 0.11
07
Epoch 98/600
14/14  0s 5ms/step - accuracy: 0.9873 - loss: 0.0432 - val_accuracy: 0.9650 - val_loss: 0.11
93
Epoch 99/600
14/14  0s 4ms/step - accuracy: 0.9860 - loss: 0.0545 - val_accuracy: 0.9650 - val_loss: 0.11
10
Epoch 100/600
14/14  0s 3ms/step - accuracy: 0.9849 - loss: 0.0484 - val_accuracy: 0.9650 - val_loss: 0.11
02
Epoch 101/600
14/14  0s 3ms/step - accuracy: 0.9918 - loss: 0.0390 - val_accuracy: 0.9650 - val_loss: 0.11
28
Epoch 102/600
14/14  0s 4ms/step - accuracy: 0.9802 - loss: 0.0582 - val_accuracy: 0.9650 - val_loss: 0.11
02
Epoch 103/600


14/14  0s 4ms/step - accuracy: 0.9741 - loss: 0.0673 - val_accuracy: 0.9650 - val_loss: 0.1095
Epoch 104/600
14/14  0s 4ms/step - accuracy: 0.9848 - loss: 0.0365 - val_accuracy: 0.9650 - val_loss: 0.1142
Epoch 105/600
14/14  0s 3ms/step - accuracy: 0.9888 - loss: 0.0395 - val_accuracy: 0.9650 - val_loss: 0.1121
Epoch 106/600
14/14  0s 3ms/step - accuracy: 0.9829 - loss: 0.0552 - val_accuracy: 0.9650 - val_loss: 0.1141
Epoch 107/600
14/14  0s 4ms/step - accuracy: 0.9926 - loss: 0.0359 - val_accuracy: 0.9650 - val_loss: 0.1123
Epoch 108/600
14/14  0s 4ms/step - accuracy: 0.9897 - loss: 0.0432 - val_accuracy: 0.9650 - val_loss: 0.1078
Epoch 109/600
14/14  0s 5ms/step - accuracy: 0.9842 - loss: 0.0473 - val_accuracy: 0.9650 - val_loss: 0.1125
Epoch 110/600
14/14  0s 4ms/step - accuracy: 0.9872 - loss: 0.0496 - val_accuracy: 0.9650 - val_loss: 0.1150
Epoch 111/600
14/14  0s 4ms/step - accuracy: 0.9801 - loss: 0.0660 - val_accuracy: 0.9930 - val_loss: 0.1042
Epoch 112/600
14/14  0s 3ms/step - accuracy: 0.9775 - loss: 0.0621 - val_accuracy: 0.9650 - val_loss: 0.1098
Epoch 113/600
14/14  0s 3ms/step - accuracy: 0.9772 - loss: 0.0600 - val_accuracy: 0.9650 - val_loss: 0.1088
Epoch 114/600
14/14  0s 3ms/step - accuracy: 0.9823 - loss: 0.0446 - val_accuracy: 0.9650 - val_loss: 0.1206
Epoch 115/600
14/14  0s 3ms/step - accuracy: 0.9801 - loss: 0.0510 - val_accuracy: 0.9930 - val_loss: 0.1038
Epoch 116/600
14/14  0s 5ms/step - accuracy: 0.9836 - loss: 0.0520 - val_accuracy: 0.9650 - val_loss: 0.1162
Epoch 117/600
14/14  0s 4ms/step - accuracy: 0.9808 - loss: 0.0592 - val_accuracy: 0.9720 - val_loss: 0.1042
Epoch 118/600
14/14  0s 4ms/step - accuracy: 0.9845 - loss: 0.0426 - val_accuracy: 0.9650 - val_loss: 0.1106
Epoch 119/600
14/14  0s 4ms/step - accuracy: 0.9858 - loss: 0.0486 - val_accuracy: 0.9720 - val_loss: 0.1065
Epoch 120/600
14/14  0s 3ms/step - accuracy: 0.9845 - loss: 0.0559 - val_accuracy: 0.9720 - val_loss: 0.1066
Epoch 121/600
14/14  0s 4ms/step - accuracy: 0.9809 - loss: 0.0442 - val_accuracy: 0.9650 - val_loss: 0.1172
Epoch 122/600
14/14  0s 4ms/step - accuracy: 0.9911 - loss: 0.0384 - val_accuracy: 0.9650 - val_loss: 0.1090
Epoch 123/600
14/14  0s 4ms/step - accuracy: 0.9850 - loss: 0.0401 - val_accuracy: 0.9650 - val_loss: 0.1085
Epoch 124/600
14/14  0s 4ms/step - accuracy: 0.9789 - loss: 0.0495 - val_accuracy: 0.9650 - val_loss: 0.1105
Epoch 125/600
14/14  0s 3ms/step - accuracy: 0.9833 - loss: 0.0496 - val_accuracy: 0.9650 - val_loss: 0.1120
Epoch 126/600
14/14  0s 3ms/step - accuracy: 0.9819 - loss: 0.0418 - val_accuracy: 0.9720 - val_loss: 0.1086
Epoch 127/600
14/14  0s 4ms/step - accuracy: 0.9797 - loss: 0.0597 - val_accuracy: 0.9720 - val_loss: 0.1085
Epoch 128/600
14/14  0s 3ms/step - accuracy: 0.9850 - loss: 0.0459 - val_accuracy: 0.9650 - val_loss: 0.1107
Epoch 129/600
14/14  0s 4ms/step - accuracy: 0.9887 - loss: 0.0450 - val_accuracy: 0.9650 - val_loss: 0.1142
Epoch 130/600
14/14  0s 3ms/step - accuracy: 0.9827 - loss: 0.0499 - val_accuracy: 0.9650 - val_loss: 0.1094


Epoch 131/600
14/14  0s 4ms/step - accuracy: 0.9821 - loss: 0.0515 - val_accuracy: 0.9650 - val_loss: 0.1239


Epoch 132/600
14/14  0s 3ms/step - accuracy: 0.9757 - loss: 0.0580 - val_accuracy: 0.9720 - val_loss: 0.1071


Epoch 133/600
14/14  0s 4ms/step - accuracy: 0.9892 - loss: 0.0433 - val_accuracy: 0.9650 - val_loss: 0.1110


Epoch 134/600
14/14  0s 6ms/step - accuracy: 0.9848 - loss: 0.0507 - val_accuracy: 0.9650 - val_loss: 0.1096


Epoch 135/600
14/14  0s 5ms/step - accuracy: 0.9904 - loss: 0.0285 - val_accuracy: 0.9650 - val_loss: 0.1142


Epoch 136/600
14/14  0s 4ms/step - accuracy: 0.9842 - loss: 0.0479 - val_accuracy: 0.9650 - val_loss: 0.1142


Epoch 137/600
14/14  0s 5ms/step - accuracy: 0.9853 - loss: 0.0475 - val_accuracy: 0.9650 - val_loss: 0.1139


Epoch 138/600
14/14  0s 4ms/step - accuracy: 0.9847 - loss: 0.0489 - val_accuracy: 0.9650 - val_loss: 0.1116


Epoch 139/600
14/14  0s 3ms/step - accuracy: 0.9856 - loss: 0.0366 - val_accuracy: 0.9650 - val_loss: 0.1202


Epoch 140/600
14/14  0s 3ms/step - accuracy: 0.9798 - loss: 0.0609 - val_accuracy: 0.9790 - val_loss: 0.1061


Epoch 141/600
14/14  0s 3ms/step - accuracy: 0.9796 - loss: 0.0437 - val_accuracy: 0.9650 - val_loss: 0.1233


Epoch 142/600
14/14  0s 3ms/step - accuracy: 0.9869 - loss: 0.0453 - val_accuracy: 0.9720 - val_loss: 0.1074


Epoch 143/600
14/14  0s 3ms/step - accuracy: 0.9922 - loss: 0.0375 - val_accuracy: 0.9650 - val_loss: 0.1185


Epoch 144/600
14/14  0s 3ms/step - accuracy: 0.9891 - loss: 0.0334 - val_accuracy: 0.9650 - val_loss: 0.1172


Epoch 145/600
14/14  0s 3ms/step - accuracy: 0.9941 - loss: 0.0256 - val_accuracy: 0.9650 - val_loss: 0.1119


Epoch 146/600
14/14  0s 3ms/step - accuracy: 0.9926 - loss: 0.0302 - val_accuracy: 0.9650 - val_loss: 0.1173


Epoch 147/600
14/14  0s 3ms/step - accuracy: 0.9845 - loss: 0.0446 - val_accuracy: 0.9650 - val_loss: 0.1120


Epoch 148/600
14/14  0s 4ms/step - accuracy: 0.9883 - loss: 0.0395 - val_accuracy: 0.9650 - val_loss: 0.1104


Epoch 149/600
14/14  0s 4ms/step - accuracy: 0.9844 - loss: 0.0396 - val_accuracy: 0.9650 - val_loss: 0.1152


Epoch 150/600
14/14  0s 5ms/step - accuracy: 0.9756 - loss: 0.0524 - val_accuracy: 0.9650 - val_loss: 0.1103


Epoch 151/600
14/14  0s 3ms/step - accuracy: 0.9881 - loss: 0.0319 - val_accuracy: 0.9650 - val_loss: 0.1088


Epoch 152/600
14/14  0s 3ms/step - accuracy: 0.9921 - loss: 0.0329 - val_accuracy: 0.9650 - val_loss: 0.1230


Epoch 153/600
14/14  0s 3ms/step - accuracy: 0.9799 - loss: 0.0516 - val_accuracy: 0.9930 - val_loss: 0.1055




























Epoch 154/600
14/14  0s 4ms/step - accuracy: 0.9892 - loss: 0.0339 - val_accuracy: 0.9650 - val_loss: 0.1167






















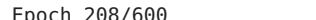


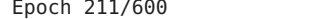
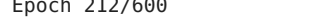
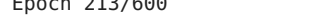

Epoch 155/600
14/14  0s 3ms/step - accuracy: 0.9829 - loss: 0.0406 - val_accuracy: 0.9720 - val_loss: 0.1072


Epoch 156/600
14/14  0s 3ms/step - accuracy: 0.9913 - loss: 0.0299 - val_accuracy: 0.9650 - val_loss: 0.1162


Epoch 157/600
14/14  0s 3ms/step - accuracy: 0.9850 - loss: 0.0437 - val_accuracy: 0.9650 - val_loss: 0.1120


Epoch 158/600
14/14  0s 4ms/step - accuracy: 0.9802 - loss: 0.0392 - val_accuracy: 0.9650 - val_loss: 0.11


23
Epoch 159/600
14/14  0s 4ms/step - accuracy: 0.9879 - loss: 0.0361 - val_accuracy: 0.9650 - val_loss: 0.11
63
Epoch 160/600
14/14  0s 3ms/step - accuracy: 0.9942 - loss: 0.0315 - val_accuracy: 0.9650 - val_loss: 0.11
19
Epoch 161/600
14/14  0s 3ms/step - accuracy: 0.9844 - loss: 0.0429 - val_accuracy: 0.9650 - val_loss: 0.11
67
Epoch 162/600
14/14  0s 6ms/step - accuracy: 0.9865 - loss: 0.0411 - val_accuracy: 0.9650 - val_loss: 0.11
64
Epoch 163/600
14/14  0s 3ms/step - accuracy: 0.9812 - loss: 0.0476 - val_accuracy: 0.9650 - val_loss: 0.11
48
Epoch 164/600
14/14  0s 4ms/step - accuracy: 0.9888 - loss: 0.0345 - val_accuracy: 0.9650 - val_loss: 0.11
73
Epoch 165/600
14/14  0s 4ms/step - accuracy: 0.9876 - loss: 0.0358 - val_accuracy: 0.9650 - val_loss: 0.11
36
Epoch 166/600
14/14  0s 3ms/step - accuracy: 0.9864 - loss: 0.0398 - val_accuracy: 0.9650 - val_loss: 0.11
76
Epoch 167/600
14/14  0s 3ms/step - accuracy: 0.9830 - loss: 0.0459 - val_accuracy: 0.9720 - val_loss: 0.11
33
Epoch 168/600
14/14  0s 3ms/step - accuracy: 0.9854 - loss: 0.0355 - val_accuracy: 0.9650 - val_loss: 0.11
93
Epoch 169/600
14/14  0s 3ms/step - accuracy: 0.9824 - loss: 0.0451 - val_accuracy: 0.9650 - val_loss: 0.12
30
Epoch 170/600
14/14  0s 3ms/step - accuracy: 0.9865 - loss: 0.0361 - val_accuracy: 0.9720 - val_loss: 0.11
10
Epoch 171/600
14/14  0s 3ms/step - accuracy: 0.9839 - loss: 0.0413 - val_accuracy: 0.9650 - val_loss: 0.11
99
Epoch 172/600
14/14  0s 3ms/step - accuracy: 0.9875 - loss: 0.0437 - val_accuracy: 0.9650 - val_loss: 0.11
60
Epoch 173/600
14/14  0s 4ms/step - accuracy: 0.9891 - loss: 0.0419 - val_accuracy: 0.9650 - val_loss: 0.11
54
Epoch 174/600
14/14  0s 3ms/step - accuracy: 0.9864 - loss: 0.0454 - val_accuracy: 0.9720 - val_loss: 0.11
43
Epoch 175/600
14/14  0s 4ms/step - accuracy: 0.9872 - loss: 0.0406 - val_accuracy: 0.9650 - val_loss: 0.11
84
Epoch 176/600
14/14  0s 3ms/step - accuracy: 0.9913 - loss: 0.0341 - val_accuracy: 0.9720 - val_loss: 0.11
51
Epoch 177/600
14/14  0s 3ms/step - accuracy: 0.9840 - loss: 0.0378 - val_accuracy: 0.9650 - val_loss: 0.12
52
Epoch 178/600
14/14  0s 5ms/step - accuracy: 0.9846 - loss: 0.0429 - val_accuracy: 0.9720 - val_loss: 0.11
47
Epoch 179/600
14/14  0s 3ms/step - accuracy: 0.9927 - loss: 0.0295 - val_accuracy: 0.9650 - val_loss: 0.12
44
Epoch 180/600
14/14  0s 3ms/step - accuracy: 0.9865 - loss: 0.0349 - val_accuracy: 0.9720 - val_loss: 0.11
81
Epoch 181/600
14/14  0s 4ms/step - accuracy: 0.9884 - loss: 0.0326 - val_accuracy: 0.9720 - val_loss: 0.11
64
Epoch 182/600
14/14  0s 4ms/step - accuracy: 0.9843 - loss: 0.0437 - val_accuracy: 0.9650 - val_loss: 0.11
77
Epoch 183/600
14/14  0s 3ms/step - accuracy: 0.9878 - loss: 0.0413 - val_accuracy: 0.9720 - val_loss: 0.11
35
Epoch 184/600
14/14  0s 3ms/step - accuracy: 0.9919 - loss: 0.0297 - val_accuracy: 0.9650 - val_loss: 0.12
02
Epoch 185/600
14/14  0s 3ms/step - accuracy: 0.9848 - loss: 0.0403 - val_accuracy: 0.9720 - val_loss: 0.11
65
Epoch 186/600


