Epoch 1/15

50000/50000 [==============================] - 111s 2ms/sample - loss: 0.0640 - acc: 0.4703 - val\_loss: 0.0325 - val\_acc: 0.7735

Epoch 2/15

50000/50000 [==============================] - 129s 3ms/sample - loss: 0.0140 - acc: 0.9089 - val\_loss: 0.0109 - val\_acc: 0.9291

Epoch 3/15

50000/50000 [==============================] - 197s 4ms/sample - loss: 0.0083 - acc: 0.9461 - val\_loss: 0.0069 - val\_acc: 0.9573

Epoch 4/15

50000/50000 [==============================] - 325s 6ms/sample - loss: 0.0063 - acc: 0.9599 - val\_loss: 0.0056 - val\_acc: 0.9644

Epoch 5/15

50000/50000 [==============================] - 342s 7ms/sample - loss: 0.0052 - acc: 0.9672 - val\_loss: 0.0050 - val\_acc: 0.9691

Epoch 6/15

50000/50000 [==============================] - 342s 7ms/sample - loss: 0.0045 - acc: 0.9710 - val\_loss: 0.0043 - val\_acc: 0.9728

Epoch 7/15

50000/50000 [==============================] - 341s 7ms/sample - loss: 0.0041 - acc: 0.9745 - val\_loss: 0.0043 - val\_acc: 0.9723

Epoch 8/15

50000/50000 [==============================] - 335s 7ms/sample - loss: 0.0036 - acc: 0.9768 - val\_loss: 0.0038 - val\_acc: 0.9759

Epoch 9/15

50000/50000 [==============================] - 325s 6ms/sample - loss: 0.0033 - acc: 0.9791 - val\_loss: 0.0038 - val\_acc: 0.9752

Epoch 10/15

50000/50000 [==============================] - 327s 7ms/sample - loss: 0.0030 - acc: 0.9810 - val\_loss: 0.0033 - val\_acc: 0.9788

Epoch 11/15

50000/50000 [==============================] - 355s 7ms/sample - loss: 0.0029 - acc: 0.9822 - val\_loss: 0.0033 - val\_acc: 0.9774

Epoch 12/15

50000/50000 [==============================] - 401s 8ms/sample - loss: 0.0026 - acc: 0.9837 - val\_loss: 0.0040 - val\_acc: 0.9749

Epoch 13/15

50000/50000 [==============================] - 400s 8ms/sample - loss: 0.0024 - acc: 0.9847 - val\_loss: 0.0041 - val\_acc: 0.9754

Epoch 14/15

50000/50000 [==============================] - 386s 8ms/sample - loss: 0.0024 - acc: 0.9853 - val\_loss: 0.0031 - val\_acc: 0.9800

Epoch 15/15

50000/50000 [==============================] - 338s 7ms/sample - loss: 0.0022 - acc: 0.9863 - val\_loss: 0.0025 - val\_acc: 0.9843

10000/10000 [==============================] - 43s 4ms/sample - loss: 0.0042 - acc: 0.9791

The testing accuracy metric for 0 dropout percentage is [0.00416648180563933, 0.9791]

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Train on 50000 samples, validate on 10000 samples

Epoch 1/15

50000/50000 [==============================] - 379s 8ms/sample - loss: 0.0676 - acc: 0.4309 - val\_loss: 0.0197 - val\_acc: 0.8705

Epoch 2/15

50000/50000 [==============================] - 370s 7ms/sample - loss: 0.0148 - acc: 0.9028 - val\_loss: 0.0090 - val\_acc: 0.9408

Epoch 3/15

50000/50000 [==============================] - 270s 5ms/sample - loss: 0.0083 - acc: 0.9471 - val\_loss: 0.0056 - val\_acc: 0.9637

Epoch 4/15

50000/50000 [==============================] - 377s 8ms/sample - loss: 0.0063 - acc: 0.9602 - val\_loss: 0.0060 - val\_acc: 0.9610

Epoch 5/15

50000/50000 [==============================] - 389s 8ms/sample - loss: 0.0052 - acc: 0.9663 - val\_loss: 0.0054 - val\_acc: 0.9665

Epoch 6/15

50000/50000 [==============================] - 420s 8ms/sample - loss: 0.0045 - acc: 0.9704 - val\_loss: 0.0039 - val\_acc: 0.9746

Epoch 7/15

50000/50000 [==============================] - 387s 8ms/sample - loss: 0.0040 - acc: 0.9749 - val\_loss: 0.0036 - val\_acc: 0.9775

Epoch 8/15

50000/50000 [==============================] - 400s 8ms/sample - loss: 0.0037 - acc: 0.9766 - val\_loss: 0.0043 - val\_acc: 0.9726

Epoch 9/15

50000/50000 [==============================] - 384s 8ms/sample - loss: 0.0033 - acc: 0.9790 - val\_loss: 0.0031 - val\_acc: 0.9796

Epoch 10/15

50000/50000 [==============================] - 387s 8ms/sample - loss: 0.0030 - acc: 0.9804 - val\_loss: 0.0034 - val\_acc: 0.9784

Epoch 11/15

50000/50000 [==============================] - 337s 7ms/sample - loss: 0.0027 - acc: 0.9828 - val\_loss: 0.0027 - val\_acc: 0.9822

Epoch 12/15

50000/50000 [==============================] - 335s 7ms/sample - loss: 0.0025 - acc: 0.9845 - val\_loss: 0.0029 - val\_acc: 0.9811

Epoch 13/15

50000/50000 [==============================] - 391s 8ms/sample - loss: 0.0024 - acc: 0.9843 - val\_loss: 0.0026 - val\_acc: 0.9836

Epoch 14/15

50000/50000 [==============================] - 366s 7ms/sample - loss: 0.0021 - acc: 0.9869 - val\_loss: 0.0028 - val\_acc: 0.9822

Epoch 15/15

50000/50000 [==============================] - 403s 8ms/sample - loss: 0.0020 - acc: 0.9874 - val\_loss: 0.0024 - val\_acc: 0.9846

10000/10000 [==============================] - 42s 4ms/sample - loss: 0.0038 - acc: 0.9809

The testing accuracy metric for 0.1 dropout percentage is [0.00380483011235959, 0.9809]

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Train on 50000 samples, validate on 10000 samples

Epoch 1/15

50000/50000 [==============================] - 400s 8ms/sample - loss: 0.0755 - acc: 0.3581 - val\_loss: 0.0333 - val\_acc: 0.7593

Epoch 2/15

50000/50000 [==============================] - 381s 8ms/sample - loss: 0.0187 - acc: 0.8764 - val\_loss: 0.0109 - val\_acc: 0.9278

Epoch 3/15

50000/50000 [==============================] - 405s 8ms/sample - loss: 0.0096 - acc: 0.9381 - val\_loss: 0.0068 - val\_acc: 0.9557

Epoch 4/15

50000/50000 [==============================] - 332s 7ms/sample - loss: 0.0070 - acc: 0.9551 - val\_loss: 0.0055 - val\_acc: 0.9640

Epoch 5/15

50000/50000 [==============================] - 316s 6ms/sample - loss: 0.0058 - acc: 0.9633 - val\_loss: 0.0054 - val\_acc: 0.9639

Epoch 6/15

50000/50000 [==============================] - 401s 8ms/sample - loss: 0.0049 - acc: 0.9690 - val\_loss: 0.0039 - val\_acc: 0.9739

Epoch 7/15

50000/50000 [==============================] - 370s 7ms/sample - loss: 0.0044 - acc: 0.9720 - val\_loss: 0.0050 - val\_acc: 0.9684

Epoch 8/15

50000/50000 [==============================] - 359s 7ms/sample - loss: 0.0041 - acc: 0.9742 - val\_loss: 0.0033 - val\_acc: 0.9790

Epoch 9/15

50000/50000 [==============================] - 374s 7ms/sample - loss: 0.0035 - acc: 0.9779 - val\_loss: 0.0033 - val\_acc: 0.9789

Epoch 10/15

50000/50000 [==============================] - 389s 8ms/sample - loss: 0.0033 - acc: 0.9788 - val\_loss: 0.0039 - val\_acc: 0.9755

Epoch 11/15

50000/50000 [==============================] - 367s 7ms/sample - loss: 0.0030 - acc: 0.9813 - val\_loss: 0.0028 - val\_acc: 0.9818

Epoch 12/15

50000/50000 [==============================] - 306s 6ms/sample - loss: 0.0027 - acc: 0.9832 - val\_loss: 0.0029 - val\_acc: 0.9815

Epoch 13/15

50000/50000 [==============================] - 213s 4ms/sample - loss: 0.0025 - acc: 0.9844 - val\_loss: 0.0033 - val\_acc: 0.9787

Epoch 14/15

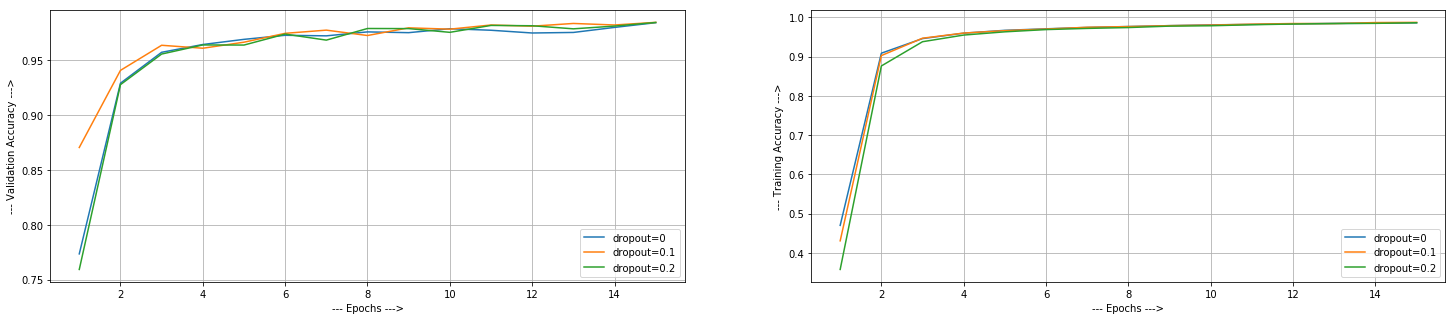
50000/50000 [==============================] - 179s 4ms/sample - loss: 0.0024 - acc: 0.9849 - val\_loss: 0.0030 - val\_acc: 0.9812

Epoch 15/15

50000/50000 [==============================] - 176s 4ms/sample - loss: 0.0022 - acc: 0.9865 - val\_loss: 0.0025 - val\_acc: 0.9845

10000/10000 [==============================] - 7s 653us/sample - loss: 0.0048 - acc: 0.9759

The testing accuracy metric for 0.2 dropout percentage is [0.00481778420060874, 0.9759]



**Observation:**

We can see that the model with less dropout ratio is able to reach more accuracy within 2 epochs. This might be because it has more parameters to learn, so it will learn more accurately. But it will be quite computationally expensive than the one with more dropout ratio. So, there is a trade off between the time and space efficiency. We can also see that all the model is able to reach same accuracy after significant amount of epochs.