In [2]:
```
!pip install tensorflow
```

```
Requirement already satisfied: tensorflow in c:\users\mano\anaconda3\lib\site
-packages (2.17.0)
Requirement already satisfied: tensorflow-intel==2.17.0 in c:\users\mano\anac
onda3\lib\site-packages (from tensorflow) (2.17.0)
Requirement already satisfied: absl-py>=1.0.0 in c:\users\mano\anaconda3\lib
\site-packages (from tensorflow-intel==2.17.0->tensorflow) (2.1.0)
Requirement already satisfied: astunparse>=1.6.0 in c:\users\mano\anaconda3\l
ib\site-packages (from tensorflow-intel==2.17.0->tensorflow) (1.6.3)
Requirement already satisfied: flatbuffers>=24.3.25 in c:\users\mano\anaconda
3\lib\site-packages (from tensorflow-intel==2.17.0->tensorflow) (24.3.25)
Requirement already satisfied: gast!=0.5.0,!=0.5.1,!=0.5.2,>=0.2.1 in c:\user
s\mano\anaconda3\lib\site-packages (from tensorflow-intel==2.17.0->tensorflo
w) (0.6.0)
Requirement already satisfied: google-pasta>=0.1.1 in c:\users\mano\anaconda3
\lib\site-packages (from tensorflow-intel==2.17.0->tensorflow) (0.2.0)
Requirement already satisfied: h5py>=3.10.0 in c:\users\mano\anaconda3\lib\si
te-packages (from tensorflow-intel==2.17.0->tensorflow) (3.11.0)
Requirement already satisfied: libclang>=13.0.0 in c:\users\mano\anaconda3\li
b\site-packages (from tensorflow-intel==2.17.0->tensorflow) (18.1.1)
Requirement already satisfied: ml-dtypes<0.5.0,>=0.3.1 in c:\users\mano\anaco
nda3\lib\site-packages (from tensorflow-intel==2.17.0->tensorflow) (0.4.1)
Requirement already satisfied: opt-einsum>=2.3.2 in c:\users\mano\anaconda3\l
ib\site-packages (from tensorflow-intel==2.17.0->tensorflow) (3.3.0)
Requirement already satisfied: packaging in c:\users\mano\anaconda3\lib\site-
packages (from tensorflow-intel==2.17.0->tensorflow) (23.0)
Requirement already satisfied: protobuf!=4.21.0,!=4.21.1,!=4.21.2,!=4.21.3,!=
4.21.4,!=4.21.5,<5.0.0dev,>=3.20.3 in c:\users\mano\anaconda3\lib\site-packag
es (from tensorflow-intel==2.17.0->tensorflow) (4.25.5)
Requirement already satisfied: requests<3,>=2.21.0 in c:\users\mano\anaconda3
\lib\site-packages (from tensorflow-intel==2.17.0->tensorflow) (2.29.0)
Requirement already satisfied: setuptools in c:\users\mano\anaconda3\lib\site
-packages (from tensorflow-intel==2.17.0->tensorflow) (67.8.0)
Requirement already satisfied: six>=1.12.0 in c:\users\mano\anaconda3\lib\sit
e-packages (from tensorflow-intel==2.17.0->tensorflow) (1.16.0)
Requirement already satisfied: termcolor>=1.1.0 in c:\users\mano\anaconda3\li
b\site-packages (from tensorflow-intel==2.17.0->tensorflow) (2.4.0)
Requirement already satisfied: typing-extensions>=3.6.6 in c:\users\mano\anac
onda3\lib\site-packages (from tensorflow-intel==2.17.0->tensorflow) (4.6.3)
Requirement already satisfied: wrapt>=1.11.0 in c:\users\mano\anaconda3\lib\s
ite-packages (from tensorflow-intel==2.17.0->tensorflow) (1.14.1)
Requirement already satisfied: grpcio<2.0,>=1.24.3 in c:\users\mano\anaconda3
\lib\site-packages (from tensorflow-intel==2.17.0->tensorflow) (1.66.1)
Requirement already satisfied: tensorboard<2.18,>=2.17 in c:\users\mano\anaco