14/14  0s 4ms/step - accuracy: 0.9842 - loss: 0.0443 - val_accuracy: 0.9650 - val_loss: 0.1184
Epoch 187/600
14/14  0s 3ms/step - accuracy: 0.9875 - loss: 0.0307 - val_accuracy: 0.9720 - val_loss: 0.1130
Epoch 188/600
14/14  0s 3ms/step - accuracy: 0.9879 - loss: 0.0411 - val_accuracy: 0.9650 - val_loss: 0.1168
Epoch 189/600
14/14  0s 3ms/step - accuracy: 0.9805 - loss: 0.0462 - val_accuracy: 0.9650 - val_loss: 0.1209
Epoch 190/600
14/14  0s 3ms/step - accuracy: 0.9957 - loss: 0.0294 - val_accuracy: 0.9720 - val_loss: 0.1126
Epoch 191/600
14/14  0s 4ms/step - accuracy: 0.9911 - loss: 0.0343 - val_accuracy: 0.9650 - val_loss: 0.1217
Epoch 192/600
14/14  0s 4ms/step - accuracy: 0.9769 - loss: 0.0520 - val_accuracy: 0.9720 - val_loss: 0.1118
Epoch 193/600
14/14  0s 3ms/step - accuracy: 0.9838 - loss: 0.0398 - val_accuracy: 0.9720 - val_loss: 0.1133
Epoch 194/600
14/14  0s 3ms/step - accuracy: 0.9804 - loss: 0.0443 - val_accuracy: 0.9650 - val_loss: 0.1171
Epoch 195/600
14/14  0s 3ms/step - accuracy: 0.9895 - loss: 0.0358 - val_accuracy: 0.9650 - val_loss: 0.1199
Epoch 196/600
14/14  0s 3ms/step - accuracy: 0.9852 - loss: 0.0442 - val_accuracy: 0.9720 - val_loss: 0.1141
Epoch 197/600
14/14  0s 3ms/step - accuracy: 0.9898 - loss: 0.0356 - val_accuracy: 0.9650 - val_loss: 0.1187
Epoch 198/600
14/14  0s 3ms/step - accuracy: 0.9917 - loss: 0.0357 - val_accuracy: 0.9720 - val_loss: 0.1172
Epoch 199/600
14/14  0s 3ms/step - accuracy: 0.9879 - loss: 0.0308 - val_accuracy: 0.9720 - val_loss: 0.1180
Epoch 200/600
14/14  0s 3ms/step - accuracy: 0.9935 - loss: 0.0237 - val_accuracy: 0.9650 - val_loss: 0.1264
Epoch 201/600
14/14  0s 4ms/step - accuracy: 0.9877 - loss: 0.0352 - val_accuracy: 0.9720 - val_loss: 0.1129
Epoch 202/600
14/14  0s 3ms/step - accuracy: 0.9881 - loss: 0.0337 - val_accuracy: 0.9650 - val_loss: 0.1196
Epoch 203/600
14/14  0s 3ms/step - accuracy: 0.9896 - loss: 0.0290 - val_accuracy: 0.9790 - val_loss: 0.1122
Epoch 204/600
14/14  0s 3ms/step - accuracy: 0.9862 - loss: 0.0402 - val_accuracy: 0.9720 - val_loss: 0.1157
Epoch 205/600
14/14  0s 3ms/step - accuracy: 0.9868 - loss: 0.0346 - val_accuracy: 0.9720 - val_loss: 0.1136
Epoch 206/600
14/14  0s 4ms/step - accuracy: 0.9805 - loss: 0.0409 - val_accuracy: 0.9720 - val_loss: 0.1162
Epoch 207/600
14/14  0s 3ms/step - accuracy: 0.9867 - loss: 0.0345 - val_accuracy: 0.9650 - val_loss: 0.1198
Epoch 208/600
14/14  0s 3ms/step - accuracy: 0.9826 - loss: 0.0385 - val_accuracy: 0.9650 - val_loss: 0.1190
Epoch 209/600
14/14  0s 3ms/step - accuracy: 0.9851 - loss: 0.0292 - val_accuracy: 0.9720 - val_loss: 0.1170
Epoch 210/600
14/14  0s 3ms/step - accuracy: 0.9776 - loss: 0.0557 - val_accuracy: 0.9650 - val_loss: 0.1180
Epoch 211/600
14/14  0s 3ms/step - accuracy: 0.9880 - loss: 0.0325 - val_accuracy: 0.9720 - val_loss: 0.1129
Epoch 212/600
14/14  0s 4ms/step - accuracy: 0.9928 - loss: 0.0285 - val_accuracy: 0.9580 - val_loss: 0.1276
Epoch 213/600
14/14  0s 3ms/step - accuracy: 0.9892 - loss: 0.0340 - val_accuracy: 0.9650 - val_loss: 0.1172


Epoch 214/600
14/14  0s 3ms/step - accuracy: 0.9842 - loss: 0.0404 - val_accuracy: 0.9650 - val_loss: 0.1161


Epoch 215/600
14/14  0s 3ms/step - accuracy: 0.9866 - loss: 0.0358 - val_accuracy: 0.9650 - val_loss: 0.1225


Epoch 216/600
14/14  0s 4ms/step - accuracy: 0.9801 - loss: 0.0433 - val_accuracy: 0.9720 - val_loss: 0.1153


Epoch 217/600
14/14  0s 3ms/step - accuracy: 0.9850 - loss: 0.0459 - val_accuracy: 0.9650 - val_loss: 0.1189


Epoch 218/600
14/14  0s 3ms/step - accuracy: 0.9898 - loss: 0.0330 - val_accuracy: 0.9650 - val_loss: 0.1188


Epoch 219/600
14/14  0s 3ms/step - accuracy: 0.9927 - loss: 0.0261 - val_accuracy: 0.9650 - val_loss: 0.1187


Epoch 220/600
14/14  0s 4ms/step - accuracy: 0.9873 - loss: 0.0372 - val_accuracy: 0.9580 - val_loss: 0.1261


Epoch 221/600
14/14  0s 4ms/step - accuracy: 0.9778 - loss: 0.0390 - val_accuracy: 0.9720 - val_loss: 0.1167


Epoch 222/600
14/14  0s 3ms/step - accuracy: 0.9890 - loss: 0.0295 - val_accuracy: 0.9720 - val_loss: 0.1188


Epoch 223/600
14/14  0s 4ms/step - accuracy: 0.9855 - loss: 0.0391 - val_accuracy: 0.9720 - val_loss: 0.1166


Epoch 224/600
14/14  0s 4ms/step - accuracy: 0.9906 - loss: 0.0245 - val_accuracy: 0.9650 - val_loss: 0.1248


Epoch 225/600
14/14  0s 3ms/step - accuracy: 0.9843 - loss: 0.0355 - val_accuracy: 0.9720 - val_loss: 0.1188


Epoch 226/600
14/14  0s 3ms/step - accuracy: 0.9875 - loss: 0.0295 - val_accuracy: 0.9720 - val_loss: 0.1186


Epoch 227/600
14/14  0s 3ms/step - accuracy: 0.9894 - loss: 0.0330 - val_accuracy: 0.9720 - val_loss: 0.1184


Epoch 228/600
14/14  0s 5ms/step - accuracy: 0.9822 - loss: 0.0386 - val_accuracy: 0.9720 - val_loss: 0.1199


Epoch 229/600
14/14  0s 3ms/step - accuracy: 0.9865 - loss: 0.0368 - val_accuracy: 0.9720 - val_loss: 0.1165


Epoch 230/600
14/14  0s 3ms/step - accuracy: 0.9916 - loss: 0.0383 - val_accuracy: 0.9720 - val_loss: 0.1169


Epoch 231/600
14/14  0s 3ms/step - accuracy: 0.9791 - loss: 0.0453 - val_accuracy: 0.9720 - val_loss: 0.1161


Epoch 232/600
14/14  0s 4ms/step - accuracy: 0.9913 - loss: 0.0265 - val_accuracy: 0.9650 - val_loss: 0.1223


Epoch 233/600
14/14  0s 4ms/step - accuracy: 0.9864 - loss: 0.0363 - val_accuracy: 0.9720 - val_loss: 0.1204


Epoch 234/600
14/14  0s 3ms/step - accuracy: 0.9843 - loss: 0.0365 - val_accuracy: 0.9720 - val_loss: 0.1183


Epoch 235/600
14/14  0s 4ms/step - accuracy: 0.9856 - loss: 0.0387 - val_accuracy: 0.9650 - val_loss: 0.1191


Epoch 236/600
14/14  0s 4ms/step - accuracy: 0.9919 - loss: 0.0302 - val_accuracy: 0.9720 - val_loss: 0.1171




























Epoch 237/600
14/14  0s 3ms/step - accuracy: 0.9939 - loss: 0.0230 - val_accuracy: 0.9650 - val_loss: 0.1205


Epoch 238/600
14/14  0s 3ms/step - accuracy: 0.9885 - loss: 0.0266 - val_accuracy: 0.9720 - val_loss: 0.1212


Epoch 239/600
14/14  0s 3ms/step - accuracy: 0.9858 - loss: 0.0341 - val_accuracy: 0.9720 - val_loss: 0.1201


Epoch 240/600
14/14  0s 5ms/step - accuracy: 0.9914 - loss: 0.0254 - val_accuracy: 0.9720 - val_loss: 0.1184


Epoch 241/600
14/14  0s 4ms/step - accuracy: 0.9817 - loss: 0.0375 - val_accuracy: 0.9720 - val_loss: 0.11


