

# Project Part 3: Classification Using Neural Networks and Deep Learning

## Objective:

The main objective of this project is learning and understanding the concept of convolutional neural network in an experiment with different parameters and settings.

## Dataset:

The dataset is the same as that of Project 1 – MNIST dataset and can be easily brought into the workspace using libraries in Keras.

## Tasks:

The major 3 tasks to be implemented are:

1. Run the baseline code.
2. Change the kernel size to 5 X 5 and redo the experiment again and plot the learning errors vs epoch and report the testing error and testing accuracy.
3. Change the number of feature maps in the first and second convolutional layers and repeat the experiment. Plot the learning errors vs epoch and report the testing error and testing accuracy.

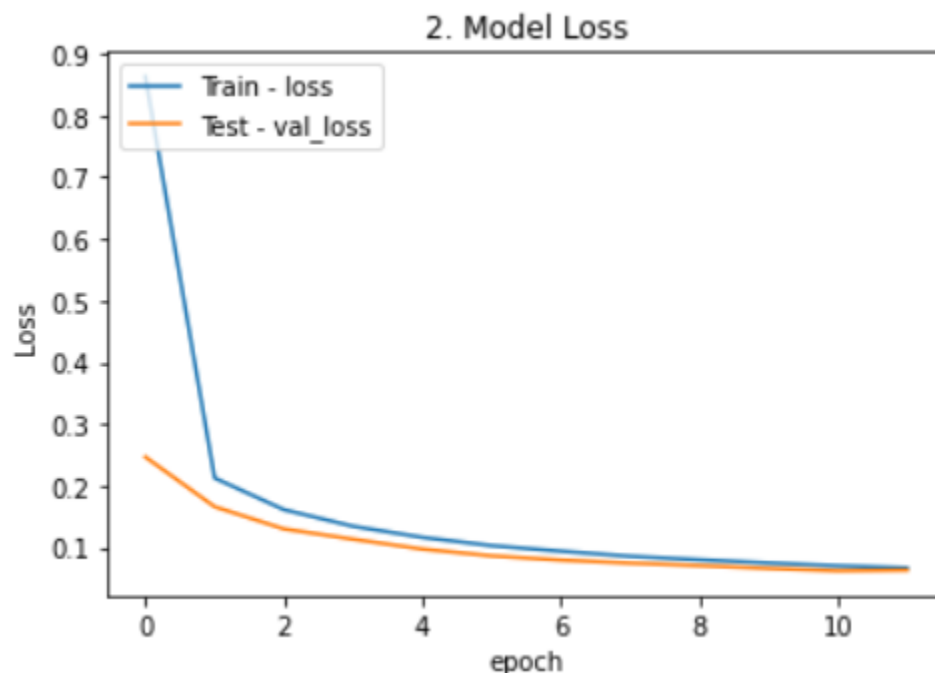
## Results:

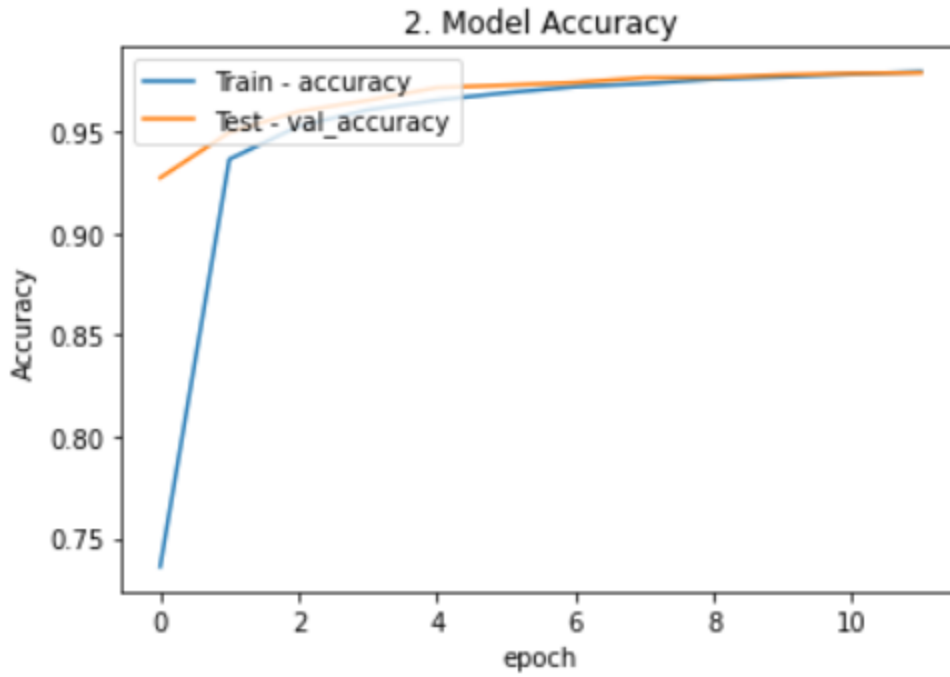
The plot of learning error vs epoch and accuracy are plotted at each stage of the experiment conducted.

