

2. Noisy MNIST Fashion classification

```
CNN_model = tf.keras.models.Sequential([
    tf.keras.layers.Input(shape=(28, 28, 1)),
    tf.keras.layers.Conv2D(16, (3, 3), activation='relu'),
    tf.keras.layers.MaxPooling2D((2, 2)),
    tf.keras.layers.Flatten(),
    tf.keras.layers.Dense(10, activation='sigmoid')
])

train_labels_onehot = tf.keras.utils.to_categorical(train_labels, num_classes=10)
test_labels_onehot = tf.keras.utils.to_categorical(test_labels, num_classes=10)

CNN_model.compile(optimizer='adam', loss=tf.keras.losses.categorical_crossentropy, metrics='accuracy')

CNN_model.fit(train_images, train_labels_onehot,
              epochs=5,
              shuffle=False)
```

Report classification accuracy for the clean test images

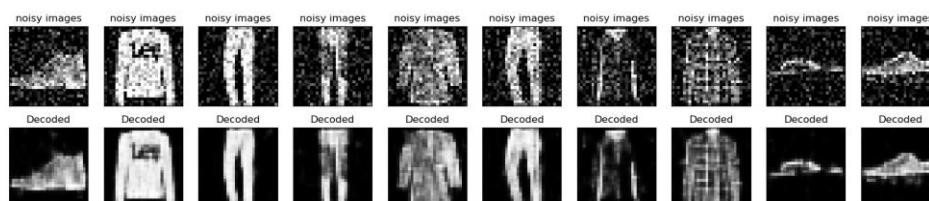
```
Clean trained CNN test accuracy for clean images:
313/313 [=====] - 1s 3ms/step - loss: 0.3026 - accuracy: 0.8955
```

Report classification accuracy for the noisy test images

```
Clean trained CNN test accuracy for noisy images:
313/313 [=====] - 1s 2ms/step - loss: 1.9524 - accuracy: 0.5066
```

Define a CNN autoencoder model to denoise the noisy images and train it using noisy training images
- plot examples

```
Epoch 1/5
1875/1875 [=====] - 112s 59ms/step - loss: 0.0148 - accuracy: 0.5083 - val_loss: 0.0084 - val_accuracy: 0.5078
Epoch 2/5
1875/1875 [=====] - 89s 47ms/step - loss: 0.0078 - accuracy: 0.5100 - val_loss: 0.0076 - val_accuracy: 0.5078
Epoch 3/5
1875/1875 [=====] - 88s 47ms/step - loss: 0.0074 - accuracy: 0.5100 - val_loss: 0.0073 - val_accuracy: 0.5078
Epoch 4/5
1875/1875 [=====] - 89s 47ms/step - loss: 0.0072 - accuracy: 0.5100 - val_loss: 0.0071 - val_accuracy: 0.5078
Epoch 5/5
1875/1875 [=====] - 98s 52ms/step - loss: 0.0069 - accuracy: 0.5100 - val_loss: 0.0069 - val_accuracy: 0.5078
```



Report classification accuracy for autoencoder denoised test images

```
Clean trained CNN test accuracy for denoised images:  
313/313 [=====] - 2s 6ms/step - loss: 0.4319 - accuracy: 0.8404
```

Train the original model with noisy train images and report accuracy for noisy test images

```
Noisy trained CNN test accuracy for noisy images:  
313/313 [=====] - 1s 3ms/step - loss: 0.4089 - accuracy: 0.8542
```