98
Epoch 242/600
14/14  0s 3ms/step - accuracy: 0.9823 - loss: 0.0422 - val_accuracy: 0.9720 - val_loss: 0.11
71
Epoch 243/600
14/14  0s 3ms/step - accuracy: 0.9808 - loss: 0.0467 - val_accuracy: 0.9650 - val_loss: 0.12
27
Epoch 244/600
14/14  0s 3ms/step - accuracy: 0.9860 - loss: 0.0320 - val_accuracy: 0.9790 - val_loss: 0.11
49
Epoch 245/600
14/14  0s 3ms/step - accuracy: 0.9848 - loss: 0.0376 - val_accuracy: 0.9720 - val_loss: 0.11
76
Epoch 246/600
14/14  0s 3ms/step - accuracy: 0.9956 - loss: 0.0179 - val_accuracy: 0.9650 - val_loss: 0.12
23
Epoch 247/600
14/14  0s 4ms/step - accuracy: 0.9936 - loss: 0.0269 - val_accuracy: 0.9650 - val_loss: 0.12
39
Epoch 248/600
14/14  0s 3ms/step - accuracy: 0.9858 - loss: 0.0268 - val_accuracy: 0.9720 - val_loss: 0.12
22
Epoch 249/600
14/14  0s 3ms/step - accuracy: 0.9832 - loss: 0.0393 - val_accuracy: 0.9720 - val_loss: 0.11
79
Epoch 250/600
14/14  0s 3ms/step - accuracy: 0.9815 - loss: 0.0365 - val_accuracy: 0.9720 - val_loss: 0.11
96
Epoch 251/600
14/14  0s 5ms/step - accuracy: 0.9871 - loss: 0.0323 - val_accuracy: 0.9720 - val_loss: 0.12
04
Epoch 252/600
14/14  0s 3ms/step - accuracy: 0.9860 - loss: 0.0296 - val_accuracy: 0.9860 - val_loss: 0.11
20
Epoch 253/600
14/14  0s 3ms/step - accuracy: 0.9879 - loss: 0.0319 - val_accuracy: 0.9650 - val_loss: 0.12
29
Epoch 254/600
14/14  0s 3ms/step - accuracy: 0.9948 - loss: 0.0254 - val_accuracy: 0.9580 - val_loss: 0.12
84
Epoch 255/600
14/14  0s 3ms/step - accuracy: 0.9859 - loss: 0.0322 - val_accuracy: 0.9790 - val_loss: 0.11
53
Epoch 256/600
14/14  0s 3ms/step - accuracy: 0.9827 - loss: 0.0366 - val_accuracy: 0.9720 - val_loss: 0.11
90
Epoch 257/600
14/14  0s 3ms/step - accuracy: 0.9774 - loss: 0.0423 - val_accuracy: 0.9720 - val_loss: 0.11
87
Epoch 258/600
14/14  0s 3ms/step - accuracy: 0.9874 - loss: 0.0333 - val_accuracy: 0.9720 - val_loss: 0.11
75
Epoch 259/600
14/14  0s 3ms/step - accuracy: 0.9900 - loss: 0.0311 - val_accuracy: 0.9720 - val_loss: 0.12
08
Epoch 260/600
14/14  0s 3ms/step - accuracy: 0.9951 - loss: 0.0198 - val_accuracy: 0.9720 - val_loss: 0.11
91
Epoch 261/600
14/14  0s 3ms/step - accuracy: 0.9921 - loss: 0.0237 - val_accuracy: 0.9720 - val_loss: 0.11
59
Epoch 262/600
14/14  0s 4ms/step - accuracy: 0.9872 - loss: 0.0285 - val_accuracy: 0.9720 - val_loss: 0.11
61
Epoch 263/600
14/14  0s 3ms/step - accuracy: 0.9829 - loss: 0.0300 - val_accuracy: 0.9790 - val_loss: 0.11
30
Epoch 264/600
14/14  0s 3ms/step - accuracy: 0.9840 - loss: 0.0281 - val_accuracy: 0.9650 - val_loss: 0.12
22
Epoch 265/600
14/14  0s 3ms/step - accuracy: 0.9805 - loss: 0.0351 - val_accuracy: 0.9790 - val_loss: 0.11
37
Epoch 266/600
14/14  0s 3ms/step - accuracy: 0.9906 - loss: 0.0249 - val_accuracy: 0.9580 - val_loss: 0.12
47
Epoch 267/600
14/14  0s 4ms/step - accuracy: 0.9846 - loss: 0.0312 - val_accuracy: 0.9650 - val_loss: 0.11
93
Epoch 268/600
14/14  0s 4ms/step - accuracy: 0.9843 - loss: 0.0321 - val_accuracy: 0.9720 - val_loss: 0.11
72
Epoch 269/600


14/14  0s 4ms/step - accuracy: 0.9832 - loss: 0.0291 - val_accuracy: 0.9720 - val_loss: 0.1135
Epoch 270/600


14/14  0s 4ms/step - accuracy: 0.9887 - loss: 0.0298 - val_accuracy: 0.9580 - val_loss: 0.1218
Epoch 271/600


14/14  0s 3ms/step - accuracy: 0.9836 - loss: 0.0367 - val_accuracy: 0.9650 - val_loss: 0.1229
Epoch 272/600


14/14  0s 4ms/step - accuracy: 0.9835 - loss: 0.0329 - val_accuracy: 0.9720 - val_loss: 0.1196
Epoch 273/600


14/14  0s 4ms/step - accuracy: 0.9786 - loss: 0.0436 - val_accuracy: 0.9650 - val_loss: 0.1215
Epoch 274/600


14/14  0s 4ms/step - accuracy: 0.9856 - loss: 0.0369 - val_accuracy: 0.9720 - val_loss: 0.1202
Epoch 275/600


14/14  0s 4ms/step - accuracy: 0.9909 - loss: 0.0245 - val_accuracy: 0.9580 - val_loss: 0.1243
Epoch 276/600


14/14  0s 4ms/step - accuracy: 0.9858 - loss: 0.0319 - val_accuracy: 0.9650 - val_loss: 0.1218
Epoch 277/600


14/14  0s 4ms/step - accuracy: 0.9917 - loss: 0.0269 - val_accuracy: 0.9580 - val_loss: 0.1215
Epoch 278/600


14/14  0s 3ms/step - accuracy: 0.9926 - loss: 0.0242 - val_accuracy: 0.9510 - val_loss: 0.1285
Epoch 279/600


14/14  0s 3ms/step - accuracy: 0.9907 - loss: 0.0262 - val_accuracy: 0.9790 - val_loss: 0.1161
Epoch 280/600


14/14  0s 3ms/step - accuracy: 0.9840 - loss: 0.0384 - val_accuracy: 0.9720 - val_loss: 0.1194
Epoch 281/600


14/14  0s 5ms/step - accuracy: 0.9827 - loss: 0.0349 - val_accuracy: 0.9580 - val_loss: 0.1253
Epoch 282/600


14/14  0s 4ms/step - accuracy: 0.9873 - loss: 0.0334 - val_accuracy: 0.9580 - val_loss: 0.1210
Epoch 283/600


14/14  0s 5ms/step - accuracy: 0.9817 - loss: 0.0335 - val_accuracy: 0.9720 - val_loss: 0.1193
Epoch 284/600


14/14  0s 5ms/step - accuracy: 0.9841 - loss: 0.0347 - val_accuracy: 0.9790 - val_loss: 0.1161
Epoch 285/600


14/14  0s 4ms/step - accuracy: 0.9894 - loss: 0.0241 - val_accuracy: 0.9650 - val_loss: 0.1204
Epoch 286/600


14/14  0s 3ms/step - accuracy: 0.9902 - loss: 0.0247 - val_accuracy: 0.9790 - val_loss: 0.1138
Epoch 287/600


14/14  0s 3ms/step - accuracy: 0.9886 - loss: 0.0319 - val_accuracy: 0.9650 - val_loss: 0.1197
Epoch 288/600

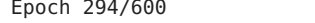
14/14  0s 3ms/step - accuracy: 0.9860 - loss: 0.0322 - val_accuracy: 0.9650 - val_loss: 0.1220
Epoch 289/600

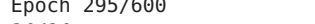
14/14  0s 4ms/step - accuracy: 0.9924 - loss: 0.0207 - val_accuracy: 0.9510 - val_loss: 0.1296
Epoch 290/600

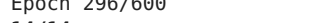
14/14  0s 4ms/step - accuracy: 0.9876 - loss: 0.0262 - val_accuracy: 0.9790 - val_loss: 0.1180
Epoch 291/600


14/14  0s 3ms/step - accuracy: 0.9903 - loss: 0.0240 - val_accuracy: 0.9580 - val_loss: 0.1243
Epoch 292/600


14/14  0s 4ms/step - accuracy: 0.9837 - loss: 0.0321 - val_accuracy: 0.9790 - val_loss: 0.1155
Epoch 293/600


14/14  0s 4ms/step - accuracy: 0.9879 - loss: 0.0304 - val_accuracy: 0.9441 - val_loss: 0.1573
Epoch 294/600


14/14  0s 7ms/step - accuracy: 0.9871 - loss: 0.0428 - val_accuracy: 0.9790 - val_loss: 0.1129
Epoch 295/600


14/14  0s 4ms/step - accuracy: 0.9834 - loss: 0.0332 - val_accuracy: 0.9720 - val_loss: 0.1205
Epoch 296/600


14/14  0s 5ms/step - accuracy: 0.9864 - loss: 0.0313 - val_accuracy: 0.9790 - val_loss: 0.1184


Epoch 297/600
14/14  0s 4ms/step - accuracy: 0.9780 - loss: 0.0387 - val_accuracy: 0.9720 - val_loss: 0.1196


Epoch 298/600
14/14  0s 3ms/step - accuracy: 0.9954 - loss: 0.0219 - val_accuracy: 0.9580 - val_loss: 0.1234


Epoch 299/600
14/14  0s 3ms/step - accuracy: 0.9910 - loss: 0.0213 - val_accuracy: 0.9580 - val_loss: 0.1246


Epoch 300/600
14/14  0s 3ms/step - accuracy: 0.9935 - loss: 0.0223 - val_accuracy: 0.9790 - val_loss: 0.1175


Epoch 301/600
14/14  0s 3ms/step - accuracy: 0.9935 - loss: 0.0205 - val_accuracy: 0.9510 - val_loss: 0.1269


Epoch 302/600
14/14  0s 3ms/step - accuracy: 0.9913 - loss: 0.0253 - val_accuracy: 0.9790 - val_loss: 0.1175


Epoch 303/600
14/14  0s 4ms/step - accuracy: 0.9937 - loss: 0.0206 - val_accuracy: 0.9790 - val_loss: 0.1186


Epoch 304/600
14/14  0s 3ms/step - accuracy: 0.9855 - loss: 0.0260 - val_accuracy: 0.9510 - val_loss: 0.1268


Epoch 305/600
14/14  0s 3ms/step - accuracy: 0.9862 - loss: 0.0255 - val_accuracy: 0.9790 - val_loss: 0.1178


Epoch 306/600
14/14  0s 5ms/step - accuracy: 0.9914 - loss: 0.0256 - val_accuracy: 0.9580 - val_loss: 0.1219


Epoch 307/600
14/14  0s 3ms/step - accuracy: 0.9858 - loss: 0.0252 - val_accuracy: 0.9580 - val_loss: 0.1243


Epoch 308/600
14/14  0s 4ms/step - accuracy: 0.9873 - loss: 0.0274 - val_accuracy: 0.9790 - val_loss: 0.1166


Epoch 309/600
14/14  0s 4ms/step - accuracy: 0.9878 - loss: 0.0275 - val_accuracy: 0.9580 - val_loss: 0.1213


Epoch 310/600
14/14  0s 5ms/step - accuracy: 0.9866 - loss: 0.0289 - val_accuracy: 0.9650 - val_loss: 0.1185


Epoch 311/600
14/14  0s 4ms/step - accuracy: 0.9961 - loss: 0.0150 - val_accuracy: 0.9510 - val_loss: 0.1274


Epoch 312/600
14/14  0s 3ms/step - accuracy: 0.9939 - loss: 0.0236 - val_accuracy: 0.9720 - val_loss: 0.1212


Epoch 313/600
14/14  0s 3ms/step - accuracy: 0.9856 - loss: 0.0248 - val_accuracy: 0.9580 - val_loss: 0.1212


Epoch 314/600
14/14  0s 4ms/step - accuracy: 0.9875 - loss: 0.0250 - val_accuracy: 0.9580 - val_loss: 0.1210


Epoch 315/600
14/14  0s 4ms/step - accuracy: 0.9910 - loss: 0.0227 - val_accuracy: 0.9510 - val_loss: 0.1240

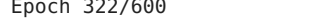
Epoch 316/600
14/14  0s 4ms/step - accuracy: 0.9917 - loss: 0.0193 - val_accuracy: 0.9650 - val_loss: 0.1215

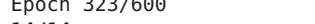
Epoch 317/600
14/14  0s 3ms/step - accuracy: 0.9882 - loss: 0.0258 - val_accuracy: 0.9510 - val_loss: 0.1237

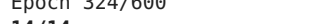
Epoch 318/600
14/14  0s 3ms/step - accuracy: 0.9896 - loss: 0.0242 - val_accuracy: 0.9510 - val_loss: 0.1257


Epoch 319/600
14/14  0s 3ms/step - accuracy: 0.9811 - loss: 0.0364 - val_accuracy: 0.9580 - val_loss: 0.1244




























Epoch 320/600
14/14  0s 3ms/step - accuracy: 0.9921 - loss: 0.0214 - val_accuracy: 0.9510 - val_loss: 0.1274





























Epoch 321/600
14/14  0s 3ms/step - accuracy: 0.9923 - loss: 0.0220 - val_accuracy: 0.9510 - val_loss: 0.1312


Epoch 322/600
14/14  0s 3ms/step - accuracy: 0.9850 - loss: 0.0285 - val_accuracy: 0.9790 - val_loss: 0.1211


Epoch 323/600
14/14  0s 3ms/step - accuracy: 0.9859 - loss: 0.0271 - val_accuracy: 0.9720 - val_loss: 0.1222


Epoch 324/600
14/14  0s 3ms/step - accuracy: 0.9877 - loss: 0.0218 - val_accuracy: 0.9510 - val_loss: 0.12


