These Experiments were done on Kaggle platform which consumed 12.5GB of RAM to process in the given below time.

Experiment 1:

This is a simple CNN with 3 Convolutions, 3 Maxpooling, 1 Flatten and 3 Dense Layers. Also used EarlyStopping to stop the training once accuracy stops increasing in the middle of Epochs.

Execution Time : 18 min Epochs: 6 Accuracy: 10.32%

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_________________________________________________________________
Layer (type)                 Output Shape              Param #
=================================================================
conv2d_1 (Conv2D)            (None, 238, 238, 32)      320
_________________________________________________________________
max_pooling2d_1 (MaxPooling2 (None, 119, 119, 32)      0
_________________________________________________________________
conv2d_2 (Conv2D)            (None, 119, 119, 64)      18496
_________________________________________________________________
max_pooling2d_2 (MaxPooling2 (None, 60, 60, 64)        0
_________________________________________________________________
conv2d_3 (Conv2D)            (None, 60, 60, 128)       73856
_________________________________________________________________
max_pooling2d_3 (MaxPooling2 (None, 30, 30, 128)       0
_________________________________________________________________
flatten_1 (Flatten)          (None, 115200)            0
_________________________________________________________________
dense_1 (Dense)              (None, 512)               58982912
_________________________________________________________________
dense_2 (Dense)              (None, 128)               65664
_________________________________________________________________

dense_3 (Dense)              (None, 10)                1290
=================================================================
Total params: 59,142,538
Trainable params: 59,142,538
Non-trainable params: 0
_________________________________________________________________
```

Experiment 2:

Tried to improve Accuracy by adding Dropout layers at the Dense layers, But could not achieve that. Accuracy gone down after this.

Execution Time : 20 min Epochs: 6 Accuracy: 8.77%

Layer (type)	Output Shape	Param #
conv2d_1 (Conv2D)	(None, 238, 238, 32)	320
max_pooling2d_1 (MaxPooling2	(None, 119, 119, 32)	0
conv2d_2 (Conv2D)	(None, 119, 119, 64)	18496
max_pooling2d_2 (MaxPooling2	(None, 60, 60, 64)	0
conv2d_3 (Conv2D)	(None, 60, 60, 128)	73856
max_pooling2d_3 (MaxPooling2	(None, 30, 30, 128)	0
flatten_1 (Flatten)	(None, 115200)	0
dense_1 (Dense)	(None, 512)	58982912
dropout_1 (Dropout)	(None, 512)	0
dense_2 (Dense)	(None, 128)	65664
dropout_2 (Dropout)	(None, 128)	0
dense_3 (Dense)	(None, 10)	1290

Total params: 59,142,538
Trainable params: 59,142,538
Non-trainable params: 0

Experiment 3:

Again added more Dropout layers at all convolution layers. Now the accuracy gone up a little.

Execution Time : 20 min Epochs: 6 Accuracy: 10.15%

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_________________________________________________________________
Layer (type)                 Output Shape              Param #
=================================================================
conv2d_1 (Conv2D)            (None, 238, 238, 32)      320
_________________________________________________________________
max_pooling2d_1 (MaxPooling  (None, 119, 119, 32)      0
_________________________________________________________________
dropout_1 (Dropout)          (None, 119, 119, 32)      0
_________________________________________________________________
conv2d_2 (Conv2D)            (None, 119, 119, 64)      18496
_________________________________________________________________
max_pooling2d_2 (MaxPooling  (None, 60, 60, 64)        0
_________________________________________________________________
dropout_2 (Dropout)          (None, 60, 60, 64)        0
_________________________________________________________________
conv2d_3 (Conv2D)            (None, 60, 60, 128)       73856
_________________________________________________________________
max_pooling2d_3 (MaxPooling  (None, 30, 30, 128)       0
_________________________________________________________________
dropout_3 (Dropout)          (None, 30, 30, 128)       0
_________________________________________________________________
flatten_1 (Flatten)          (None, 115200)            0
_________________________________________________________________
dense_1 (Dense)              (None, 512)               58982912
_________________________________________________________________
dropout_4 (Dropout)          (None, 512)               0
_________________________________________________________________
dense_2 (Dense)              (None, 128)               65664
_________________________________________________________________
dropout_5 (Dropout)          (None, 128)               0
_________________________________________________________________
dense_3 (Dense)              (None, 10)                1290
=================================================================
Total params: 59,142,538
Trainable params: 59,142,538
Non-trainable params: 0
_________________________________________________________________
```

Experiment 3:

Now added Batch Normalization after the Dense layer, Accuracy jumped at once from 10% to 99%.

