```
import tensorflow
from tensorflow import keras
from tensorflow.keras import Sequential
from tensorflow.keras.layers import Dense,Flatten


(X_train,y_train),(X_test,y_test) = keras.datasets.mnist.load_data()

X_train.shape
X_test.shape
X_train[0]
y_train[0]

import matplotlib.pyplot as plt
plt.imshow(X_train[0])
X_train = X_train/255
X_test = X_test/255
X_train[0]
model = Sequential([
    Flatten(input_shape=(28,28)),
    Dense(128,activation='relu'),
    Dense(32,activation='relu'),
    Dense(10,activation='softmax')
])
model.summary()

model.compile(loss='sparse_categorical_crossentropy',optimizer='Adam',metrics=['accuracy'])

history = model.fit(X_train,y_train,epochs=25,validation_split=0.2)

y_prob = model.predict(X_test)
y_prob[0]
y_pred = y_prob.argmax(axis=1)
y_pred[0]

from sklearn.metrics import accuracy_score
accuracy_score(y_test,y_pred)

plt.plot(history.history['loss'])
plt.plot(history.history['val_loss'])
plt.plot(history.history['accuracy'])
plt.plot(history.history['val_accuracy'])

y_test
plt.imshow(X_test[1])
plt.imshow(X_train[0])
```

```
Downloading data from https://storage.googleapis.com/tensorflow/tf-keras-datasets/mnist.npz
11490434/11490434 ━━━━━━━━━━━━━━━━━━━━ 0s 0us/step
/usr/local/lib/python3.11/dist-packages/keras/src/layers/reshaping/flatten.py:37: UserWarning: Do not pass an `input_shape`/`input_di
  super().__init__(**kwargs)
Model: "sequential"
```

Layer (type)	Output Shape	Param #
flatten (Flatten)	(None, 784)	0
dense (Dense)	(None, 128)	100,480
dense_1 (Dense)	(None, 32)	4,128
dense_2 (Dense)	(None, 10)	330

```
 Total params: 104,938 (409.91 KB)
 Trainable params: 104,938 (409.91 KB)
 Non-trainable params: 0 (0.00 B)
Epoch 1/25
1500/1500 ━━━━━━━━━━━━━━━━━━━━ 11s 5ms/step - accuracy: 0.8484 - loss: 0.5086 - val_accuracy: 0.9552 - val_loss: 0.1482
Epoch 2/25
1500/1500 ━━━━━━━━━━━━━━━━━━━━ 9s 4ms/step - accuracy: 0.9652 - loss: 0.1220 - val_accuracy: 0.9671 - val_loss: 0.1082
Epoch 3/25
1500/1500 ━━━━━━━━━━━━━━━━━━━━ 8s 5ms/step - accuracy: 0.9744 - loss: 0.0821 - val_accuracy: 0.9694 - val_loss: 0.1042
Epoch 4/25
1500/1500 ━━━━━━━━━━━━━━━━━━━━ 7s 4ms/step - accuracy: 0.9823 - loss: 0.0554 - val_accuracy: 0.9707 - val_loss: 0.1008
Epoch 5/25
1500/1500 ━━━━━━━━━━━━━━━━━━━━ 8s 5ms/step - accuracy: 0.9862 - loss: 0.0458 - val_accuracy: 0.9682 - val_loss: 0.1105
Epoch 6/25
1500/1500 ━━━━━━━━━━━━━━━━━━━━ 7s 5ms/step - accuracy: 0.9887 - loss: 0.0354 - val_accuracy: 0.9745 - val_loss: 0.0912
Epoch 7/25