84
Epoch 325/600
14/14  0s 3ms/step - accuracy: 0.9923 - loss: 0.0203 - val_accuracy: 0.9510 - val_loss: 0.13
23
Epoch 326/600
14/14  0s 4ms/step - accuracy: 0.9877 - loss: 0.0238 - val_accuracy: 0.9720 - val_loss: 0.12
35
Epoch 327/600
14/14  0s 4ms/step - accuracy: 0.9892 - loss: 0.0220 - val_accuracy: 0.9720 - val_loss: 0.12
34
Epoch 328/600
14/14  0s 3ms/step - accuracy: 0.9862 - loss: 0.0241 - val_accuracy: 0.9510 - val_loss: 0.14
08
Epoch 329/600
14/14  0s 3ms/step - accuracy: 0.9931 - loss: 0.0250 - val_accuracy: 0.9790 - val_loss: 0.11
58
Epoch 330/600
14/14  0s 3ms/step - accuracy: 0.9895 - loss: 0.0347 - val_accuracy: 0.9510 - val_loss: 0.13
89
Epoch 331/600
14/14  0s 3ms/step - accuracy: 0.9809 - loss: 0.0356 - val_accuracy: 0.9510 - val_loss: 0.12
96
Epoch 332/600
14/14  0s 4ms/step - accuracy: 0.9849 - loss: 0.0270 - val_accuracy: 0.9790 - val_loss: 0.12
43
Epoch 333/600
14/14  0s 3ms/step - accuracy: 0.9747 - loss: 0.0342 - val_accuracy: 0.9790 - val_loss: 0.11
99
Epoch 334/600
14/14  0s 3ms/step - accuracy: 0.9803 - loss: 0.0318 - val_accuracy: 0.9720 - val_loss: 0.11
97
Epoch 335/600
14/14  0s 3ms/step - accuracy: 0.9820 - loss: 0.0287 - val_accuracy: 0.9720 - val_loss: 0.12
79
Epoch 336/600
14/14  0s 3ms/step - accuracy: 0.9867 - loss: 0.0251 - val_accuracy: 0.9790 - val_loss: 0.12
13
Epoch 337/600
14/14  0s 5ms/step - accuracy: 0.9884 - loss: 0.0266 - val_accuracy: 0.9510 - val_loss: 0.13
36
Epoch 338/600
14/14  0s 3ms/step - accuracy: 0.9929 - loss: 0.0217 - val_accuracy: 0.9790 - val_loss: 0.12
14
Epoch 339/600
14/14  0s 3ms/step - accuracy: 0.9895 - loss: 0.0276 - val_accuracy: 0.9510 - val_loss: 0.13
59
Epoch 340/600
14/14  0s 3ms/step - accuracy: 0.9872 - loss: 0.0249 - val_accuracy: 0.9510 - val_loss: 0.13
55
Epoch 341/600
14/14  0s 3ms/step - accuracy: 0.9890 - loss: 0.0220 - val_accuracy: 0.9790 - val_loss: 0.12
17
Epoch 342/600
14/14  0s 3ms/step - accuracy: 0.9864 - loss: 0.0208 - val_accuracy: 0.9580 - val_loss: 0.13
16
Epoch 343/600
14/14  0s 3ms/step - accuracy: 0.9879 - loss: 0.0214 - val_accuracy: 0.9650 - val_loss: 0.12
87
Epoch 344/600
14/14  0s 4ms/step - accuracy: 0.9791 - loss: 0.0307 - val_accuracy: 0.9650 - val_loss: 0.12
66
Epoch 345/600
14/14  0s 4ms/step - accuracy: 0.9872 - loss: 0.0244 - val_accuracy: 0.9790 - val_loss: 0.12
15
Epoch 346/600
14/14  0s 4ms/step - accuracy: 0.9939 - loss: 0.0177 - val_accuracy: 0.9650 - val_loss: 0.12
74
Epoch 347/600
14/14  0s 4ms/step - accuracy: 0.9848 - loss: 0.0265 - val_accuracy: 0.9580 - val_loss: 0.12
98
Epoch 348/600
14/14  0s 4ms/step - accuracy: 0.9841 - loss: 0.0253 - val_accuracy: 0.9720 - val_loss: 0.12
73
Epoch 349/600
14/14  0s 3ms/step - accuracy: 0.9845 - loss: 0.0292 - val_accuracy: 0.9720 - val_loss: 0.12
95
Epoch 350/600
14/14  0s 3ms/step - accuracy: 0.9938 - loss: 0.0150 - val_accuracy: 0.9580 - val_loss: 0.13
02
Epoch 351/600
14/14  0s 3ms/step - accuracy: 0.9920 - loss: 0.0171 - val_accuracy: 0.9580 - val_loss: 0.13
05
Epoch 352/600


14/14  0s 3ms/step - accuracy: 0.9953 - loss: 0.0217 - val_accuracy: 0.9790 - val_loss: 0.12
36
Epoch 353/600
14/14  0s 3ms/step - accuracy: 0.9872 - loss: 0.0248 - val_accuracy: 0.9580 - val_loss: 0.13
03
Epoch 354/600
14/14  0s 3ms/step - accuracy: 0.9841 - loss: 0.0225 - val_accuracy: 0.9790 - val_loss: 0.12
27
Epoch 355/600
14/14  0s 3ms/step - accuracy: 0.9927 - loss: 0.0203 - val_accuracy: 0.9510 - val_loss: 0.13
38
Epoch 356/600
14/14  0s 3ms/step - accuracy: 0.9876 - loss: 0.0238 - val_accuracy: 0.9720 - val_loss: 0.12
68
Epoch 357/600
14/14  0s 3ms/step - accuracy: 0.9818 - loss: 0.0255 - val_accuracy: 0.9790 - val_loss: 0.12
88
Epoch 358/600
14/14  0s 3ms/step - accuracy: 0.9908 - loss: 0.0204 - val_accuracy: 0.9580 - val_loss: 0.13
18
Epoch 359/600
14/14  0s 3ms/step - accuracy: 0.9962 - loss: 0.0221 - val_accuracy: 0.9650 - val_loss: 0.12
84
Epoch 360/600
14/14  0s 3ms/step - accuracy: 0.9909 - loss: 0.0253 - val_accuracy: 0.9580 - val_loss: 0.14
00
Epoch 361/600
14/14  0s 3ms/step - accuracy: 0.9915 - loss: 0.0318 - val_accuracy: 0.9580 - val_loss: 0.13
30
Epoch 362/600
14/14  0s 3ms/step - accuracy: 0.9917 - loss: 0.0215 - val_accuracy: 0.9790 - val_loss: 0.12
43
Epoch 363/600
14/14  0s 7ms/step - accuracy: 0.9851 - loss: 0.0243 - val_accuracy: 0.9580 - val_loss: 0.14
09
Epoch 364/600
14/14  0s 3ms/step - accuracy: 0.9960 - loss: 0.0174 - val_accuracy: 0.9580 - val_loss: 0.13
50
Epoch 365/600
14/14  0s 3ms/step - accuracy: 0.9969 - loss: 0.0162 - val_accuracy: 0.9720 - val_loss: 0.13
00
Epoch 366/600
14/14  0s 3ms/step - accuracy: 0.9899 - loss: 0.0241 - val_accuracy: 0.9510 - val_loss: 0.14
04
Epoch 367/600
14/14  0s 3ms/step - accuracy: 0.9955 - loss: 0.0145 - val_accuracy: 0.9720 - val_loss: 0.12
51
Epoch 368/600
14/14  0s 3ms/step - accuracy: 0.9888 - loss: 0.0201 - val_accuracy: 0.9580 - val_loss: 0.13
65
Epoch 369/600
14/14  0s 3ms/step - accuracy: 0.9950 - loss: 0.0173 - val_accuracy: 0.9580 - val_loss: 0.13
20
Epoch 370/600
14/14  0s 3ms/step - accuracy: 0.9974 - loss: 0.0129 - val_accuracy: 0.9580 - val_loss: 0.13
98
Epoch 371/600
14/14  0s 3ms/step - accuracy: 0.9944 - loss: 0.0203 - val_accuracy: 0.9650 - val_loss: 0.13
03
Epoch 372/600
14/14  0s 4ms/step - accuracy: 0.9919 - loss: 0.0230 - val_accuracy: 0.9720 - val_loss: 0.12
55
Epoch 373/600
14/14  0s 5ms/step - accuracy: 0.9894 - loss: 0.0203 - val_accuracy: 0.9790 - val_loss: 0.12
92
Epoch 374/600
14/14  0s 4ms/step - accuracy: 0.9886 - loss: 0.0197 - val_accuracy: 0.9510 - val_loss: 0.15
31
Epoch 375/600
14/14  0s 3ms/step - accuracy: 0.9923 - loss: 0.0227 - val_accuracy: 0.9860 - val_loss: 0.12
16
Epoch 376/600
14/14  0s 3ms/step - accuracy: 0.9899 - loss: 0.0256 - val_accuracy: 0.9580 - val_loss: 0.14
24
Epoch 377/600
14/14  0s 3ms/step - accuracy: 0.9885 - loss: 0.0315 - val_accuracy: 0.9790 - val_loss: 0.12
48
Epoch 378/600
14/14  0s 3ms/step - accuracy: 0.9891 - loss: 0.0262 - val_accuracy: 0.9580 - val_loss: 0.14
30
Epoch 379/600
14/14  0s 3ms/step - accuracy: 0.9877 - loss: 0.0270 - val_accuracy: 0.9790 - val_loss: 0.12
54


Epoch 380/600
14/14  0s 4ms/step - accuracy: 0.9926 - loss: 0.0204 - val_accuracy: 0.9510 - val_loss: 0.1481


Epoch 381/600
14/14  0s 4ms/step - accuracy: 0.9974 - loss: 0.0156 - val_accuracy: 0.9720 - val_loss: 0.1236


Epoch 382/600
14/14  0s 3ms/step - accuracy: 0.9935 - loss: 0.0192 - val_accuracy: 0.9580 - val_loss: 0.1437


Epoch 383/600
14/14  0s 3ms/step - accuracy: 0.9889 - loss: 0.0200 - val_accuracy: 0.9580 - val_loss: 0.1363


Epoch 384/600
14/14  0s 3ms/step - accuracy: 0.9916 - loss: 0.0198 - val_accuracy: 0.9580 - val_loss: 0.1342


Epoch 385/600
14/14  0s 3ms/step - accuracy: 0.9985 - loss: 0.0159 - val_accuracy: 0.9720 - val_loss: 0.1284


Epoch 386/600
14/14  0s 3ms/step - accuracy: 0.9941 - loss: 0.0137 - val_accuracy: 0.9580 - val_loss: 0.1394


Epoch 387/600
14/14  0s 4ms/step - accuracy: 0.9888 - loss: 0.0256 - val_accuracy: 0.9580 - val_loss: 0.1341


Epoch 388/600
14/14  0s 3ms/step - accuracy: 0.9841 - loss: 0.0242 - val_accuracy: 0.9650 - val_loss: 0.1345


Epoch 389/600
14/14  0s 3ms/step - accuracy: 0.9867 - loss: 0.0206 - val_accuracy: 0.9580 - val_loss: 0.1379


Epoch 390/600
14/14  0s 3ms/step - accuracy: 0.9966 - loss: 0.0167 - val_accuracy: 0.9720 - val_loss: 0.1330


Epoch 391/600
14/14  0s 3ms/step - accuracy: 0.9901 - loss: 0.0171 - val_accuracy: 0.9580 - val_loss: 0.1363


Epoch 392/600
14/14  0s 3ms/step - accuracy: 0.9853 - loss: 0.0275 - val_accuracy: 0.9720 - val_loss: 0.1316


Epoch 393/600
14/14  0s 3ms/step - accuracy: 0.9905 - loss: 0.0177 - val_accuracy: 0.9650 - val_loss: 0.1372


Epoch 394/600
14/14  0s 3ms/step - accuracy: 0.9950 - loss: 0.0164 - val_accuracy: 0.9580 - val_loss: 0.1442


Epoch 395/600
14/14  0s 3ms/step - accuracy: 0.9987 - loss: 0.0129 - val_accuracy: 0.9720 - val_loss: 0.1338


Epoch 396/600
14/14  0s 3ms/step - accuracy: 0.9853 - loss: 0.0256 - val_accuracy: 0.9650 - val_loss: 0.1380


Epoch 397/600
14/14  0s 3ms/step - accuracy: 0.9976 - loss: 0.0151 - val_accuracy: 0.9650 - val_loss: 0.1384


Epoch 398/600
14/14  0s 3ms/step - accuracy: 0.9944 - loss: 0.0193 - val_accuracy: 0.9650 - val_loss: 0.1391


Epoch 399/600
14/14  0s 3ms/step - accuracy: 0.9923 - loss: 0.0215 - val_accuracy: 0.9580 - val_loss: 0.1429


Epoch 400/600
14/14  0s 5ms/step - accuracy: 0.9902 - loss: 0.0205 - val_accuracy: 0.9580 - val_loss: 0.1527


Epoch 401/600
14/14  0s 3ms/step - accuracy: 0.9932 - loss: 0.0176 - val_accuracy: 0.9720 - val_loss: 0.1347


Epoch 402/600
14/14  0s 3ms/step - accuracy: 0.9856 - loss: 0.0227 - val_accuracy: 0.9720 - val_loss: 0.1355




























Epoch 403/600
14/14  0s 3ms/step - accuracy: 0.9941 - loss: 0.0174 - val_accuracy: 0.9580 - val_loss: 0.1506





























Epoch 404/600
14/14  0s 3ms/step - accuracy: 0.9914 - loss: 0.0224 - val_accuracy: 0.9720 - val_loss: 0.1407