Execution Time : 22 min Epochs: 10 Accuracy: 98.94%

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_________________________________________________________________
Layer (type)                 Output Shape              Param #
=================================================================
conv2d_1 (Conv2D)            (None, 238, 238, 32)      320
_________________________________________________________________
max_pooling2d_1 (MaxPooling2 (None, 119, 119, 32)      0
_________________________________________________________________
dropout_1 (Dropout)          (None, 119, 119, 32)      0
_________________________________________________________________
conv2d_2 (Conv2D)            (None, 119, 119, 64)      18496
_________________________________________________________________
max_pooling2d_2 (MaxPooling2 (None, 60, 60, 64)        0
_________________________________________________________________
dropout_2 (Dropout)          (None, 60, 60, 64)        0
_________________________________________________________________
conv2d_3 (Conv2D)            (None, 60, 60, 128)       73856
_________________________________________________________________
max_pooling2d_3 (MaxPooling2 (None, 30, 30, 128)       0
_________________________________________________________________
dropout_3 (Dropout)          (None, 30, 30, 128)       0
_________________________________________________________________
flatten_1 (Flatten)          (None, 115200)            0
_________________________________________________________________
dense_1 (Dense)              (None, 512)               58982912
_________________________________________________________________
batch_normalization_1 (Batch (None, 512)               2048
_________________________________________________________________
dropout_4 (Dropout)          (None, 512)               0
_________________________________________________________________
dense_2 (Dense)              (None, 128)               65664
_________________________________________________________________
dropout_5 (Dropout)          (None, 128)               0
_________________________________________________________________
dense_3 (Dense)              (None, 10)                1290
=================================================================
Total params: 59,144,586
Trainable params: 59,143,562
Non-trainable params: 1,024
_________________________________________________________________
```

Experiment 4:

Now added Batch Normalization after every Convolution layer, Accuracy moved to 99.51%.

Execution Time : 26 min Epochs: 17 Accuracy: 99.51%

```
_________________________________________________________________
Layer (type)                 Output Shape              Param #
=================================================================
conv2d_1 (Conv2D)            (None, 238, 238, 32)      320
_________________________________________________________________
batch_normalization_1 (Batch (None, 238, 238, 32)      128
_________________________________________________________________
max_pooling2d_1 (MaxPooling  (None, 119, 119, 32)      0
_________________________________________________________________
dropout_1 (Dropout)          (None, 119, 119, 32)      0
_________________________________________________________________
conv2d_2 (Conv2D)            (None, 119, 119, 64)      18496
_________________________________________________________________
batch_normalization_2 (Batch (None, 119, 119, 64)      256
_________________________________________________________________
max_pooling2d_2 (MaxPooling  (None, 60, 60, 64)        0
_________________________________________________________________
dropout_2 (Dropout)          (None, 60, 60, 64)        0
_________________________________________________________________
conv2d_3 (Conv2D)            (None, 60, 60, 128)       73856
_________________________________________________________________
batch_normalization_3 (Batch (None, 60, 60, 128)       512
_________________________________________________________________
max_pooling2d_3 (MaxPooling  (None, 30, 30, 128)       0
_________________________________________________________________
dropout_3 (Dropout)          (None, 30, 30, 128)       0
_________________________________________________________________
flatten_1 (Flatten)           (None, 115200)            0
_________________________________________________________________
dense_1 (Dense)              (None, 512)               58982912
_________________________________________________________________
batch_normalization_4 (Batch (None, 512)               2048
_________________________________________________________________
dropout_4 (Dropout)          (None, 512)               0
_________________________________________________________________
dense_2 (Dense)              (None, 128)               65664
_________________________________________________________________
dropout_5 (Dropout)          (None, 128)               0
_________________________________________________________________
Dense_3 (Dense)              (None, 10)                1290
=================================================================
Total params: 59,145,482
Trainable params: 59,144,010
Non-trainable params: 1,472
_________________________________________________________________
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