# fashion-minst

September 30, 2023

[ ]:
```
import numpy as np
import pandas as pd
import matplotlib.pyplot as plt
```

[ ]:
```
import tensorflow as tf
from tensorflow import keras
from keras.datasets import fashion_mnist

from tensorflow.keras.models import Sequential
from tensorflow.keras.layers import Dense, Flatten, Conv2D, Dropout, MaxPool2D
```

[ ]:
```
(X_train,y_train),(X_test,y_test)=fashion_mnist.load_data()
```

```
Downloading data from https://storage.googleapis.com/tensorflow/tf-keras-
datasets/train-labels-idx1-ubyte.gz
29515/29515 [==============================] - 0s 0us/step
Downloading data from https://storage.googleapis.com/tensorflow/tf-keras-
datasets/train-images-idx3-ubyte.gz
26421880/26421880 [==============================] - 0s 0us/step
Downloading data from https://storage.googleapis.com/tensorflow/tf-keras-
datasets/t10k-labels-idx1-ubyte.gz
5148/5148 [==============================] - 0s 0us/step
Downloading data from https://storage.googleapis.com/tensorflow/tf-keras-
datasets/t10k-images-idx3-ubyte.gz
4422102/4422102 [==============================] - 0s 0us/step
```

[ ]:
```
X_train.shape
```

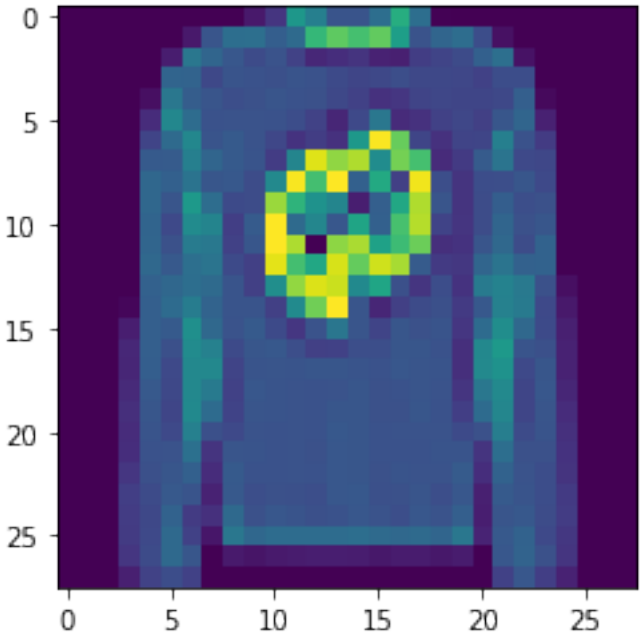
[ ]:
```
(60000, 28, 28)
```

[ ]:
```
X_test.shape
```

[ ]:
```
(10000, 28, 28)
```

[ ]:
```
plt.imshow(X_train[123])
```

[ ]:
```
<matplotlib.image.AxesImage at 0x7fb5c06d7550>
```




[ ]:
```
model = Sequential()
model.add(Flatten(input_shape=(28,28)))
model.add(Dense(128, activation='relu'))
model.add(Dense(64, activation='relu'))
model.add(Dense(32,activation='relu'))
model.add(Dense(10, activation='softmax'))
```

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

```
Model: "sequential"
_________________________________________________________________
 Layer (type)                Output Shape              Param #
=================================================================
 flatten (Flatten)           (None, 784)               0

 dense (Dense)               (None, 128)               100480

 dense_1 (Dense)             (None, 64)                8256

 dense_2 (Dense)             (None, 32)                2080

 dense_3 (Dense)             (None, 10)                330

=================================================================
Total params: 111,146
Trainable params: 111,146
```