### Task 1:

Kernel size = 3 X 3. The test loss and accuracy of the experiment with the given (default) parameters are:

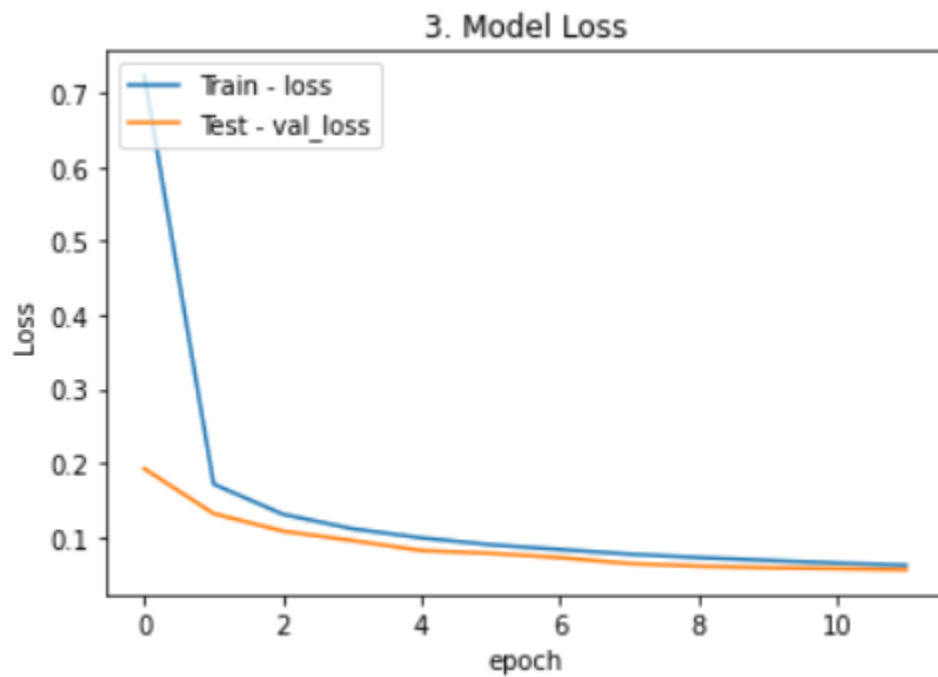
Test loss: 0.06363399029728026  
Test accuracy: 0.9789999723434448

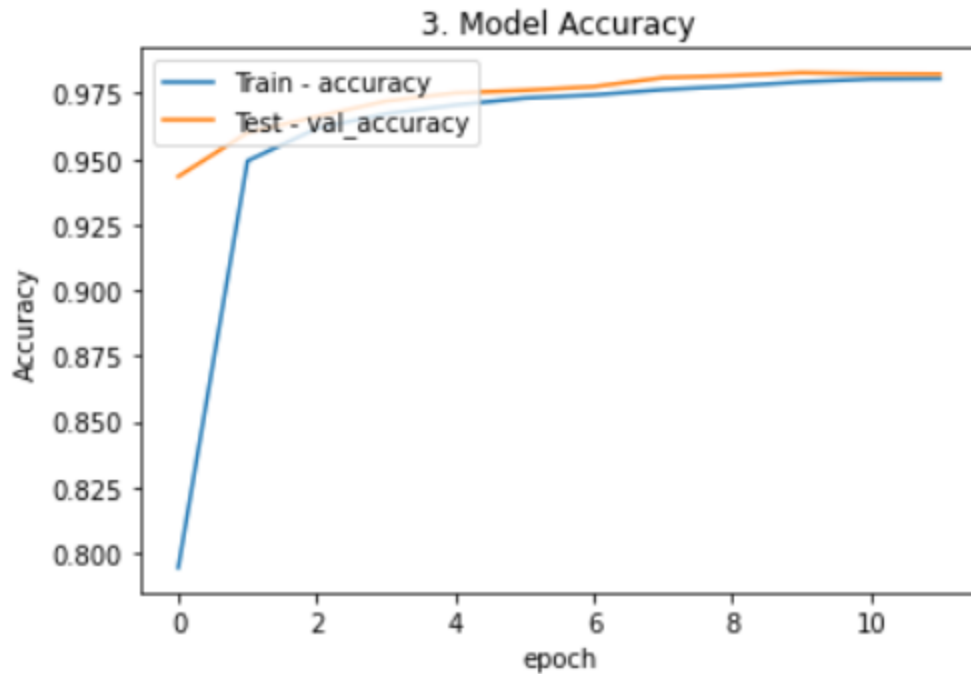




**Task 2:** Change the kernel size to 5X5 and redo the experiment. The test loss and accuracy of the experiment with the changed parameters are:

Test loss: 0.05527253094362095  
Test accuracy: 0.9822999835014343





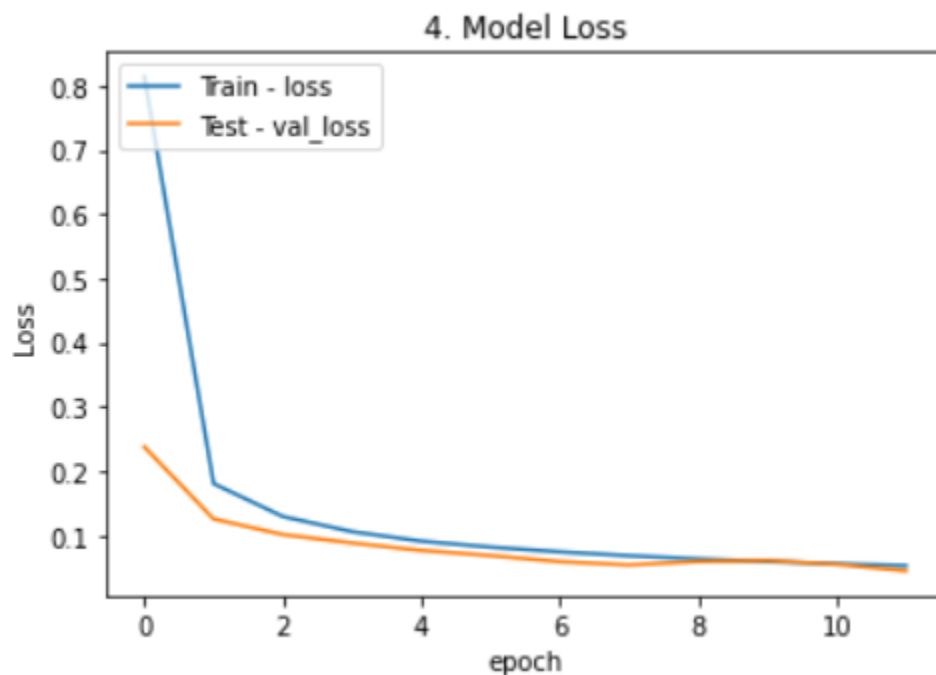
**Observation:** The accuracy seems to increase to 98.2% when the kernel size is increased.

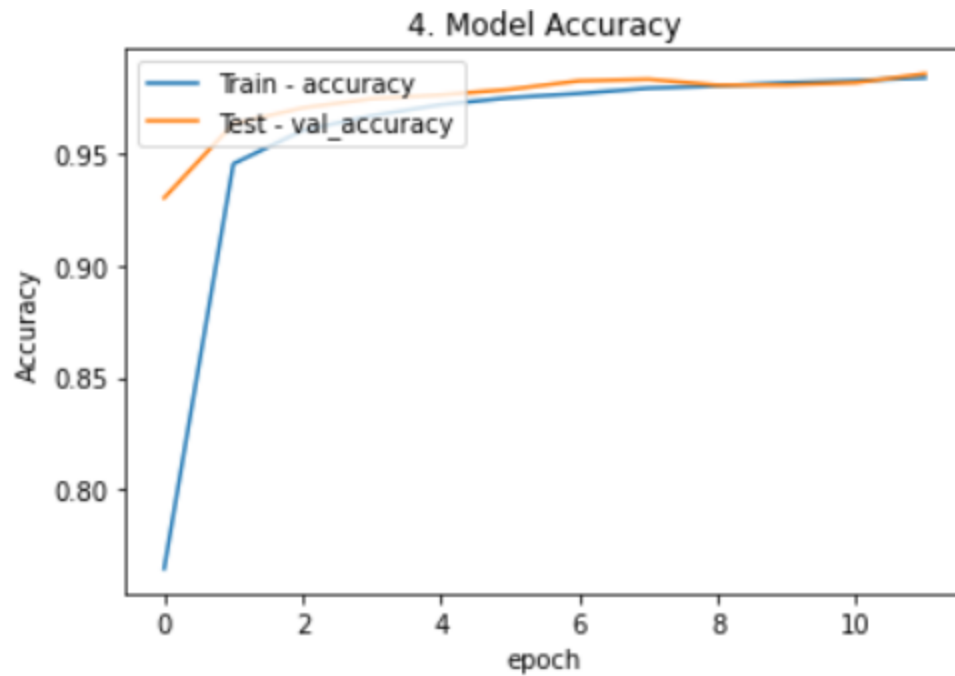
**Task 3:** Change the number of feature maps in the first and second convolutional layers and redo the experiment [ # feature maps for 1<sup>st</sup> layer – 32, 2<sup>nd</sup> layer – 64]

The test loss and accuracy of the experiment with the changed parameters are:

Test loss: 0.04485189812846947

Test accuracy: 0.9861000180244446





**Observation:** The accuracy seems to increase to 98.6% when the feature maps are increased in the first and second layers.

The overall observation is that the model performs better when increasing the kernel size and the number of feature maps and is evident in the above mentioned obtained test accuracies.