nda3\lib\site-packages (from tensorflow-intel==2.17.0->tensorflow) (2.17.1)
Requirement already satisfied: keras>=3.2.0 in c:\users\mano\anaconda3\lib\si
te-packages (from tensorflow-intel==2.17.0->tensorflow) (3.5.0)
Requirement already satisfied: tensorflow-io-gcs-filesystem>=0.23.1 in c:\use
rs\mano\anaconda3\lib\site-packages (from tensorflow-intel==2.17.0->tensorflo
w) (0.31.0)
Requirement already satisfied: numpy<2.0.0,>=1.23.5 in c:\users\mano\anaconda
3\lib\site-packages (from tensorflow-intel==2.17.0->tensorflow) (1.24.3)
Requirement already satisfied: wheel<1.0,>=0.23.0 in c:\users\mano\anaconda3
\lib\site-packages (from astunparse>=1.6.0->tensorflow-intel==2.17.0->tensorf
low) (0.38.4)
Requirement already satisfied: rich in c:\users\mano\anaconda3\lib\site-packa
ges (from keras>=3.2.0->tensorflow-intel==2.17.0->tensorflow) (13.8.1)
Requirement already satisfied: namex in c:\users\mano\anaconda3\lib\site-pack
```

```
ages (from keras>=3.2.0->tensorflow-intel==2.17.0->tensorflow) (0.0.8)
Requirement already satisfied: optree in c:\users\mano\anaconda3\lib\site-pac
kages (from keras>=3.2.0->tensorflow-intel==2.17.0->tensorflow) (0.12.1)
Requirement already satisfied: charset-normalizer<4,>=2 in c:\users\mano\anac
onda3\lib\site-packages (from requests<3,>=2.21.0->tensorflow-intel==2.17.0->
tensorflow) (2.0.4)
Requirement already satisfied: idna<4,>=2.5 in c:\users\mano\anaconda3\lib\si
te-packages (from requests<3,>=2.21.0->tensorflow-intel==2.17.0->tensorflow)
(3.4)
Requirement already satisfied: urllib3<1.27,>=1.21.1 in c:\users\mano\anacond
a3\lib\site-packages (from requests<3,>=2.21.0->tensorflow-intel==2.17.0->ten
sorflow) (1.26.16)
Requirement already satisfied: certifi>=2017.4.17 in c:\users\mano\anaconda3
\lib\site-packages (from requests<3,>=2.21.0->tensorflow-intel==2.17.0->tenso
rflow) (2023.5.7)
Requirement already satisfied: markdown>=2.6.8 in c:\users\mano\anaconda3\lib
\site-packages (from tensorboard<2.18,>=2.17->tensorflow-intel==2.17.0->tenso
rflow) (3.4.1)
Requirement already satisfied: tensorboard-data-server<0.8.0,>=0.7.0 in c:\us
ers\mano\anaconda3\lib\site-packages (from tensorboard<2.18,>=2.17->tensorflo
w-intel==2.17.0->tensorflow) (0.7.2)
Requirement already satisfied: werkzeug>=1.0.1 in c:\users\mano\anaconda3\lib
\site-packages (from tensorboard<2.18,>=2.17->tensorflow-intel==2.17.0->tenso
rflow) (2.2.3)
Requirement already satisfied: MarkupSafe>=2.1.1 in c:\users\mano\anaconda3\l
ib\site-packages (from werkzeug>=1.0.1->tensorboard<2.18,>=2.17->tensorflow-i
ntel==2.17.0->tensorflow) (2.1.1)
Requirement already satisfied: markdown-it-py>=2.2.0 in c:\users\mano\anacond
a3\lib\site-packages (from rich->keras>=3.2.0->tensorflow-intel==2.17.0->tens
orflow) (2.2.0)
Requirement already satisfied: pygments<3.0.0,>=2.13.0 in c:\users\mano\anaco
nda3\lib\site-packages (from rich->keras>=3.2.0->tensorflow-intel==2.17.0->te
nsorflow) (2.15.1)
Requirement already satisfied: mdurl~=0.1 in c:\users\mano\anaconda3\lib\site
-packages (from markdown-it-py>=2.2.0->rich->keras>=3.2.0->tensorflow-intel==
2.17.0->tensorflow) (0.1.0)
```

