In [ ]:

```python
#importing important libraries
import numpy as np
from keras.models import Sequential
from keras.layers import Dense, Dropout, Flatten, BatchNormalization, Activation
from keras.layers.convolutional import Conv2D, MaxPooling2D
from keras.utils import np_utils
from keras.datasets import fashion_mnist
import PIL
import matplotlib.pyplot as plt
import tensorflow as tf
from tensorflow.keras import layers
from tensorflow.keras.models import Sequential
from tensorflow import keras
```
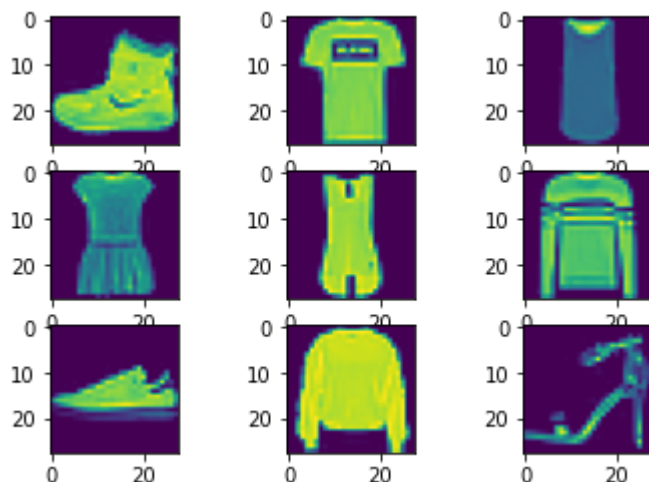
In [ ]:

```python
(x_train, y_train), (x_test, y_test) = fashion_mnist.load_data()
```

In [ ]:

```python
import matplotlib.pyplot as plt
for i in range(9):
  plt.subplot(330+i+1)
  plt.imshow(x_train[i])
plt.show()
```



In [ ]:

```python
x = x_test
x_train = x_train.astype('float32')
x_test = x_test.astype('float32')
x_train = x_train/255
x_test = x_test/255
```

In [ ]:

```python
y_train = np_utils.to_categorical(y_train,10)
y_test = np_utils.to_categorical(y_test,10)
```

In [ ]:

```python
from keras.layers.convolutional import Conv2D, MaxPooling2D
from keras.models import Sequential
from keras.layers import Dense, Dropout, Flatten, BatchNormalization, Activation
from tensorflow.keras.models import Sequential
model=Sequential()
model.add(Conv2D(64,(3,3),activation='relu',kernel_initializer='he_uniform',padding='sa
me',input_shape=(28,28,1)))
model.add(Conv2D(64,(3,3),activation='relu',kernel_initializer='he_uniform',padding='sa
me'))
model.add(MaxPooling2D(2,2))
```

In [ ]:

```python
model.add(MaxPooling2D(2,2))
```

In [ ]:

```python
model.add(Flatten())
```

In [ ]:

```python
model.add(Dense(128, activation = 'relu', kernel_initializer = 'he_uniform',input_shape
=(28,28)))
model.add(Dropout(0.2))
model.add(Dense(10,activation='relu'))
model.add(Dropout(0.1))
```

In [ ]:

```python
model.add(Dense(10, activation = 'softmax'))
```

In [ ]:

```python
from tensorflow.keras.optimizers import SGD
```

In [ ]:

```python
opt = SGD(lr = 0.01, momentum = 0.9)
```

```
/usr/local/lib/python3.7/dist-packages/keras/optimizer_v2/gradient_descen
t.py:102: UserWarning: The `lr` argument is deprecated, use `learning_rate
` instead.
  super(SGD, self).__init__(name, **kwargs)
```

In [ ]:

```python
from keras.backend import categorical_crossentropy
model.compile(optimizer = opt, loss = 'categorical_crossentropy', metrics = ['accuracy'
])
```