1500/1500 ━━━━━━━━━━━━━━━━━━━━ 9s 4ms/step - accuracy: 0.9916 - loss: 0.0263 - val_accuracy: 0.9755 - val_loss: 0.0929
Epoch 8/25
1500/1500 ━━━━━━━━━━━━━━━━━━━━ 7s 5ms/step - accuracy: 0.9906 - loss: 0.0259 - val_accuracy: 0.9770 - val_loss: 0.0985
Epoch 9/25
1500/1500 ━━━━━━━━━━━━━━━━━━━━ 11s 6ms/step - accuracy: 0.9939 - loss: 0.0189 - val_accuracy: 0.9751 - val_loss: 0.1034
Epoch 10/25
1500/1500 ━━━━━━━━━━━━━━━━━━━━ 6s 4ms/step - accuracy: 0.9942 - loss: 0.0172 - val_accuracy: 0.9742 - val_loss: 0.1104
Epoch 11/25
1500/1500 ━━━━━━━━━━━━━━━━━━━━ 8s 5ms/step - accuracy: 0.9949 - loss: 0.0157 - val_accuracy: 0.9738 - val_loss: 0.1156
Epoch 12/25
1500/1500 ━━━━━━━━━━━━━━━━━━━━ 9s 4ms/step - accuracy: 0.9952 - loss: 0.0138 - val_accuracy: 0.9732 - val_loss: 0.1213
Epoch 13/25
1500/1500 ━━━━━━━━━━━━━━━━━━━━ 10s 4ms/step - accuracy: 0.9954 - loss: 0.0135 - val_accuracy: 0.9753 - val_loss: 0.1272
Epoch 14/25
1500/1500 ━━━━━━━━━━━━━━━━━━━━ 8s 5ms/step - accuracy: 0.9969 - loss: 0.0093 - val_accuracy: 0.9747 - val_loss: 0.1331
Epoch 15/25
1500/1500 ━━━━━━━━━━━━━━━━━━━━ 6s 4ms/step - accuracy: 0.9969 - loss: 0.0100 - val_accuracy: 0.9744 - val_loss: 0.1409
Epoch 16/25
1500/1500 ━━━━━━━━━━━━━━━━━━━━ 10s 4ms/step - accuracy: 0.9964 - loss: 0.0110 - val_accuracy: 0.9755 - val_loss: 0.1271
Epoch 17/25
1500/1500 ━━━━━━━━━━━━━━━━━━━━ 11s 4ms/step - accuracy: 0.9964 - loss: 0.0092 - val_accuracy: 0.9734 - val_loss: 0.1383
Epoch 18/25
1500/1500 ━━━━━━━━━━━━━━━━━━━━ 10s 4ms/step - accuracy: 0.9969 - loss: 0.0089 - val_accuracy: 0.9747 - val_loss: 0.1425
Epoch 19/25
1500/1500 ━━━━━━━━━━━━━━━━━━━━ 10s 4ms/step - accuracy: 0.9985 - loss: 0.0053 - val_accuracy: 0.9726 - val_loss: 0.1586
Epoch 20/25
1500/1500 ━━━━━━━━━━━━━━━━━━━━ 12s 5ms/step - accuracy: 0.9957 - loss: 0.0129 - val_accuracy: 0.9729 - val_loss: 0.1602
Epoch 21/25
1500/1500 ━━━━━━━━━━━━━━━━━━━━ 6s 4ms/step - accuracy: 0.9968 - loss: 0.0099 - val_accuracy: 0.9722 - val_loss: 0.1646
Epoch 22/25
1500/1500 ━━━━━━━━━━━━━━━━━━━━ 11s 5ms/step - accuracy: 0.9971 - loss: 0.0086 - val_accuracy: 0.9738 - val_loss: 0.1585
Epoch 23/25
1500/1500 ━━━━━━━━━━━━━━━━━━━━ 10s 4ms/step - accuracy: 0.9980 - loss: 0.0058 - val_accuracy: 0.9761 - val_loss: 0.1562
Epoch 24/25
1500/1500 ━━━━━━━━━━━━━━━━━━━━ 8s 5ms/step - accuracy: 0.9956 - loss: 0.0121 - val_accuracy: 0.9732 - val_loss: 0.1676
Epoch 25/25
1500/1500 ━━━━━━━━━━━━━━━━━━━━ 9s 4ms/step - accuracy: 0.9979 - loss: 0.0063 - val_accuracy: 0.9752 - val_loss: 0.1554
313/313 ━━━━━━━━━━━━━━━━━━━━ 1s 3ms/step
<matplotlib.image.AxesImage at 0x7cb028f07990>
```