In [3]:
```
import pandas as pd
import numpy as np
import matplotlib.pyplot as plt
import seaborn as sns
import tensorflow as tf
```

In [4]:
```
data = pd.read_csv("Downloads/creditcard.csv.zip")
data
```

Out[4]:

	Time	V1	V2	V3	V4	V5	V6	V7	
0	0.0	-1.359807	-0.072781	2.536347	1.378155	-0.338321	0.462388	0.239599	0
1	0.0	1.191857	0.266151	0.166480	0.448154	0.060018	-0.082361	-0.078803	0
2	1.0	-1.358354	-1.340163	1.773209	0.379780	-0.503198	1.800499	0.791461	0
3	1.0	-0.966272	-0.185226	1.792993	-0.863291	-0.010309	1.247203	0.237609	0
4	2.0	-1.158233	0.877737	1.548718	0.403034	-0.407193	0.095921	0.592941	-0
...	...	...	...	...	...	...	...	...	
284802	172786.0	-11.881118	10.071785	-9.834783	-2.066656	-5.364473	-2.606837	-4.918215	7
284803	172787.0	-0.732789	-0.055080	2.035030	-0.738589	0.868229	1.058415	0.024330	0
284804	172788.0	1.919565	-0.301254	-3.249640	-0.557828	2.630515	3.031260	-0.296827	0
284805	172788.0	-0.240440	0.530483	0.702510	0.689799	-0.377961	0.623708	-0.686180	0
284806	172792.0	-0.533413	-0.189733	0.703337	-0.506271	-0.012546	-0.649617	1.577006	-0

284807 rows × 31 columns

In [5]:
```
data.info()
```

```
<class 'pandas.core.frame.DataFrame'>
RangeIndex: 284807 entries, 0 to 284806
Data columns (total 31 columns):
 #   Column  Non-Null Count   Dtype  
---  ------  --------------   -----  
 0   Time    284807 non-null  float64
 1   V1      284807 non-null  float64
 2   V2      284807 non-null  float64
 3   V3      284807 non-null  float64
 4   V4      284807 non-null  float64
 5   V5      284807 non-null  float64
 6   V6      284807 non-null  float64
 7   V7      284807 non-null  float64
 8   V8      284807 non-null  float64
 9   V9      284807 non-null  float64
 10  V10     284807 non-null  float64
 11  V11     284807 non-null  float64
 12  V12     284807 non-null  float64
 13  V13     284807 non-null  float64
 14  V14     284807 non-null  float64
 15  V15     284807 non-null  float64
 16  V16     284807 non-null  float64
 17  V17     284807 non-null  float64
 18  V18     284807 non-null  float64
 19  V19     284807 non-null  float64
 20  V20     284807 non-null  float64
 21  V21     284807 non-null  float64
 22  V22     284807 non-null  float64
 23  V23     284807 non-null  float64
 24  V24     284807 non-null  float64
 25  V25     284807 non-null  float64
 26  V26     284807 non-null  float64
 27  V27     284807 non-null  float64
 28  V28     284807 non-null  float64
 29  Amount  284807 non-null  float64
 30  Class   284807 non-null  int64  
dtypes: float64(30), int64(1)
memory usage: 67.4 MB
```

In [6]:
```
data.shape
```

Out[6]: (284807, 31)

In [7]:
```
data.describe()
```

Out[7]:

	Time	V1	V2	V3	V4	V5
count	284807.000000	2.848070e+05	2.848070e+05	2.848070e+05	2.848070e+05	2.848070e+05
mean	94813.859575	1.168375e-15	3.416908e-16	-1.379537e-15	2.074095e-15	9.604066e-16
std	47488.145955	1.958696e+00	1.651309e+00	1.516255e+00	1.415869e+00	1.380247e+00
min	0.000000	-5.640751e+01	-7.271573e+01	-4.832559e+01	-5.683171e+00	-1.137433e+02
25%	54201.500000	-9.203734e-01	-5.985499e-01	-8.903648e-01	-8.486401e-01	-6.915971e-01
50%	84692.000000	1.810880e-02	6.548556e-02	1.798463e-01	-1.984653e-02	-5.433583e-02
75%	139320.500000	1.315642e+00	8.037239e-01	1.027196e+00	7.433413e-01	6.119264e-01
max	172792.000000	2.454930e+00	2.205773e+01	9.382558e+00	1.687534e+01	3.480167e+01

8 rows × 31 columns

In [8]:
```
data.duplicated().sum()
```

Out[8]:
```
1081
```

In [9]:
```
data.drop_duplicates(inplace = True)
```

In [10]:
```
data.duplicated().sum()
```

Out[10]:
```
0
```

In [11]:
```
data.isnull().sum()
```

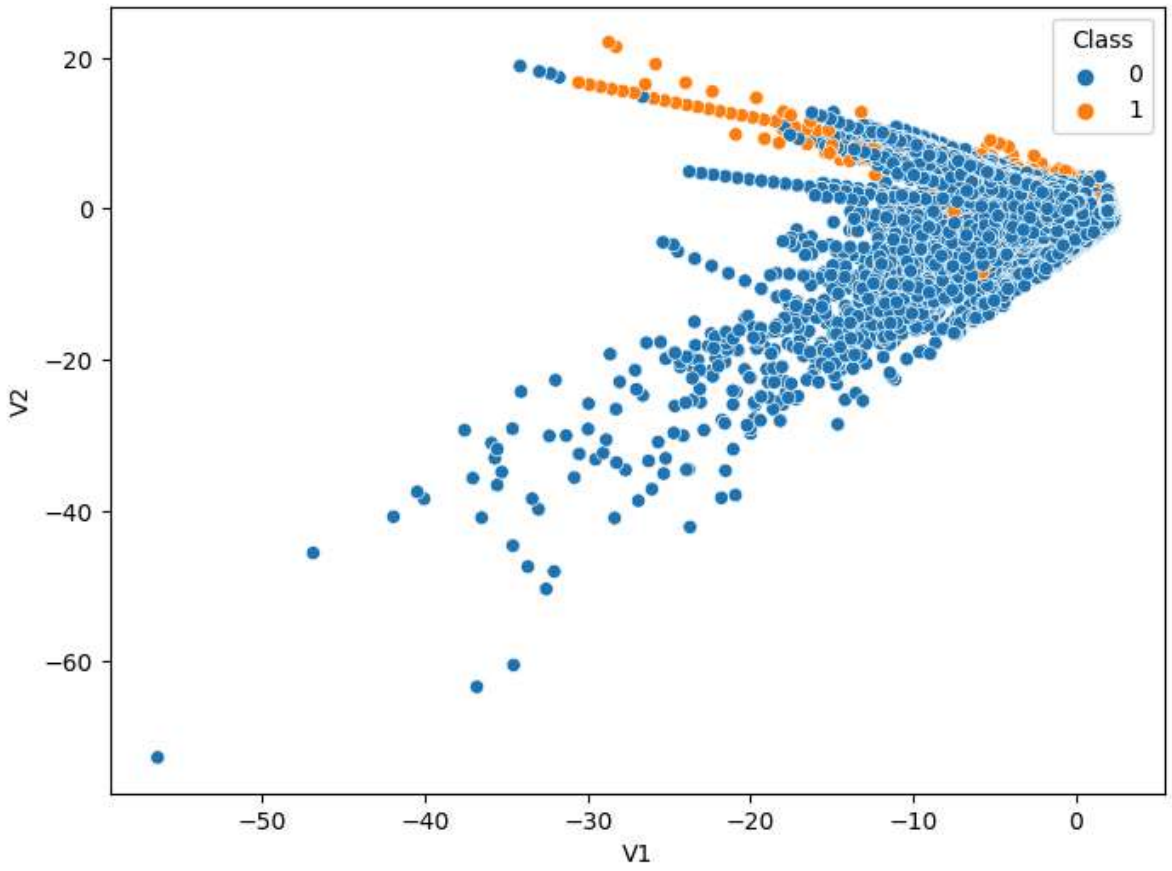
Out[11]:
```
Time      0
V1        0
V2        0
V3        0
V4        0
V5        0
V6        0
V7        0
V8        0
V9        0
V10       0
V11       0
V12       0
V13       0
V14       0
V15       0
V16       0
V17       0
V18       0
V19       0
V20       0
V21       0
V22       0
V23       0
V24       0
V25       0
V26       0
V27       0
V28       0
Amount    0
Class     0
dtype: int64
```

In [12]:
```
data['Class'].value_counts()
```

Out[12]:
```
0    283253
1       473
Name: Class, dtype: int64
```

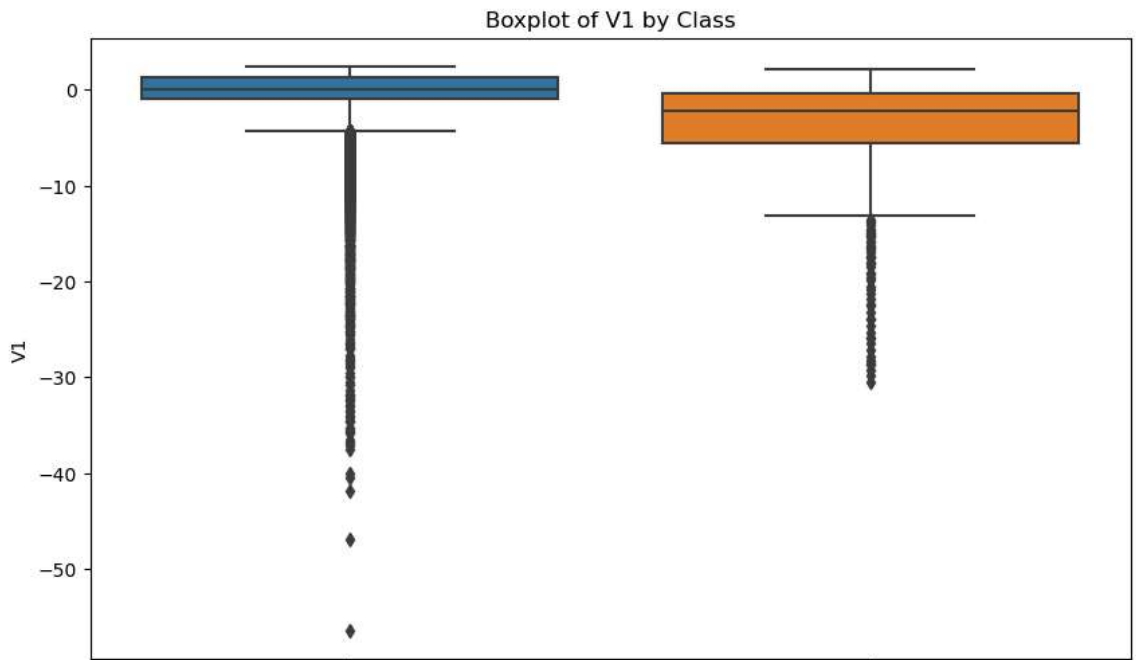
In [13]:
```
import seaborn as sns
import matplotlib.pyplot as plt

plt.figure(figsize=(8, 6))
sns.scatterplot(data=data, x='V1', y='V2', hue='Class')
plt.show()
```



In [14]:
```
x = data.drop(columns = 'Class', axis = 1)
X_notime = x.drop(columns = 'Time', axis = 1)
Y = data[['Class']]
```

In [15]:
```
for column in X_notime.columns:
    plt.figure(figsize=(10, 6))
    sns.boxplot(x='Class', y=column, data=data)
    plt.title(f'Boxplot of {column} by Class')
    plt.show()
```



In [16]:
```
print(x.shape)
x.head()
```

```
(283726, 30)
```

Out[16]:

	Time	V1	V2	V3	V4	V5	V6	V7	V8	
0	0.0	-1.359807	-0.072781	2.536347	1.378155	-0.338321	0.462388	0.239599	0.098698	0
1	0.0	1.191857	0.266151	0.166480	0.448154	0.060018	-0.082361	-0.078803	0.085102	-0
2	1.0	-1.358354	-1.340163	1.773209	0.379780	-0.503198	1.800499	0.791461	0.247676	-1
3	1.0	-0.966272	-0.185226	1.792993	-0.863291	-0.010309	1.247203	0.237609	0.377436	-1
4	2.0	-1.158233	0.877737	1.548718	0.403034	-0.407193	0.095921	0.592941	-0.270533	0