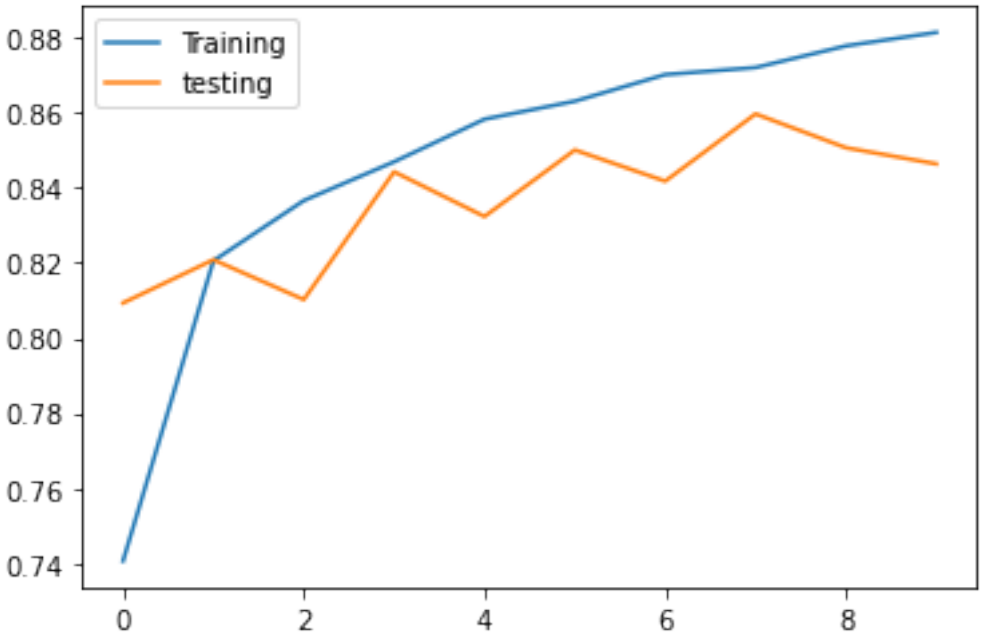
```
Non-trainable params: 0
_________________________________________________________________
```

[ ]:
```
model.compile(
              optimizer='adam',
              loss='sparse_categorical_crossentropy',
              metrics=['accuracy']
              )
```

[ ]:
```
history = model.fit(X_train,y_train,epochs=10,validation_data=(X_test,y_test))
```

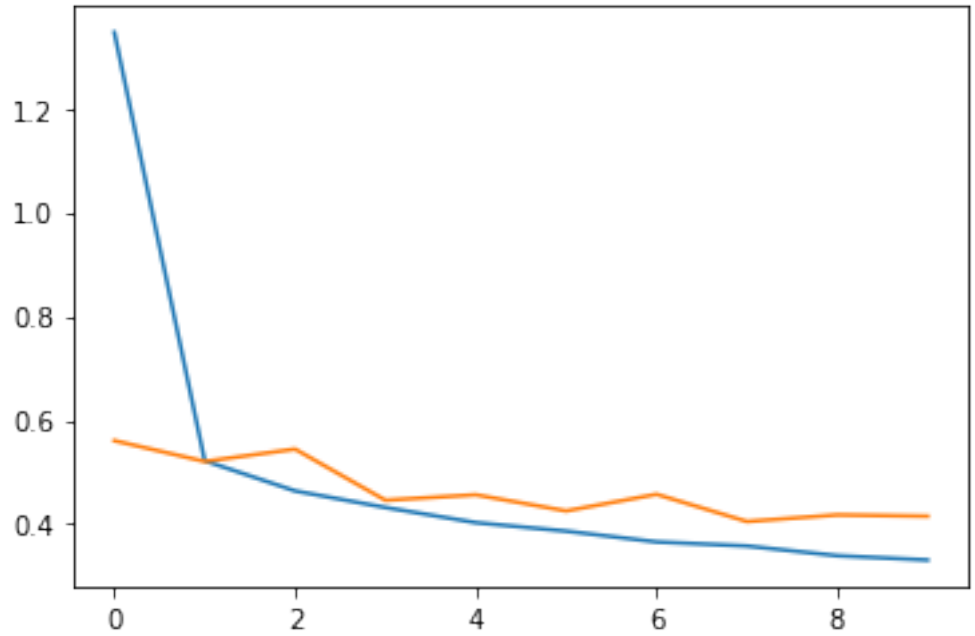
```
Epoch 1/10
1875/1875 [==============================] - 10s 5ms/step - loss: 1.3464 -
accuracy: 0.7407 - val_loss: 0.5604 - val_accuracy: 0.8093
Epoch 2/10
1875/1875 [==============================] - 6s 3ms/step - loss: 0.5217 -
accuracy: 0.8205 - val_loss: 0.5204 - val_accuracy: 0.8208
Epoch 3/10
1875/1875 [==============================] - 6s 3ms/step - loss: 0.4637 -
accuracy: 0.8365 - val_loss: 0.5442 - val_accuracy: 0.8102
Epoch 4/10
1875/1875 [==============================] - 7s 4ms/step - loss: 0.4317 -
accuracy: 0.8469 - val_loss: 0.4457 - val_accuracy: 0.8442
Epoch 5/10
1875/1875 [==============================] - 6s 3ms/step - loss: 0.4026 -
accuracy: 0.8582 - val_loss: 0.4562 - val_accuracy: 0.8323
Epoch 6/10
1875/1875 [==============================] - 5s 3ms/step - loss: 0.3862 -
accuracy: 0.8630 - val_loss: 0.4251 - val_accuracy: 0.8500
Epoch 7/10
1875/1875 [==============================] - 6s 3ms/step - loss: 0.3655 -
accuracy: 0.8701 - val_loss: 0.4571 - val_accuracy: 0.8417
Epoch 8/10
1875/1875 [==============================] - 6s 3ms/step - loss: 0.3576 -
accuracy: 0.8719 - val_loss: 0.4048 - val_accuracy: 0.8596
Epoch 9/10
1875/1875 [==============================] - 7s 4ms/step - loss: 0.3390 -
accuracy: 0.8777 - val_loss: 0.4175 - val_accuracy: 0.8506
Epoch 10/10
1875/1875 [==============================] - 6s 3ms/step - loss: 0.3307 -
accuracy: 0.8813 - val_loss: 0.4150 - val_accuracy: 0.8463
```