In [ ]:

```
history = model.fit(x_train, y_train, epochs = 10, batch_size = 128, validation_data =
(x_test, y_test))
```

```
Epoch 1/10
469/469 [==============================] - 13s 27ms/step - loss: 0.7756 -
accuracy: 0.7108 - val_loss: 0.4014 - val_accuracy: 0.8595
Epoch 2/10
469/469 [==============================] - 12s 25ms/step - loss: 0.4806 -
accuracy: 0.8326 - val_loss: 0.3495 - val_accuracy: 0.8810
Epoch 3/10
469/469 [==============================] - 12s 25ms/step - loss: 0.4011 -
accuracy: 0.8604 - val_loss: 0.3081 - val_accuracy: 0.8886
Epoch 4/10
469/469 [==============================] - 12s 26ms/step - loss: 0.3549 -
accuracy: 0.8770 - val_loss: 0.3011 - val_accuracy: 0.8920
Epoch 5/10
469/469 [==============================] - 12s 25ms/step - loss: 0.3292 -
accuracy: 0.8859 - val_loss: 0.2924 - val_accuracy: 0.8969
Epoch 6/10
469/469 [==============================] - 13s 27ms/step - loss: 0.3072 -
accuracy: 0.8927 - val_loss: 0.2608 - val_accuracy: 0.9070
Epoch 7/10
469/469 [==============================] - 12s 25ms/step - loss: 0.2882 -
accuracy: 0.8983 - val_loss: 0.2594 - val_accuracy: 0.9094
Epoch 8/10
469/469 [==============================] - 12s 25ms/step - loss: 0.2722 -
accuracy: 0.9050 - val_loss: 0.2563 - val_accuracy: 0.9063
Epoch 9/10
469/469 [==============================] - 12s 26ms/step - loss: 0.2593 -
accuracy: 0.9079 - val_loss: 0.2504 - val_accuracy: 0.9127
Epoch 10/10
469/469 [==============================] - 12s 26ms/step - loss: 0.2463 -
accuracy: 0.9136 - val_loss: 0.2413 - val_accuracy: 0.9141
```
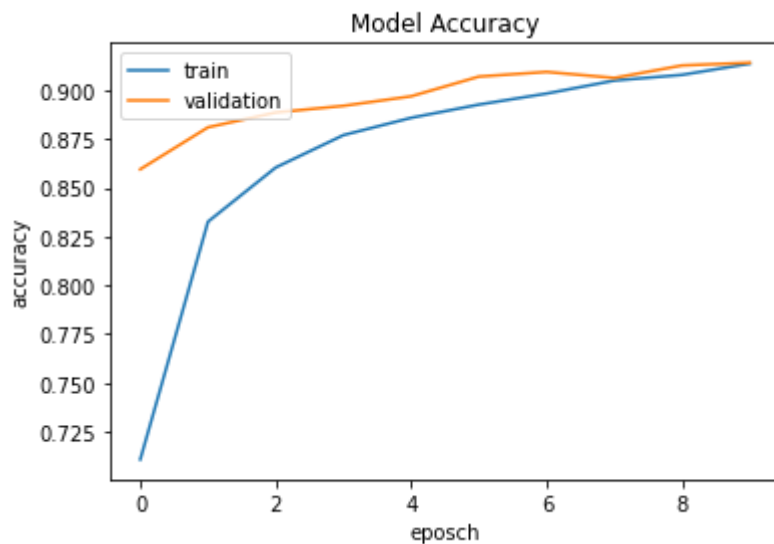
In [ ]:

```python
plt.plot(history.history['accuracy'])
plt.plot(history.history['val_accuracy'])
plt.title('Model Accuracy')
plt.ylabel('accuracy')
plt.xlabel('eposch')
plt.legend(['train','validation'], loc = 'upper left')
```
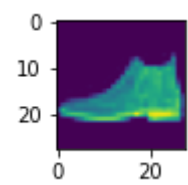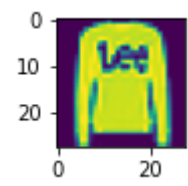
Out[ ]:

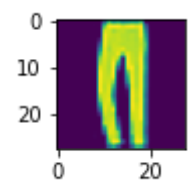<matplotlib.legend.Legend at 0x7efb83305e10>

In [ ]:

```python
y_pred=model.predict(x_test)
for i in range(9):
  plt.subplot(330+i+1)
  plt.imshow(x[i])
  plt.show()
  print(np.round(y_pred[i]))
```
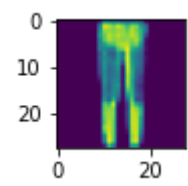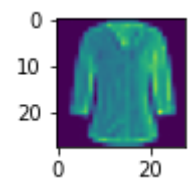
[0. 0. 0. 0. 0. 0. 0. 0. 0. 1.]