5 rows × 30 columns

In [17]:
```
from sklearn.model_selection import train_test_split
```

In [18]:
```
Y.head()
```

Out[18]:

	Class
0	0
1	0
2	0
3	0
4	0

In [19]:
```
x_train,x_test,Y_train,Y_test = train_test_split(x,Y, test_size=0.2)
```

In [20]:
```
print(x_train.shape, Y_train.shape, x_test.shape, Y_test.shape)
```

```
(226980, 30) (226980, 1) (56746, 30) (56746, 1)
```

In [21]:
```
x_train.head()
```

Out[21]:

	Time	V1	V2	V3	V4	V5	V6	V7	
195326	131000.0	2.024727	-0.309874	-0.584394	0.274736	-0.150772	0.152302	-0.554461	-0.(
19307	30167.0	0.859628	-0.579655	0.878631	0.512729	-0.872311	0.183771	-0.481253	0.2
235196	148290.0	-0.861697	-5.804744	-2.142568	0.562905	-2.596802	-0.264409	1.312983	-0.(
96140	65626.0	-1.172792	0.426326	0.521474	-2.269887	0.067164	0.778728	-0.194597	0.5
191459	129265.0	2.286954	-1.209759	-1.534512	-1.789623	-0.719573	-0.718512	-0.744285	-0.1

5 rows × 30 columns

In [22]:
```
from sklearn.preprocessing import StandardScaler
scaler = StandardScaler()
X_train_scaled  = scaler.fit_transform(x_train)
x_test_scaled = scaler.fit_transform(x_test)
```

In [23]:
```
X_train_scaled[0]
```

Out[23]:
```
array([ 0.76102126,  1.03771932, -0.18674055, -0.38796425,  0.1964525 ,
       -0.11103442,  0.1151833 , -0.45296348, -0.02313302,  1.13627195,
       -0.20324673, -1.19164788,  1.15226499,  1.89953069, -0.60389888,
        0.41024806,  0.20642168, -0.96691798,  0.24682385, -0.03486224,
       -0.08790687,  0.23419697,  1.09762478,  0.10889258,  0.49916457,
        0.09774602, -0.45963929,  0.11376366, -0.09401007, -0.31443527])
```

In [24]:
```
import tensorflow as tf
from tensorflow import keras
```

In [25]:
```
model = keras.Sequential([
    keras.layers.Dense(64, activation='relu', input_dim = 30),
    keras.layers.Dense(64, activation='relu'),
    keras.layers.Dense(1,activation='sigmoid')])
```

```
C:\Users\Mano\anaconda3\Lib\site-packages\keras\src\layers\core\dense.py:87:
UserWarning: Do not pass an `input_shape`/`input_dim` argument to a layer. Wh
en using Sequential models, prefer using an `Input(shape)` object as the firs
t layer in the model instead.
  super().__init__(activity_regularizer=activity_regularizer, **kwargs)
```

In [26]:
```
model.summary()
```

Model: "sequential"

Layer (type)	Output Shape	
dense (Dense)	(None, 64)	
dense_1 (Dense)	(None, 64)	
dense_2 (Dense)	(None, 1)	

Total params: 6,209 (24.25 KB)

Trainable params: 6,209 (24.25 KB)

Non-trainable params: 0 (0.00 B)

In [27]:
```
model.compile(optimizer='adam', loss = 'binary_crossentropy',metrics=['accurac
```

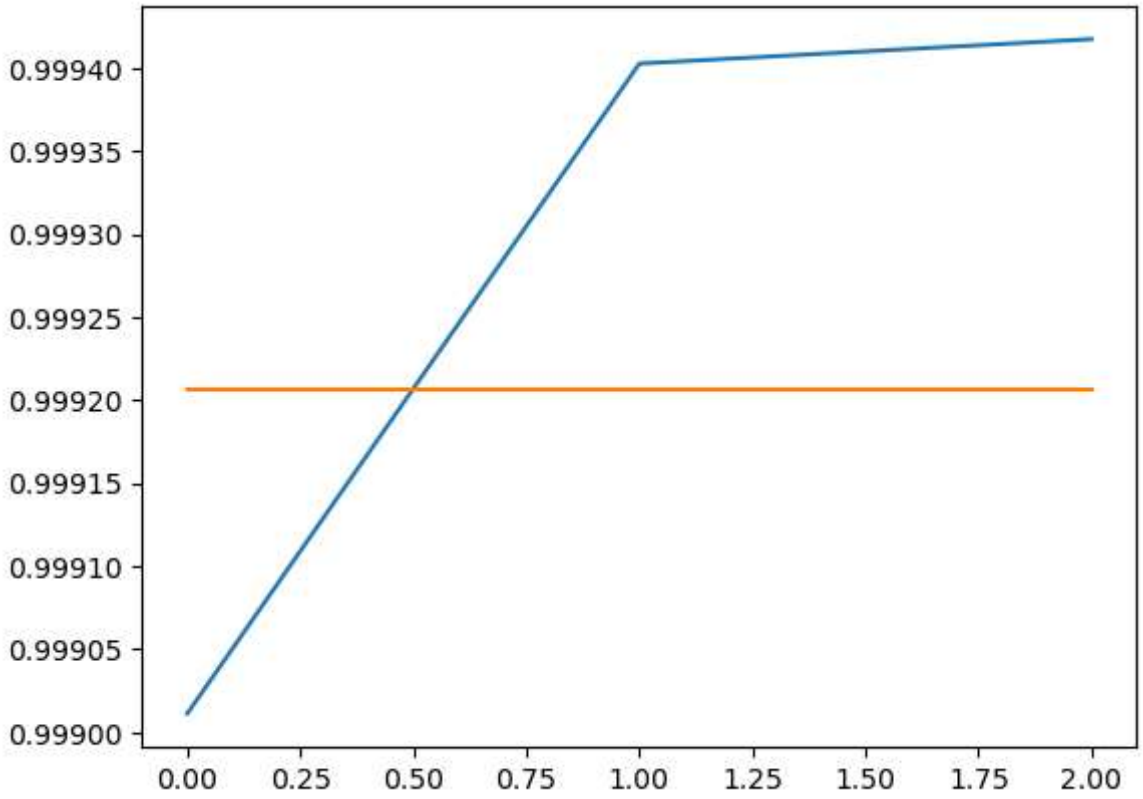
In [28]:
```
callback = keras.callbacks.EarlyStopping(
    monitor="val_loss",
    min_delta=0,
    patience=0,
    verbose=1,
    mode="auto",
    baseline=None,
    restore_best_weights=False,
    start_from_epoch=0,
)
```

In [29]:
```
history = model.fit(X_train_scaled, Y_train, epochs=10, callbacks=[callback],
```

```
Epoch 1/10
6384/6384 ━━━━━━━━━━━━━━━━━━━━ 25s 3ms/step - accuracy: 0.9966 - loss: 0.0173
- val_accuracy: 0.9992 - val_loss: 0.0031
Epoch 2/10
6384/6384 ━━━━━━━━━━━━━━━━━━━━ 20s 3ms/step - accuracy: 0.9995 - loss: 0.0030
- val_accuracy: 0.9992 - val_loss: 0.0028
Epoch 3/10
6384/6384 ━━━━━━━━━━━━━━━━━━━━ 20s 3ms/step - accuracy: 0.9995 - loss: 0.0023
- val_accuracy: 0.9992 - val_loss: 0.0030
Epoch 3: early stopping
```

In [30]:
```
plt.plot(history.history["accuracy"])
plt.plot(history.history['val_accuracy'])
```

Out[30]:
```
[<matplotlib.lines.Line2D at 0x1d8c50536d0>]
```



In [31]:
```
accuracy = model.evaluate(x_test_scaled,Y_test)
```

```
1774/1774 ━━━━━━━━━━━━━━━━━━━━ 4s 2ms/step - accuracy: 0.9994 - loss: 0.0032
```

In [ ]:
```

```