Epoch 405/600
14/14  0s 3ms/step - accuracy: 0.9951 - loss: 0.0250 - val_accuracy: 0.9720 - val_loss: 0.1357


Epoch 406/600
14/14  0s 3ms/step - accuracy: 0.9924 - loss: 0.0235 - val_accuracy: 0.9650 - val_loss: 0.1450


Epoch 407/600
14/14  0s 3ms/step - accuracy: 0.9905 - loss: 0.0191 - val_accuracy: 0.9650 - val_loss: 0.14


71
Epoch 408/600
14/14  0s 3ms/step - accuracy: 0.9961 - loss: 0.0160 - val_accuracy: 0.9650 - val_loss: 0.14
48
Epoch 409/600
14/14  0s 3ms/step - accuracy: 0.9957 - loss: 0.0197 - val_accuracy: 0.9720 - val_loss: 0.13
82
Epoch 410/600
14/14  0s 3ms/step - accuracy: 0.9912 - loss: 0.0184 - val_accuracy: 0.9580 - val_loss: 0.15
09
Epoch 411/600
14/14  0s 3ms/step - accuracy: 0.9959 - loss: 0.0182 - val_accuracy: 0.9650 - val_loss: 0.14
48
Epoch 412/600
14/14  0s 3ms/step - accuracy: 0.9978 - loss: 0.0151 - val_accuracy: 0.9720 - val_loss: 0.13
68
Epoch 413/600
14/14  0s 3ms/step - accuracy: 0.9966 - loss: 0.0184 - val_accuracy: 0.9580 - val_loss: 0.14
73
Epoch 414/600
14/14  0s 3ms/step - accuracy: 0.9982 - loss: 0.0187 - val_accuracy: 0.9790 - val_loss: 0.13
92
Epoch 415/600
14/14  0s 4ms/step - accuracy: 0.9975 - loss: 0.0134 - val_accuracy: 0.9580 - val_loss: 0.15
23
Epoch 416/600
14/14  0s 4ms/step - accuracy: 0.9928 - loss: 0.0230 - val_accuracy: 0.9790 - val_loss: 0.13
42
Epoch 417/600
14/14  0s 6ms/step - accuracy: 0.9933 - loss: 0.0179 - val_accuracy: 0.9580 - val_loss: 0.14
95
Epoch 418/600
14/14  0s 6ms/step - accuracy: 0.9925 - loss: 0.0259 - val_accuracy: 0.9720 - val_loss: 0.13
30
Epoch 419/600
14/14  0s 6ms/step - accuracy: 0.9950 - loss: 0.0149 - val_accuracy: 0.9580 - val_loss: 0.15
50
Epoch 420/600
14/14  0s 6ms/step - accuracy: 0.9903 - loss: 0.0221 - val_accuracy: 0.9790 - val_loss: 0.13
61
Epoch 421/600
14/14  0s 6ms/step - accuracy: 0.9865 - loss: 0.0211 - val_accuracy: 0.9650 - val_loss: 0.14
68
Epoch 422/600
14/14  0s 5ms/step - accuracy: 0.9979 - loss: 0.0136 - val_accuracy: 0.9650 - val_loss: 0.14
28
Epoch 423/600
14/14  0s 4ms/step - accuracy: 0.9936 - loss: 0.0205 - val_accuracy: 0.9580 - val_loss: 0.15
26
Epoch 424/600
14/14  0s 4ms/step - accuracy: 0.9962 - loss: 0.0205 - val_accuracy: 0.9650 - val_loss: 0.14
27
Epoch 425/600
14/14  0s 3ms/step - accuracy: 0.9968 - loss: 0.0155 - val_accuracy: 0.9580 - val_loss: 0.15
09
Epoch 426/600
14/14  0s 4ms/step - accuracy: 0.9978 - loss: 0.0165 - val_accuracy: 0.9650 - val_loss: 0.14
30
Epoch 427/600
14/14  0s 5ms/step - accuracy: 0.9982 - loss: 0.0220 - val_accuracy: 0.9650 - val_loss: 0.14
79
Epoch 428/600
14/14  0s 5ms/step - accuracy: 0.9960 - loss: 0.0113 - val_accuracy: 0.9650 - val_loss: 0.14
62
Epoch 429/600
14/14  0s 4ms/step - accuracy: 0.9969 - loss: 0.0187 - val_accuracy: 0.9650 - val_loss: 0.15
11
Epoch 430/600
14/14  0s 4ms/step - accuracy: 1.0000 - loss: 0.0144 - val_accuracy: 0.9650 - val_loss: 0.14
32
Epoch 431/600
14/14  0s 3ms/step - accuracy: 0.9990 - loss: 0.0100 - val_accuracy: 0.9650 - val_loss: 0.14
76
Epoch 432/600
14/14  0s 4ms/step - accuracy: 0.9990 - loss: 0.0158 - val_accuracy: 0.9580 - val_loss: 0.16
34
Epoch 433/600
14/14  0s 4ms/step - accuracy: 0.9970 - loss: 0.0167 - val_accuracy: 0.9650 - val_loss: 0.14
35
Epoch 434/600
14/14  0s 4ms/step - accuracy: 0.9995 - loss: 0.0081 - val_accuracy: 0.9650 - val_loss: 0.14
92
Epoch 435/600


14/14  0s 5ms/step - accuracy: 0.9985 - loss: 0.0104 - val_accuracy: 0.9650 - val_loss: 0.14
84
Epoch 436/600
14/14  0s 5ms/step - accuracy: 0.9965 - loss: 0.0166 - val_accuracy: 0.9650 - val_loss: 0.15
04
Epoch 437/600
14/14  0s 4ms/step - accuracy: 0.9979 - loss: 0.0108 - val_accuracy: 0.9650 - val_loss: 0.14
86
Epoch 438/600
14/14  0s 6ms/step - accuracy: 0.9968 - loss: 0.0215 - val_accuracy: 0.9790 - val_loss: 0.13
67
Epoch 439/600
14/14  0s 4ms/step - accuracy: 0.9832 - loss: 0.0287 - val_accuracy: 0.9301 - val_loss: 0.21
38
Epoch 440/600
14/14  0s 5ms/step - accuracy: 0.9905 - loss: 0.0281 - val_accuracy: 0.9790 - val_loss: 0.14
41
Epoch 441/600
14/14  0s 5ms/step - accuracy: 0.9934 - loss: 0.0138 - val_accuracy: 0.9580 - val_loss: 0.16
76
Epoch 442/600
14/14  0s 6ms/step - accuracy: 0.9962 - loss: 0.0170 - val_accuracy: 0.9650 - val_loss: 0.15
80
Epoch 443/600
14/14  0s 8ms/step - accuracy: 0.9997 - loss: 0.0134 - val_accuracy: 0.9650 - val_loss: 0.15
09
Epoch 444/600
14/14  0s 5ms/step - accuracy: 0.9952 - loss: 0.0179 - val_accuracy: 0.9650 - val_loss: 0.14
77
Epoch 445/600
14/14  0s 4ms/step - accuracy: 0.9980 - loss: 0.0087 - val_accuracy: 0.9580 - val_loss: 0.15
24
Epoch 446/600
14/14  0s 3ms/step - accuracy: 0.9962 - loss: 0.0168 - val_accuracy: 0.9650 - val_loss: 0.15
49
Epoch 447/600
14/14  0s 4ms/step - accuracy: 0.9945 - loss: 0.0148 - val_accuracy: 0.9650 - val_loss: 0.15
11
Epoch 448/600
14/14  0s 3ms/step - accuracy: 0.9916 - loss: 0.0223 - val_accuracy: 0.9441 - val_loss: 0.18
32
Epoch 449/600
14/14  0s 4ms/step - accuracy: 0.9948 - loss: 0.0148 - val_accuracy: 0.9650 - val_loss: 0.14
85
Epoch 450/600
14/14  0s 5ms/step - accuracy: 0.9965 - loss: 0.0178 - val_accuracy: 0.9650 - val_loss: 0.15
12
Epoch 451/600
14/14  0s 6ms/step - accuracy: 0.9978 - loss: 0.0115 - val_accuracy: 0.9650 - val_loss: 0.15
13
Epoch 452/600
14/14  0s 4ms/step - accuracy: 0.9931 - loss: 0.0176 - val_accuracy: 0.9650 - val_loss: 0.15
36
Epoch 453/600
14/14  0s 3ms/step - accuracy: 0.9994 - loss: 0.0130 - val_accuracy: 0.9650 - val_loss: 0.15
63
Epoch 454/600
14/14  0s 3ms/step - accuracy: 0.9969 - loss: 0.0148 - val_accuracy: 0.9650 - val_loss: 0.15
58
Epoch 455/600
14/14  0s 3ms/step - accuracy: 0.9982 - loss: 0.0147 - val_accuracy: 0.9580 - val_loss: 0.15
78
Epoch 456/600
14/14  0s 3ms/step - accuracy: 0.9978 - loss: 0.0135 - val_accuracy: 0.9580 - val_loss: 0.16
32
Epoch 457/600
14/14  0s 3ms/step - accuracy: 0.9969 - loss: 0.0161 - val_accuracy: 0.9720 - val_loss: 0.14
90
Epoch 458/600
14/14  0s 4ms/step - accuracy: 0.9968 - loss: 0.0112 - val_accuracy: 0.9650 - val_loss: 0.15
19
Epoch 459/600
14/14  0s 4ms/step - accuracy: 0.9956 - loss: 0.0117 - val_accuracy: 0.9580 - val_loss: 0.16
39
Epoch 460/600
14/14  0s 8ms/step - accuracy: 1.0000 - loss: 0.0131 - val_accuracy: 0.9650 - val_loss: 0.15
87
Epoch 461/600
14/14  0s 4ms/step - accuracy: 0.9995 - loss: 0.0122 - val_accuracy: 0.9650 - val_loss: 0.14
89
Epoch 462/600
14/14  0s 4ms/step - accuracy: 0.9990 - loss: 0.0149 - val_accuracy: 0.9580 - val_loss: 0.15
91


Epoch 463/600
14/14  0s 3ms/step - accuracy: 0.9974 - loss: 0.0122 - val_accuracy: 0.9650 - val_loss: 0.1527


Epoch 464/600
14/14  0s 4ms/step - accuracy: 0.9974 - loss: 0.0116 - val_accuracy: 0.9650 - val_loss: 0.1619


Epoch 465/600
14/14  0s 4ms/step - accuracy: 0.9995 - loss: 0.0099 - val_accuracy: 0.9650 - val_loss: 0.1592


Epoch 466/600
14/14  0s 3ms/step - accuracy: 0.9995 - loss: 0.0094 - val_accuracy: 0.9650 - val_loss: 0.1550


Epoch 467/600
14/14  0s 4ms/step - accuracy: 1.0000 - loss: 0.0134 - val_accuracy: 0.9650 - val_loss: 0.1542


Epoch 468/600
14/14  0s 3ms/step - accuracy: 0.9992 - loss: 0.0120 - val_accuracy: 0.9580 - val_loss: 0.1663


Epoch 469/600
14/14  0s 3ms/step - accuracy: 0.9995 - loss: 0.0143 - val_accuracy: 0.9650 - val_loss: 0.1643


Epoch 470/600
14/14  0s 3ms/step - accuracy: 0.9969 - loss: 0.0136 - val_accuracy: 0.9650 - val_loss: 0.1581


Epoch 471/600
14/14  0s 6ms/step - accuracy: 0.9931 - loss: 0.0182 - val_accuracy: 0.9650 - val_loss: 0.1631


Epoch 472/600
14/14  0s 3ms/step - accuracy: 0.9990 - loss: 0.0087 - val_accuracy: 0.9650 - val_loss: 0.1631


Epoch 473/600
14/14  0s 3ms/step - accuracy: 0.9966 - loss: 0.0115 - val_accuracy: 0.9650 - val_loss: 0.1626


Epoch 474/600
14/14  0s 3ms/step - accuracy: 0.9915 - loss: 0.0178 - val_accuracy: 0.9580 - val_loss: 0.1726


Epoch 475/600
14/14  0s 3ms/step - accuracy: 0.9990 - loss: 0.0139 - val_accuracy: 0.9720 - val_loss: 0.1510


Epoch 476/600
14/14  0s 3ms/step - accuracy: 0.9985 - loss: 0.0078 - val_accuracy: 0.9580 - val_loss: 0.1780


Epoch 477/600
14/14  0s 4ms/step - accuracy: 1.0000 - loss: 0.0131 - val_accuracy: 0.9720 - val_loss: 0.1518


Epoch 478/600
14/14  0s 4ms/step - accuracy: 0.9925 - loss: 0.0177 - val_accuracy: 0.9650 - val_loss: 0.1661


Epoch 479/600
14/14  0s 4ms/step - accuracy: 0.9972 - loss: 0.0137 - val_accuracy: 0.9650 - val_loss: 0.1594


Epoch 480/600
14/14  0s 4ms/step - accuracy: 1.0000 - loss: 0.0129 - val_accuracy: 0.9650 - val_loss: 0.1612


Epoch 481/600
14/14  0s 3ms/step - accuracy: 0.9969 - loss: 0.0149 - val_accuracy: 0.9650 - val_loss: 0.1627