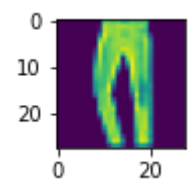[0. 0. 1. 0. 0. 0. 0. 0. 0. 0.]



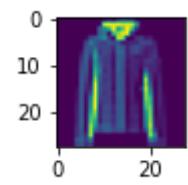[0. 1. 0. 0. 0. 0. 0. 0. 0. 0.]
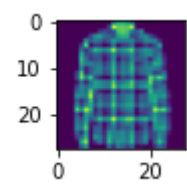


[0. 1. 0. 0. 0. 0. 0. 0. 0. 0.]



[0. 0. 0. 0. 0. 0. 1. 0. 0. 0.]
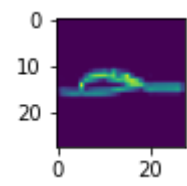


[0. 1. 0. 0. 0. 0. 0. 0. 0. 0.]



[0. 0. 0. 0. 1. 0. 0. 0. 0. 0.]

[0. 0. 0. 0. 0. 0. 1. 0. 0. 0.]



[0. 0. 0. 0. 0. 1. 0. 0. 0. 0.]

In [ ]:

```python
from google.colab import drive
drive.mount('/content/drive')
!wget -nc https://raw.githubusercontent.com/brpy/colab-pdf/master/colab_pdf.py
from colab_pdf import colab_pdf
colab_pdf('Fashion_CNN.ipynb')
```

```
Mounted at /content/drive
--2022-05-18 12:08:29--  https://raw.githubusercontent.com/brpy/colab-pdf/
master/colab_pdf.py
Resolving raw.githubusercontent.com (raw.githubusercontent.com)... 185.19
9.108.133, 185.199.111.133, 185.199.110.133, ...
Connecting to raw.githubusercontent.com (raw.githubusercontent.com)|185.19
9.108.133|:443... connected.
HTTP request sent, awaiting response... 200 OK
Length: 1864 (1.8K) [text/plain]
Saving to: 'colab_pdf.py'

colab_pdf.py         100%[===================>]   1.82K  --.-KB/s    in 0s

2022-05-18 12:08:29 (25.5 MB/s) - 'colab_pdf.py' saved [1864/1864]


WARNING: apt does not have a stable CLI interface. Use with caution in scr
ipts.


WARNING: apt does not have a stable CLI interface. Use with caution in scr
ipts.

Extracting templates from packages: 100%
[NbConvertApp] Converting notebook /content/drive/MyDrive/Colab Notebooks/
Fashion_CNN.ipynb to pdf
[NbConvertApp] Support files will be in Fashion_CNN_files/
[NbConvertApp] Making directory ./Fashion_CNN_files
[NbConvertApp] Making directory ./Fashion_CNN_files
[NbConvertApp] Making directory ./Fashion_CNN_files
[NbConvertApp] Making directory ./Fashion_CNN_files
[NbConvertApp] Making directory ./Fashion_CNN_files
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[NbConvertApp] Making directory ./Fashion_CNN_files
[NbConvertApp] Making directory ./Fashion_CNN_files
[NbConvertApp] Writing 39487 bytes to ./notebook.tex
[NbConvertApp] Building PDF
[NbConvertApp] Running xelatex 3 times: ['xelatex', './notebook.tex', '-qu
iet']
[NbConvertApp] Running bibtex 1 time: ['bibtex', './notebook']
[NbConvertApp] WARNING | bibtex had problems, most likely because there we
re no citations
[NbConvertApp] PDF successfully created
[NbConvertApp] Writing 132314 bytes to /content/drive/My Drive/Fashion_CN
N.pdf
```

Out[ ]:

'File ready to be Downloaded and Saved to Drive'

In [ ]: