Train on 50000 samples, validate on 10000 samples

Epoch 1/15

50000/50000 [==============================] - 869s 17ms/step - loss: 0.0880 - mean\_squared\_error: 0.0880 - acc: 0.3942 - val\_loss: 0.0852 - val\_mean\_squared\_error: 0.0852 - val\_acc: 0.5963

Epoch 2/15

50000/50000 [==============================] - 1236s 25ms/step - loss: 0.0787 - mean\_squared\_error: 0.0787 - acc: 0.6421 - val\_loss: 0.0671 - val\_mean\_squared\_error: 0.0671 - val\_acc: 0.7235

Epoch 3/15

50000/50000 [==============================] - 1257s 25ms/step - loss: 0.0514 - mean\_squared\_error: 0.0514 - acc: 0.7504 - val\_loss: 0.0351 - val\_mean\_squared\_error: 0.0351 - val\_acc: 0.8373

Epoch 4/15

50000/50000 [==============================] - 1081s 22ms/step - loss: 0.0300 - mean\_squared\_error: 0.0300 - acc: 0.8467 - val\_loss: 0.0224 - val\_mean\_squared\_error: 0.0224 - val\_acc: 0.8819

Epoch 5/15

50000/50000 [==============================] - 799s 16ms/step - loss: 0.0224 - mean\_squared\_error: 0.0224 - acc: 0.8764 - val\_loss: 0.0181 - val\_mean\_squared\_error: 0.0181 - val\_acc: 0.8966

Epoch 6/15

50000/50000 [==============================] - 770s 15ms/step - loss: 0.0192 - mean\_squared\_error: 0.0192 - acc: 0.8876 - val\_loss: 0.0161 - val\_mean\_squared\_error: 0.0161 - val\_acc: 0.9032

Epoch 7/15

50000/50000 [==============================] - 755s 15ms/step - loss: 0.0175 - mean\_squared\_error: 0.0175 - acc: 0.8936 - val\_loss: 0.0149 - val\_mean\_squared\_error: 0.0149 - val\_acc: 0.9091

Epoch 8/15

50000/50000 [==============================] - 775s 15ms/step - loss: 0.0164 - mean\_squared\_error: 0.0164 - acc: 0.8995 - val\_loss: 0.0141 - val\_mean\_squared\_error: 0.0141 - val\_acc: 0.9124

Epoch 9/15

50000/50000 [==============================] - 770s 15ms/step - loss: 0.0156 - mean\_squared\_error: 0.0156 - acc: 0.9037 - val\_loss: 0.0134 - val\_mean\_squared\_error: 0.0134 - val\_acc: 0.9165

Epoch 10/15

50000/50000 [==============================] - 745s 15ms/step - loss: 0.0149 - mean\_squared\_error: 0.0149 - acc: 0.9067 - val\_loss: 0.0129 - val\_mean\_squared\_error: 0.0129 - val\_acc: 0.9182

Epoch 11/15

50000/50000 [==============================] - 749s 15ms/step - loss: 0.0144 - mean\_squared\_error: 0.0144 - acc: 0.9098 - val\_loss: 0.0126 - val\_mean\_squared\_error: 0.0126 - val\_acc: 0.9189

Epoch 12/15

50000/50000 [==============================] - 763s 15ms/step - loss: 0.0139 - mean\_squared\_error: 0.0139 - acc: 0.9118 - val\_loss: 0.0123 - val\_mean\_squared\_error: 0.0123 - val\_acc: 0.9220

Epoch 13/15

50000/50000 [==============================] - 758s 15ms/step - loss: 0.0135 - mean\_squared\_error: 0.0135 - acc: 0.9146 - val\_loss: 0.0120 - val\_mean\_squared\_error: 0.0120 - val\_acc: 0.9231

Epoch 14/15

50000/50000 [==============================] - 748s 15ms/step - loss: 0.0132 - mean\_squared\_error: 0.0132 - acc: 0.9161 - val\_loss: 0.0117 - val\_mean\_squared\_error: 0.0117 - val\_acc: 0.9277

Epoch 15/15

50000/50000 [==============================] - 768s 15ms/step - loss: 0.0129 - mean\_squared\_error: 0.0129 - acc: 0.9175 - val\_loss: 0.0114 - val\_mean\_squared\_error: 0.0114 - val\_acc: 0.9275

10000/10000 [==============================] - 25s 2ms/step

The testing accuracy metric for 1 no. of CNN layers is [0.011794621224561706, 0.011794621224561706, 0.9258]

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Train on 50000 samples, validate on 10000 samples

Epoch 1/15

50000/50000 [==============================] - 824s 16ms/step - loss: 0.0897 - mean\_squared\_error: 0.0897 - acc: 0.1880 - val\_loss: 0.0892 - val\_mean\_squared\_error: 0.0892 - val\_acc: 0.3772

Epoch 2/15

50000/50000 [==============================] - 818s 16ms/step - loss: 0.0887 - mean\_squared\_error: 0.0887 - acc: 0.5216 - val\_loss: 0.0880 - val\_mean\_squared\_error: 0.0880 - val\_acc: 0.6245

Epoch 3/15

50000/50000 [==============================] - 817s 16ms/step - loss: 0.0871 - mean\_squared\_error: 0.0871 - acc: 0.6089 - val\_loss: 0.0855 - val\_mean\_squared\_error: 0.0855 - val\_acc: 0.6325

Epoch 4/15

50000/50000 [==============================] - 828s 17ms/step - loss: 0.0822 - mean\_squared\_error: 0.0822 - acc: 0.5743 - val\_loss: 0.0756 - val\_mean\_squared\_error: 0.0756 - val\_acc: 0.5811

Epoch 5/15

50000/50000 [==============================] - 825s 16ms/step - loss: 0.0609 - mean\_squared\_error: 0.0609 - acc: 0.6556 - val\_loss: 0.0421 - val\_mean\_squared\_error: 0.0421 - val\_acc: 0.7681

Epoch 6/15

50000/50000 [==============================] - 817s 16ms/step - loss: 0.0335 - mean\_squared\_error: 0.0335 - acc: 0.8117 - val\_loss: 0.0234 - val\_mean\_squared\_error: 0.0234 - val\_acc: 0.8721

Epoch 7/15

50000/50000 [==============================] - 812s 16ms/step - loss: 0.0225 - mean\_squared\_error: 0.0225 - acc: 0.8691 - val\_loss: 0.0176 - val\_mean\_squared\_error: 0.0176 - val\_acc: 0.8972

Epoch 8/15

50000/50000 [==============================] - 831s 17ms/step - loss: 0.0183 - mean\_squared\_error: 0.0183 - acc: 0.8902 - val\_loss: 0.0150 - val\_mean\_squared\_error: 0.0150 - val\_acc: 0.9080

Epoch 9/15

50000/50000 [==============================] - 816s 16ms/step - loss: 0.0161 - mean\_squared\_error: 0.0161 - acc: 0.9011 - val\_loss: 0.0136 - val\_mean\_squared\_error: 0.0136 - val\_acc: 0.9148

Epoch 10/15

50000/50000 [==============================] - 820s 16ms/step - loss: 0.0147 - mean\_squared\_error: 0.0147 - acc: 0.9084 - val\_loss: 0.0125 - val\_mean\_squared\_error: 0.0125 - val\_acc: 0.9216

Epoch 11/15

50000/50000 [==============================] - 819s 16ms/step - loss: 0.0136 - mean\_squared\_error: 0.0136 - acc: 0.9147 - val\_loss: 0.0116 - val\_mean\_squared\_error: 0.0116 - val\_acc: 0.9259

Epoch 12/15

50000/50000 [==============================] - 837s 17ms/step - loss: 0.0128 - mean\_squared\_error: 0.0128 - acc: 0.9197 - val\_loss: 0.0111 - val\_mean\_squared\_error: 0.0111 - val\_acc: 0.9304

Epoch 13/15

50000/50000 [==============================] - 814s 16ms/step - loss: 0.0121 - mean\_squared\_error: 0.0121 - acc: 0.9240 - val\_loss: 0.0104 - val\_mean\_squared\_error: 0.0104 - val\_acc: 0.9343

Epoch 14/15

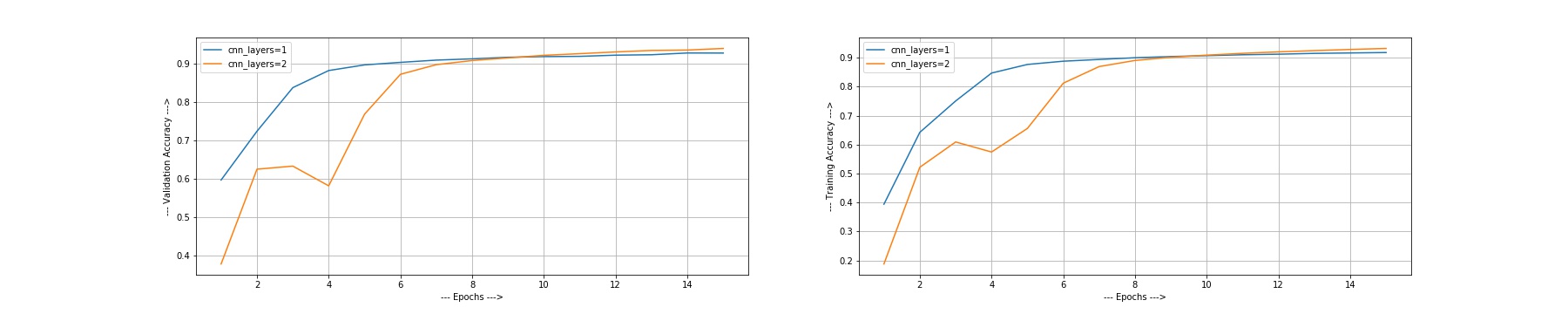
50000/50000 [==============================] - 816s 16ms/step - loss: 0.0115 - mean\_squared\_error: 0.0115 - acc: 0.9281 - val\_loss: 0.0102 - val\_mean\_squared\_error: 0.0102 - val\_acc: 0.9353

Epoch 15/15

50000/50000 [==============================] - 822s 16ms/step - loss: 0.0110 - mean\_squared\_error: 0.0110 - acc: 0.9316 - val\_loss: 0.0096 - val\_mean\_squared\_error: 0.0096 - val\_acc: 0.9395

10000/10000 [==============================] - 43s 4ms/step

The testing accuracy metric for 2 no. of CNN layers is [0.009957345556467772, 0.009957345556467772, 0.9373]



**OBSERVATIONS:**

We can see from above graph that the final accuracy is better in case the count of hidden CNN layer is 2. But we can also see that the model with 2 CNN layers took more time to converge than the one with 1 layer. This is expected as it takes more time to train more parameter. But after enough epochs, the accuracy of model with greater number of hidden CNN layers is greater. But increasing the layers after one point not only computational expensive(takes large time to compute ) but also overfits the data, which we should avoid.