Epoch 482/600
14/14  0s 4ms/step - accuracy: 1.0000 - loss: 0.0138 - val_accuracy: 0.9650 - val_loss: 0.1628


Epoch 483/600
14/14  0s 3ms/step - accuracy: 0.9982 - loss: 0.0105 - val_accuracy: 0.9790 - val_loss: 0.1524


Epoch 484/600
14/14  0s 3ms/step - accuracy: 1.0000 - loss: 0.0150 - val_accuracy: 0.9580 - val_loss: 0.1679


Epoch 485/600
14/14  0s 3ms/step - accuracy: 0.9951 - loss: 0.0168 - val_accuracy: 0.9650 - val_loss: 0.1571




























Epoch 486/600
14/14  0s 3ms/step - accuracy: 1.0000 - loss: 0.0095 - val_accuracy: 0.9650 - val_loss: 0.1684

Epoch 487/600
14/14  0s 3ms/step - accuracy: 1.0000 - loss: 0.0125 - val_accuracy: 0.9650 - val_loss: 0.1585


Epoch 488/600
14/14  0s 4ms/step - accuracy: 0.9962 - loss: 0.0150 - val_accuracy: 0.9650 - val_loss: 0.1676


Epoch 489/600
14/14  0s 3ms/step - accuracy: 1.0000 - loss: 0.0116 - val_accuracy: 0.9650 - val_loss: 0.1591


Epoch 490/600
14/14  0s 3ms/step - accuracy: 0.9931 - loss: 0.0145 - val_accuracy: 0.9650 - val_loss: 0.16


34
Epoch 491/600
14/14  0s 4ms/step - accuracy: 1.0000 - loss: 0.0093 - val_accuracy: 0.9650 - val_loss: 0.16
77
Epoch 492/600
14/14  0s 4ms/step - accuracy: 1.0000 - loss: 0.0127 - val_accuracy: 0.9650 - val_loss: 0.16
56
Epoch 493/600
14/14  0s 4ms/step - accuracy: 1.0000 - loss: 0.0119 - val_accuracy: 0.9650 - val_loss: 0.17
60
Epoch 494/600
14/14  0s 4ms/step - accuracy: 0.9982 - loss: 0.0117 - val_accuracy: 0.9790 - val_loss: 0.15
84
Epoch 495/600
14/14  0s 3ms/step - accuracy: 0.9962 - loss: 0.0186 - val_accuracy: 0.9650 - val_loss: 0.18
20
Epoch 496/600
14/14  0s 3ms/step - accuracy: 1.0000 - loss: 0.0119 - val_accuracy: 0.9650 - val_loss: 0.18
08
Epoch 497/600
14/14  0s 3ms/step - accuracy: 1.0000 - loss: 0.0103 - val_accuracy: 0.9650 - val_loss: 0.16
83
Epoch 498/600
14/14  0s 3ms/step - accuracy: 1.0000 - loss: 0.0118 - val_accuracy: 0.9650 - val_loss: 0.17
11
Epoch 499/600
14/14  0s 3ms/step - accuracy: 1.0000 - loss: 0.0139 - val_accuracy: 0.9650 - val_loss: 0.17
20
Epoch 500/600
14/14  0s 4ms/step - accuracy: 1.0000 - loss: 0.0132 - val_accuracy: 0.9650 - val_loss: 0.16
91
Epoch 501/600
14/14  0s 3ms/step - accuracy: 0.9994 - loss: 0.0120 - val_accuracy: 0.9650 - val_loss: 0.16
74
Epoch 502/600
14/14  0s 3ms/step - accuracy: 1.0000 - loss: 0.0077 - val_accuracy: 0.9580 - val_loss: 0.18
23
Epoch 503/600
14/14  0s 5ms/step - accuracy: 1.0000 - loss: 0.0120 - val_accuracy: 0.9650 - val_loss: 0.17
24
Epoch 504/600
14/14  0s 3ms/step - accuracy: 0.9987 - loss: 0.0068 - val_accuracy: 0.9580 - val_loss: 0.18
69
Epoch 505/600
14/14  0s 4ms/step - accuracy: 0.9969 - loss: 0.0132 - val_accuracy: 0.9650 - val_loss: 0.16
96
Epoch 506/600
14/14  0s 4ms/step - accuracy: 0.9969 - loss: 0.0077 - val_accuracy: 0.9650 - val_loss: 0.17
41
Epoch 507/600
14/14  0s 3ms/step - accuracy: 0.9994 - loss: 0.0081 - val_accuracy: 0.9650 - val_loss: 0.17
41
Epoch 508/600
14/14  0s 3ms/step - accuracy: 1.0000 - loss: 0.0114 - val_accuracy: 0.9650 - val_loss: 0.16
85
Epoch 509/600
14/14  0s 3ms/step - accuracy: 0.9990 - loss: 0.0088 - val_accuracy: 0.9650 - val_loss: 0.17
74
Epoch 510/600
14/14  0s 3ms/step - accuracy: 0.9969 - loss: 0.0129 - val_accuracy: 0.9650 - val_loss: 0.17
26
Epoch 511/600
14/14  0s 3ms/step - accuracy: 1.0000 - loss: 0.0101 - val_accuracy: 0.9650 - val_loss: 0.17
38
Epoch 512/600
14/14  0s 3ms/step - accuracy: 0.9950 - loss: 0.0114 - val_accuracy: 0.9580 - val_loss: 0.19
43
Epoch 513/600
14/14  0s 6ms/step - accuracy: 0.9961 - loss: 0.0140 - val_accuracy: 0.9720 - val_loss: 0.16
55
Epoch 514/600
14/14  0s 3ms/step - accuracy: 0.9919 - loss: 0.0162 - val_accuracy: 0.9371 - val_loss: 0.21
79
Epoch 515/600
14/14  0s 3ms/step - accuracy: 0.9951 - loss: 0.0143 - val_accuracy: 0.9790 - val_loss: 0.16
42
Epoch 516/600
14/14  0s 3ms/step - accuracy: 0.9974 - loss: 0.0118 - val_accuracy: 0.9580 - val_loss: 0.18
65
Epoch 517/600
14/14  0s 4ms/step - accuracy: 1.0000 - loss: 0.0101 - val_accuracy: 0.9720 - val_loss: 0.16
20
Epoch 518/600


14/14 ————— 0s 3ms/step - accuracy: 0.9963 - loss: 0.0090 - val_accuracy: 0.9580 - val_loss: 0.19
17
Epoch 519/600
14/14 ————— 0s 4ms/step - accuracy: 1.0000 - loss: 0.0139 - val_accuracy: 0.9650 - val_loss: 0.17
42
Epoch 520/600
14/14 ————— 0s 4ms/step - accuracy: 0.9987 - loss: 0.0108 - val_accuracy: 0.9790 - val_loss: 0.16
82
Epoch 521/600
14/14 ————— 0s 5ms/step - accuracy: 0.9978 - loss: 0.0126 - val_accuracy: 0.9650 - val_loss: 0.18
61
Epoch 522/600
14/14 ————— 0s 5ms/step - accuracy: 1.0000 - loss: 0.0103 - val_accuracy: 0.9650 - val_loss: 0.17
15
Epoch 523/600
14/14 ————— 0s 7ms/step - accuracy: 1.0000 - loss: 0.0074 - val_accuracy: 0.9580 - val_loss: 0.19
03
Epoch 524/600
14/14 ————— 0s 5ms/step - accuracy: 1.0000 - loss: 0.0105 - val_accuracy: 0.9650 - val_loss: 0.17
95
Epoch 525/600
14/14 ————— 0s 4ms/step - accuracy: 1.0000 - loss: 0.0092 - val_accuracy: 0.9650 - val_loss: 0.18
11
Epoch 526/600
14/14 ————— 0s 4ms/step - accuracy: 1.0000 - loss: 0.0052 - val_accuracy: 0.9650 - val_loss: 0.18
07
Epoch 527/600
14/14 ————— 0s 4ms/step - accuracy: 1.0000 - loss: 0.0123 - val_accuracy: 0.9580 - val_loss: 0.18
08
Epoch 528/600
14/14 ————— 0s 5ms/step - accuracy: 0.9990 - loss: 0.0061 - val_accuracy: 0.9580 - val_loss: 0.20
44
Epoch 529/600
14/14 ————— 0s 5ms/step - accuracy: 0.9962 - loss: 0.0137 - val_accuracy: 0.9650 - val_loss: 0.17
79
Epoch 530/600
14/14 ————— 0s 7ms/step - accuracy: 1.0000 - loss: 0.0098 - val_accuracy: 0.9650 - val_loss: 0.18
09
Epoch 531/600
14/14 ————— 0s 7ms/step - accuracy: 1.0000 - loss: 0.0079 - val_accuracy: 0.9510 - val_loss: 0.20
99
Epoch 532/600
14/14 ————— 0s 6ms/step - accuracy: 0.9949 - loss: 0.0141 - val_accuracy: 0.9650 - val_loss: 0.18
25
Epoch 533/600
14/14 ————— 0s 5ms/step - accuracy: 1.0000 - loss: 0.0095 - val_accuracy: 0.9580 - val_loss: 0.17
76
Epoch 534/600
14/14 ————— 0s 6ms/step - accuracy: 1.0000 - loss: 0.0080 - val_accuracy: 0.9650 - val_loss: 0.18
04
Epoch 535/600
14/14 ————— 0s 5ms/step - accuracy: 1.0000 - loss: 0.0109 - val_accuracy: 0.9650 - val_loss: 0.17
94
Epoch 536/600
14/14 ————— 0s 6ms/step - accuracy: 1.0000 - loss: 0.0079 - val_accuracy: 0.9650 - val_loss: 0.18
83
Epoch 537/600
14/14 ————— 0s 5ms/step - accuracy: 1.0000 - loss: 0.0093 - val_accuracy: 0.9580 - val_loss: 0.18
13
Epoch 538/600
14/14 ————— 0s 5ms/step - accuracy: 0.9978 - loss: 0.0108 - val_accuracy: 0.9650 - val_loss: 0.19
37
Epoch 539/600
14/14 ————— 0s 5ms/step - accuracy: 1.0000 - loss: 0.0073 - val_accuracy: 0.9580 - val_loss: 0.18
19
Epoch 540/600
14/14 ————— 0s 5ms/step - accuracy: 0.9931 - loss: 0.0121 - val_accuracy: 0.9650 - val_loss: 0.19
34
Epoch 541/600
14/14 ————— 0s 5ms/step - accuracy: 1.0000 - loss: 0.0088 - val_accuracy: 0.9580 - val_loss: 0.18
07
Epoch 542/600
14/14 ————— 0s 6ms/step - accuracy: 1.0000 - loss: 0.0083 - val_accuracy: 0.9580 - val_loss: 0.20
44
Epoch 543/600
14/14 ————— 0s 4ms/step - accuracy: 1.0000 - loss: 0.0058 - val_accuracy: 0.9580 - val_loss: 0.19
10
Epoch 544/600
14/14 ————— 0s 5ms/step - accuracy: 0.9990 - loss: 0.0055 - val_accuracy: 0.9650 - val_loss: 0.17
60
Epoch 545/600
14/14 ————— 0s 4ms/step - accuracy: 0.9978 - loss: 0.0096 - val_accuracy: 0.9650 - val_loss: 0.19
28


Epoch 546/600
14/14  0s 5ms/step - accuracy: 1.0000 - loss: 0.0094 - val_accuracy: 0.9650 - val_loss: 0.1989


Epoch 547/600
14/14  0s 7ms/step - accuracy: 1.0000 - loss: 0.0111 - val_accuracy: 0.9580 - val_loss: 0.1859


Epoch 548/600
14/14  0s 6ms/step - accuracy: 1.0000 - loss: 0.0069 - val_accuracy: 0.9650 - val_loss: 0.1898


Epoch 549/600
14/14  0s 7ms/step - accuracy: 1.0000 - loss: 0.0074 - val_accuracy: 0.9580 - val_loss: 0.1882


Epoch 550/600
14/14  0s 12ms/step - accuracy: 1.0000 - loss: 0.0094 - val_accuracy: 0.9650 - val_loss: 0.1952


Epoch 551/600
14/14  0s 5ms/step - accuracy: 1.0000 - loss: 0.0111 - val_accuracy: 0.9580 - val_loss: 0.1947


Epoch 552/600
14/14  0s 4ms/step - accuracy: 0.9983 - loss: 0.0077 - val_accuracy: 0.9720 - val_loss: 0.1913


Epoch 553/600
14/14  0s 4ms/step - accuracy: 0.9952 - loss: 0.0097 - val_accuracy: 0.9510 - val_loss: 0.2183


Epoch 554/600
14/14  0s 3ms/step - accuracy: 1.0000 - loss: 0.0141 - val_accuracy: 0.9650 - val_loss: 0.1853


Epoch 555/600
14/14  0s 3ms/step - accuracy: 1.0000 - loss: 0.0073 - val_accuracy: 0.9580 - val_loss: 0.2060


Epoch 556/600
14/14  0s 4ms/step - accuracy: 1.0000 - loss: 0.0068 - val_accuracy: 0.9580 - val_loss: 0.1951


Epoch 557/600
14/14  0s 3ms/step - accuracy: 1.0000 - loss: 0.0078 - val_accuracy: 0.9580 - val_loss: 0.1921


Epoch 558/600
14/14  0s 3ms/step - accuracy: 0.9987 - loss: 0.0077 - val_accuracy: 0.9580 - val_loss: 0.2140


Epoch 559/600
14/14  0s 4ms/step - accuracy: 0.9982 - loss: 0.0094 - val_accuracy: 0.9580 - val_loss: 0.1971


Epoch 560/600
14/14  0s 4ms/step - accuracy: 1.0000 - loss: 0.0074 - val_accuracy: 0.9580 - val_loss: 0.1987


Epoch 561/600
14/14  0s 4ms/step - accuracy: 1.0000 - loss: 0.0066 - val_accuracy: 0.9580 - val_loss: 0.2002


Epoch 562/600
14/14  0s 4ms/step - accuracy: 0.9992 - loss: 0.0074 - val_accuracy: 0.9580 - val_loss: 0.2049


Epoch 563/600
14/14  0s 6ms/step - accuracy: 1.0000 - loss: 0.0070 - val_accuracy: 0.9580 - val_loss: 0.1987


Epoch 564/600
14/14  0s 4ms/step - accuracy: 0.9994 - loss: 0.0053 - val_accuracy: 0.9580 - val_loss: 0.1968


Epoch 565/600
14/14  0s 4ms/step - accuracy: 0.9990 - loss: 0.0118 - val_accuracy: 0.9510 - val_loss: 0.2314


Epoch 566/600
14/14  0s 4ms/step - accuracy: 0.9951 - loss: 0.0126 - val_accuracy: 0.9650 - val_loss: 0.2013


Epoch 567/600
14/14  0s 4ms/step - accuracy: 0.9951 - loss: 0.0097 - val_accuracy: 0.9580 - val_loss: 0.2258


Epoch 568/600
14/14  0s 4ms/step - accuracy: 0.9994 - loss: 0.0109 - val_accuracy: 0.9580 - val_loss: 0.2172




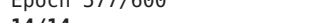
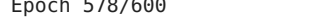
















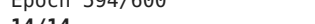
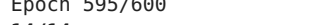




Epoch 569/600
14/14  0s 3ms/step - accuracy: 0.9974 - loss: 0.0117 - val_accuracy: 0.9790 - val_loss: 0.1977

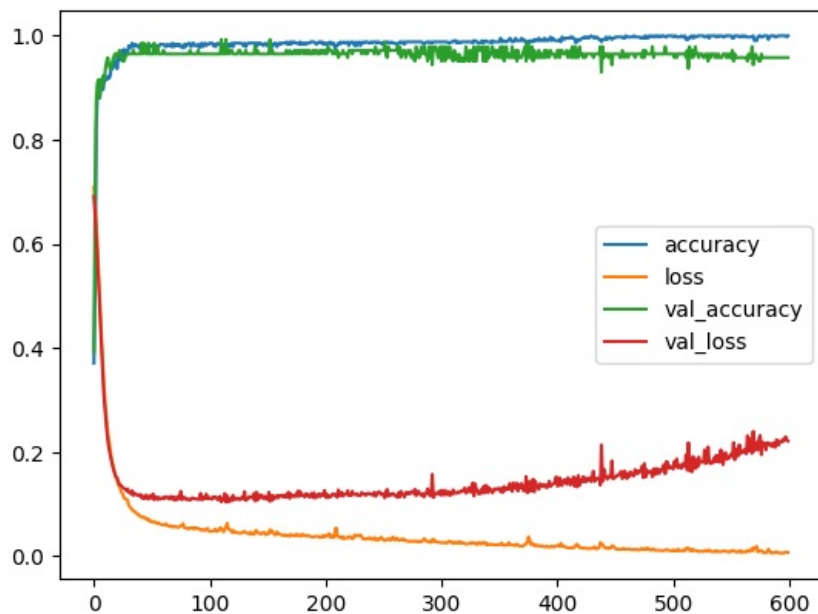
Epoch 570/600
14/14  0s 4ms/step - accuracy: 1.0000 - loss: 0.0085 - val_accuracy: 0.9441 - val_loss: 0.2398

Epoch 571/600
14/14  0s 4ms/step - accuracy: 0.9921 - loss: 0.0145 - val_accuracy: 0.9580 - val_loss: 0.2023

Epoch 572/600
14/14  0s 5ms/step - accuracy: 0.9937 - loss: 0.0143 - val_accuracy: 0.9650 - val_loss: 0.2151

Epoch 573/600
14/14  0s 4ms/step - accuracy: 0.9873 - loss: 0.0215 - val_accuracy: 0.9580 - val_loss: 0.21

91
Epoch 574/600
14/14  0s 4ms/step - accuracy: 0.9978 - loss: 0.0104 - val_accuracy: 0.9580 - val_loss: 0.2038
Epoch 575/600
14/14  0s 4ms/step - accuracy: 1.0000 - loss: 0.0093 - val_accuracy: 0.9510 - val_loss: 0.2260
Epoch 576/600
14/14  0s 4ms/step - accuracy: 1.0000 - loss: 0.0108 - val_accuracy: 0.9510 - val_loss: 0.2320
Epoch 577/600
14/14  0s 3ms/step - accuracy: 0.9985 - loss: 0.0088 - val_accuracy: 0.9650 - val_loss: 0.1950
Epoch 578/600
14/14  0s 3ms/step - accuracy: 0.9969 - loss: 0.0083 - val_accuracy: 0.9580 - val_loss: 0.2187
Epoch 579/600
14/14  0s 4ms/step - accuracy: 1.0000 - loss: 0.0063 - val_accuracy: 0.9580 - val_loss: 0.2156
Epoch 580/600
14/14  0s 5ms/step - accuracy: 1.0000 - loss: 0.0059 - val_accuracy: 0.9580 - val_loss: 0.2167
Epoch 581/600
14/14  0s 4ms/step - accuracy: 1.0000 - loss: 0.0088 - val_accuracy: 0.9580 - val_loss: 0.2041
Epoch 582/600
14/14  0s 4ms/step - accuracy: 1.0000 - loss: 0.0066 - val_accuracy: 0.9580 - val_loss: 0.2178
Epoch 583/600
14/14  0s 4ms/step - accuracy: 0.9975 - loss: 0.0073 - val_accuracy: 0.9580 - val_loss: 0.2178
Epoch 584/600
14/14  0s 5ms/step - accuracy: 0.9974 - loss: 0.0126 - val_accuracy: 0.9580 - val_loss: 0.2146
Epoch 585/600
14/14  0s 4ms/step - accuracy: 1.0000 - loss: 0.0054 - val_accuracy: 0.9580 - val_loss: 0.2153
Epoch 586/600
14/14  0s 5ms/step - accuracy: 1.0000 - loss: 0.0073 - val_accuracy: 0.9580 - val_loss: 0.2102
Epoch 587/600
14/14  0s 6ms/step - accuracy: 1.0000 - loss: 0.0081 - val_accuracy: 0.9580 - val_loss: 0.2175
Epoch 588/600
14/14  0s 11ms/step - accuracy: 1.0000 - loss: 0.0049 - val_accuracy: 0.9580 - val_loss: 0.2152
Epoch 589/600
14/14  0s 6ms/step - accuracy: 0.9987 - loss: 0.0062 - val_accuracy: 0.9580 - val_loss: 0.2091
Epoch 590/600
14/14  0s 7ms/step - accuracy: 0.9978 - loss: 0.0061 - val_accuracy: 0.9580 - val_loss: 0.2239
Epoch 591/600
14/14  0s 7ms/step - accuracy: 1.0000 - loss: 0.0080 - val_accuracy: 0.9580 - val_loss: 0.2220
Epoch 592/600
14/14  0s 6ms/step - accuracy: 1.0000 - loss: 0.0067 - val_accuracy: 0.9580 - val_loss: 0.2133
Epoch 593/600
14/14  0s 5ms/step - accuracy: 1.0000 - loss: 0.0105 - val_accuracy: 0.9580 - val_loss: 0.2216
Epoch 594/600
14/14  0s 4ms/step - accuracy: 1.0000 - loss: 0.0078 - val_accuracy: 0.9580 - val_loss: 0.2204
Epoch 595/600
14/14  0s 4ms/step - accuracy: 1.0000 - loss: 0.0054 - val_accuracy: 0.9580 - val_loss: 0.2198
Epoch 596/600
14/14  0s 4ms/step - accuracy: 1.0000 - loss: 0.0052 - val_accuracy: 0.9580 - val_loss: 0.2252
Epoch 597/600
14/14  0s 4ms/step - accuracy: 1.0000 - loss: 0.0064 - val_accuracy: 0.9580 - val_loss: 0.2219
Epoch 598/600
14/14  0s 3ms/step - accuracy: 1.0000 - loss: 0.0060 - val_accuracy: 0.9580 - val_loss: 0.2294
Epoch 599/600
14/14  0s 4ms/step - accuracy: 0.9978 - loss: 0.0065 - val_accuracy: 0.9580 - val_loss: 0.2238
Epoch 600/600
14/14  0s 5ms/step - accuracy: 1.0000 - loss: 0.0047 - val_accuracy: 0.9580 - val_loss: 0.2211



```
In [ ]: # Early Stopping
early_stop = EarlyStopping(
    monitor='val_loss', mode='min', verbose=1, patience=25)
model.fit(x=X_train, y=y_train, epochs=600, validation_data=(
    X_test, y_test), callbacks=[early_stop], verbose=1)
model_loss = pd.DataFrame(model.history.history)
model_loss.plot()
plt.xlabel('Epochs')
plt.ylabel('Loss')
plt.show()
```

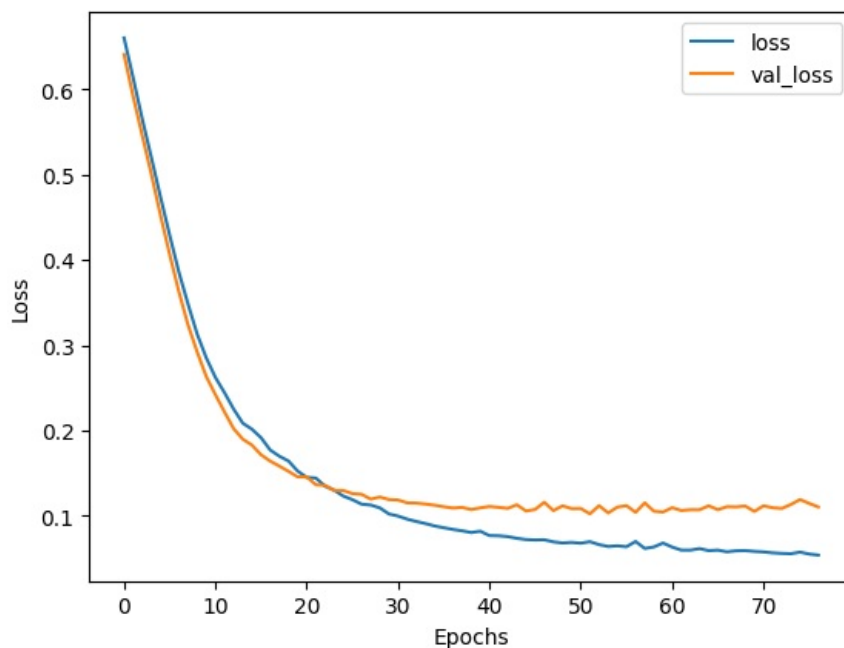
Epoch 1/600
14/14 ————— 3s 51ms/step - loss: 0.6708 - val_loss: 0.6407
Epoch 2/600
14/14 ————— 0s 12ms/step - loss: 0.6177 - val_loss: 0.5912
Epoch 3/600
14/14 ————— 0s 12ms/step - loss: 0.5778 - val_loss: 0.5454
Epoch 4/600
14/14 ————— 0s 13ms/step - loss: 0.5323 - val_loss: 0.4998
Epoch 5/600
14/14 ————— 0s 13ms/step - loss: 0.4802 - val_loss: 0.4518
Epoch 6/600
14/14 ————— 0s 8ms/step - loss: 0.4237 - val_loss: 0.4060
Epoch 7/600
14/14 ————— 0s 5ms/step - loss: 0.4111 - val_loss: 0.3628
Epoch 8/600
14/14 ————— 0s 3ms/step - loss: 0.3476 - val_loss: 0.3239
Epoch 9/600
14/14 ————— 0s 4ms/step - loss: 0.3148 - val_loss: 0.2922
Epoch 10/600
14/14 ————— 0s 3ms/step - loss: 0.3020 - val_loss: 0.2632
Epoch 11/600
14/14 ————— 0s 4ms/step - loss: 0.2732 - val_loss: 0.2420
Epoch 12/600
14/14 ————— 0s 4ms/step - loss: 0.2440 - val_loss: 0.2217
Epoch 13/600
14/14 ————— 0s 16ms/step - loss: 0.2332 - val_loss: 0.2021
Epoch 14/600
14/14 ————— 0s 10ms/step - loss: 0.2336 - val_loss: 0.1898
Epoch 15/600
14/14 ————— 0s 10ms/step - loss: 0.1998 - val_loss: 0.1830
Epoch 16/600
14/14 ————— 0s 10ms/step - loss: 0.1991 - val_loss: 0.1715
Epoch 17/600
14/14 ————— 0s 9ms/step - loss: 0.1679 - val_loss: 0.1641
Epoch 18/600
14/14 ————— 0s 10ms/step - loss: 0.1530 - val_loss: 0.1583
Epoch 19/600
14/14 ————— 0s 10ms/step - loss: 0.1700 - val_loss: 0.1521
Epoch 20/600
14/14 ————— 0s 9ms/step - loss: 0.1757 - val_loss: 0.1457
Epoch 21/600
14/14 ————— 0s 11ms/step - loss: 0.1299 - val_loss: 0.1456
Epoch 22/600
14/14 ————— 0s 12ms/step - loss: 0.1551 - val_loss: 0.1365
Epoch 23/600