[ ]:
```
plt.plot(history.history['accuracy'],label='Training')
plt.plot(history.history['val_accuracy'],label='testing')
plt.legend()
plt.show()
```




[ ]:
```
plt.plot(history.history['loss'])
plt.plot(history.history['val_loss'])
```

[ ]:
```
[<matplotlib.lines.Line2D at 0x7fb5bbaf4be0>]
```



[ ]:
```
cnn_model = Sequential()

cnn_model.add(Conv2D(filters=10, kernel_size=(3,3),activation='relu',␣
 ↪input_shape=(28,28,1))) #(-1,28,28,1) 1 for channel, gray=1,color=3
cnn_model.add(MaxPool2D(pool_size=(2,2)))
cnn_model.add(Conv2D(filters=15, kernel_size=(3,3),activation='relu'))
cnn_model.add(MaxPool2D(pool_size=(2,2)))

cnn_model.add(Flatten())
cnn_model.add(Dense(128, activation='relu'))
cnn_model.add(Dense(64, activation='relu'))
cnn_model.add(Dense(10, activation='softmax'))
```

[ ]:
```
cnn_model.summary()
```

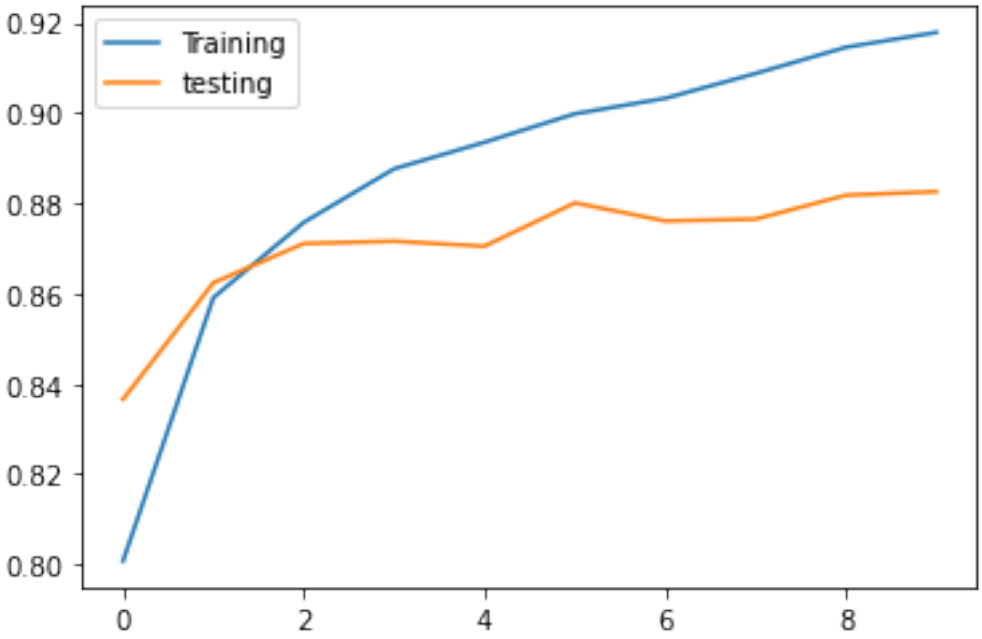
```
Model: "sequential_1"
_________________________________________________________________
 Layer (type)                Output Shape              Param #
=================================================================
 conv2d (Conv2D)             (None, 26, 26, 10)        100

 max_pooling2d (MaxPooling2D  (None, 13, 13, 10)       0
 )

 conv2d_1 (Conv2D)           (None, 11, 11, 15)        1365

 max_pooling2d_1 (MaxPooling  (None, 5, 5, 15)         0
 2D)

 flatten_1 (Flatten)         (None, 375)               0

 dense_4 (Dense)             (None, 128)               48128

 dense_5 (Dense)             (None, 64)                8256

 dense_6 (Dense)             (None, 10)                650

=================================================================
Total params: 58,499
Trainable params: 58,499
Non-trainable params: 0
_________________________________________________________________
```