14/14 — 0s 16ms/step - loss: 0.1493 - val_loss: 0.1358
Epoch 24/600
14/14 — 0s 12ms/step - loss: 0.1191 - val_loss: 0.1298
Epoch 25/600
14/14 — 0s 5ms/step - loss: 0.1128 - val_loss: 0.1297
Epoch 26/600
14/14 — 0s 12ms/step - loss: 0.1237 - val_loss: 0.1261
Epoch 27/600
14/14 — 0s 10ms/step - loss: 0.1109 - val_loss: 0.1252
Epoch 28/600
14/14 — 0s 11ms/step - loss: 0.1173 - val_loss: 0.1197
Epoch 29/600
14/14 — 0s 9ms/step - loss: 0.1120 - val_loss: 0.1220
Epoch 30/600
14/14 — 0s 9ms/step - loss: 0.1137 - val_loss: 0.1191
Epoch 31/600
14/14 — 0s 9ms/step - loss: 0.1051 - val_loss: 0.1186
Epoch 32/600
14/14 — 0s 7ms/step - loss: 0.0882 - val_loss: 0.1153
Epoch 33/600
14/14 — 0s 10ms/step - loss: 0.1004 - val_loss: 0.1150
Epoch 34/600
14/14 — 0s 9ms/step - loss: 0.1026 - val_loss: 0.1138
Epoch 35/600
14/14 — 0s 10ms/step - loss: 0.0777 - val_loss: 0.1125
Epoch 36/600
14/14 — 0s 9ms/step - loss: 0.0844 - val_loss: 0.1107
Epoch 37/600
14/14 — 0s 10ms/step - loss: 0.0835 - val_loss: 0.1092
Epoch 38/600
14/14 — 0s 6ms/step - loss: 0.0789 - val_loss: 0.1099
Epoch 39/600
14/14 — 0s 5ms/step - loss: 0.0876 - val_loss: 0.1074
Epoch 40/600
14/14 — 0s 10ms/step - loss: 0.0745 - val_loss: 0.1094
Epoch 41/600
14/14 — 0s 10ms/step - loss: 0.0697 - val_loss: 0.1110
Epoch 42/600
14/14 — 0s 11ms/step - loss: 0.0626 - val_loss: 0.1100
Epoch 43/600
14/14 — 0s 12ms/step - loss: 0.0611 - val_loss: 0.1088
Epoch 44/600
14/14 — 0s 9ms/step - loss: 0.0857 - val_loss: 0.1130
Epoch 45/600
14/14 — 0s 8ms/step - loss: 0.0696 - val_loss: 0.1057
Epoch 46/600
14/14 — 0s 9ms/step - loss: 0.0719 - val_loss: 0.1075
Epoch 47/600
14/14 — 0s 13ms/step - loss: 0.0603 - val_loss: 0.1159
Epoch 48/600
14/14 — 0s 12ms/step - loss: 0.0582 - val_loss: 0.1062
Epoch 49/600
14/14 — 0s 9ms/step - loss: 0.0749 - val_loss: 0.1118
Epoch 50/600
14/14 — 0s 8ms/step - loss: 0.0638 - val_loss: 0.1085
Epoch 51/600
14/14 — 0s 8ms/step - loss: 0.0669 - val_loss: 0.1086
Epoch 52/600
14/14 — 0s 6ms/step - loss: 0.0684 - val_loss: 0.1024
Epoch 53/600
14/14 — 0s 10ms/step - loss: 0.0664 - val_loss: 0.1120
Epoch 54/600
14/14 — 0s 10ms/step - loss: 0.0557 - val_loss: 0.1034
Epoch 55/600
14/14 — 0s 11ms/step - loss: 0.0578 - val_loss: 0.1102
Epoch 56/600
14/14 — 0s 9ms/step - loss: 0.0613 - val_loss: 0.1120
Epoch 57/600
14/14 — 0s 10ms/step - loss: 0.0625 - val_loss: 0.1042
Epoch 58/600
14/14 — 0s 9ms/step - loss: 0.0671 - val_loss: 0.1152
Epoch 59/600
14/14 — 0s 14ms/step - loss: 0.0608 - val_loss: 0.1055
Epoch 60/600
14/14 — 0s 12ms/step - loss: 0.0674 - val_loss: 0.1045
Epoch 61/600
14/14 — 0s 12ms/step - loss: 0.0524 - val_loss: 0.1096
Epoch 62/600
14/14 — 0s 10ms/step - loss: 0.0437 - val_loss: 0.1063
Epoch 63/600
14/14 — 0s 9ms/step - loss: 0.0545 - val_loss: 0.1072
Epoch 64/600
14/14 — 0s 8ms/step - loss: 0.0445 - val_loss: 0.1072


```

Epoch 65/600
14/14 ————— 0s 5ms/step - loss: 0.0480 - val_loss: 0.1118
Epoch 66/600
14/14 ————— 0s 5ms/step - loss: 0.0495 - val_loss: 0.1073
Epoch 67/600
14/14 ————— 0s 5ms/step - loss: 0.0465 - val_loss: 0.1107
Epoch 68/600
14/14 ————— 0s 6ms/step - loss: 0.0516 - val_loss: 0.1105
Epoch 69/600
14/14 ————— 0s 4ms/step - loss: 0.0516 - val_loss: 0.1115
Epoch 70/600
14/14 ————— 0s 3ms/step - loss: 0.0808 - val_loss: 0.1053
Epoch 71/600
14/14 ————— 0s 3ms/step - loss: 0.0822 - val_loss: 0.1118
Epoch 72/600
14/14 ————— 0s 4ms/step - loss: 0.0530 - val_loss: 0.1095
Epoch 73/600
14/14 ————— 0s 4ms/step - loss: 0.0527 - val_loss: 0.1087
Epoch 74/600
14/14 ————— 0s 4ms/step - loss: 0.0650 - val_loss: 0.1133
Epoch 75/600
14/14 ————— 0s 4ms/step - loss: 0.0503 - val_loss: 0.1191
Epoch 76/600
14/14 ————— 0s 4ms/step - loss: 0.0512 - val_loss: 0.1146
Epoch 77/600
14/14 ————— 0s 4ms/step - loss: 0.0573 - val_loss: 0.1104
Epoch 77: early stopping

```



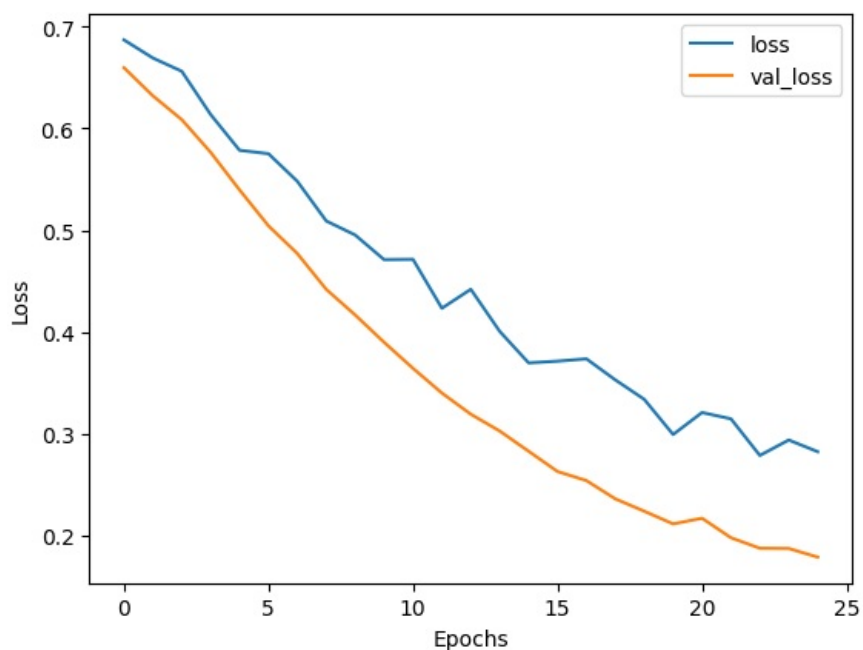
```

In [ ]: # Adding in DropOut Layers
# Resetting the model
model = Sequential([
    Dense(units=30, activation='relu'),
    Dropout(0.5),
    Dense(units=15, activation='relu'),
    Dropout(0.5),
    Dense(units=1, activation='sigmoid')
])
model.compile(loss='binary_crossentropy', optimizer='adam')

# Training with Dropout layers
model.fit(x=X_train, y=y_train, epochs=600, validation_data=(
    X_test, y_test), callbacks=[early_stop], verbose=1)
model_loss = pd.DataFrame(model.history.history)
model_loss.plot()
plt.xlabel('Epochs')
plt.ylabel('Loss')
plt.show()

```


Epoch 1/600
14/14 ————— 2s 11ms/step - loss: 0.6901 - val_loss: 0.6594
Epoch 2/600
14/14 ————— 0s 3ms/step - loss: 0.6685 - val_loss: 0.6319
Epoch 3/600
14/14 ————— 0s 4ms/step - loss: 0.6607 - val_loss: 0.6085
Epoch 4/600
14/14 ————— 0s 3ms/step - loss: 0.6163 - val_loss: 0.5764
Epoch 5/600
14/14 ————— 0s 3ms/step - loss: 0.5886 - val_loss: 0.5395
Epoch 6/600
14/14 ————— 0s 4ms/step - loss: 0.5830 - val_loss: 0.5042
Epoch 7/600
14/14 ————— 0s 3ms/step - loss: 0.5545 - val_loss: 0.4770
Epoch 8/600
14/14 ————— 0s 4ms/step - loss: 0.5122 - val_loss: 0.4419
Epoch 9/600
14/14 ————— 0s 3ms/step - loss: 0.4922 - val_loss: 0.4167
Epoch 10/600
14/14 ————— 0s 3ms/step - loss: 0.4831 - val_loss: 0.3899
Epoch 11/600
14/14 ————— 0s 3ms/step - loss: 0.4709 - val_loss: 0.3644
Epoch 12/600
14/14 ————— 0s 3ms/step - loss: 0.4227 - val_loss: 0.3401
Epoch 13/600
14/14 ————— 0s 3ms/step - loss: 0.4342 - val_loss: 0.3193
Epoch 14/600
14/14 ————— 0s 3ms/step - loss: 0.4118 - val_loss: 0.3028
Epoch 15/600
14/14 ————— 0s 3ms/step - loss: 0.3903 - val_loss: 0.2830
Epoch 16/600
14/14 ————— 0s 3ms/step - loss: 0.3738 - val_loss: 0.2631
Epoch 17/600
14/14 ————— 0s 4ms/step - loss: 0.3880 - val_loss: 0.2542
Epoch 18/600
14/14 ————— 0s 4ms/step - loss: 0.3598 - val_loss: 0.2362
Epoch 19/600
14/14 ————— 0s 3ms/step - loss: 0.3263 - val_loss: 0.2241
Epoch 20/600
14/14 ————— 0s 3ms/step - loss: 0.2939 - val_loss: 0.2116
Epoch 21/600
14/14 ————— 0s 4ms/step - loss: 0.3107 - val_loss: 0.2172
Epoch 22/600
14/14 ————— 0s 4ms/step - loss: 0.3118 - val_loss: 0.1981
Epoch 23/600
14/14 ————— 0s 3ms/step - loss: 0.2791 - val_loss: 0.1878
Epoch 24/600
14/14 ————— 0s 6ms/step - loss: 0.3027 - val_loss: 0.1875
Epoch 25/600
14/14 ————— 0s 3ms/step - loss: 0.3069 - val_loss: 0.1790
Epoch 25: early stopping



```
In [ ]: # Model Evaluation using the `predict` method
        predictions = model.predict(X_test)

        # Convert probabilities to class labels
        predictions = (predictions > 0.5).astype(int)
```

```
# Now you can use classification_report and confusion_matrix as before
print(classification_report(y_test, predictions))
print(confusion_matrix(y_test, predictions))
```

```
5/5  0s 11ms/step
```

	precision	recall	f1-score	support
0	0.87	0.96	0.91	55
1	0.98	0.91	0.94	88
accuracy			0.93	143
macro avg	0.92	0.94	0.93	143
weighted avg	0.93	0.93	0.93	143

```
[[53  2]
 [ 8 80]]
```

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