[ ]:
```
cnn_model.compile(optimizer='adam',
                  loss='sparse_categorical_crossentropy',
                  metrics=['acc']
                  )
```

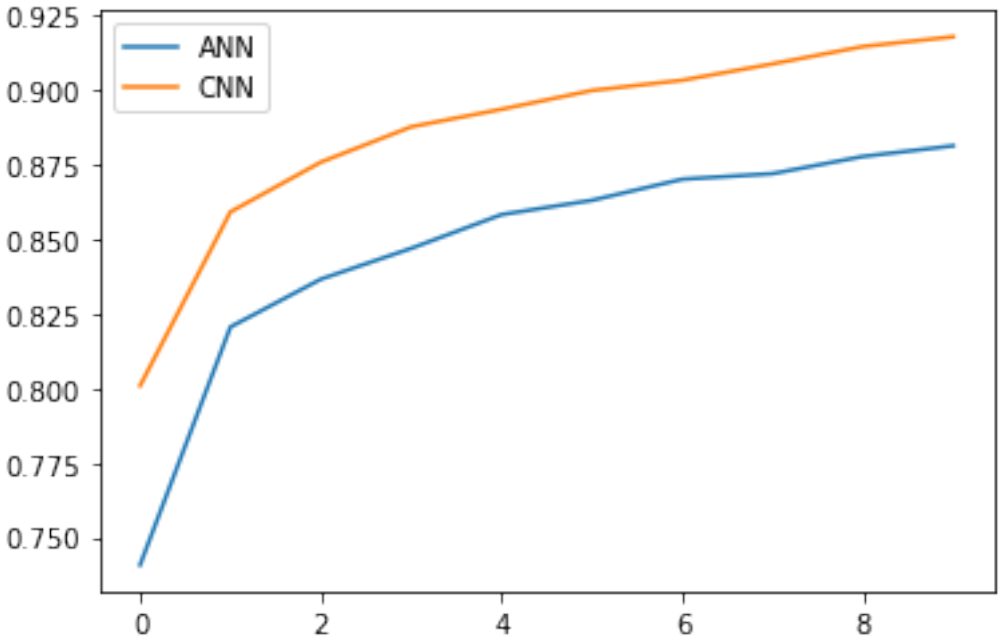
[ ]:
```
cnn_history=cnn_model.
  ↪fit(X_train,y_train,epochs=10,validation_data=(X_test,y_test))
```

```
Epoch 1/10
1875/1875 [==============================] - 29s 15ms/step - loss: 0.6453 - acc:
0.8008 - val_loss: 0.4392 - val_acc: 0.8366
Epoch 2/10
1875/1875 [==============================] - 27s 14ms/step - loss: 0.3837 - acc:
0.8591 - val_loss: 0.3799 - val_acc: 0.8624
Epoch 3/10
1875/1875 [==============================] - 27s 15ms/step - loss: 0.3358 - acc:
0.8758 - val_loss: 0.3485 - val_acc: 0.8711
Epoch 4/10
1875/1875 [==============================] - 27s 14ms/step - loss: 0.3042 - acc:
0.8877 - val_loss: 0.3368 - val_acc: 0.8716
Epoch 5/10
1875/1875 [==============================] - 27s 15ms/step - loss: 0.2834 - acc:
0.8935 - val_loss: 0.3535 - val_acc: 0.8705
Epoch 6/10
1875/1875 [==============================] - 26s 14ms/step - loss: 0.2656 - acc:
0.8998 - val_loss: 0.3376 - val_acc: 0.8801
Epoch 7/10
1875/1875 [==============================] - 27s 14ms/step - loss: 0.2541 - acc:
0.9033 - val_loss: 0.3509 - val_acc: 0.8761
Epoch 8/10
1875/1875 [==============================] - 27s 14ms/step - loss: 0.2367 - acc:
0.9088 - val_loss: 0.3453 - val_acc: 0.8765
Epoch 9/10
1875/1875 [==============================] - 27s 15ms/step - loss: 0.2260 - acc:
0.9146 - val_loss: 0.3388 - val_acc: 0.8818
Epoch 10/10
1875/1875 [==============================] - 27s 14ms/step - loss: 0.2182 - acc:
0.9179 - val_loss: 0.3436 - val_acc: 0.8826
```

[ ]:
```
plt.plot(cnn_history.history['acc'],label='Training')
plt.plot(cnn_history.history['val_acc'],label='testing')
plt.legend()
plt.show()
```




[ ]:
```
plt.plot(history.history['accuracy'],label='ANN')
plt.plot(cnn_history.history['acc'],label='CNN')
plt.legend()
plt.show()
```



[ ]: