DEEP LEARNING

ASSIGNMENT-03

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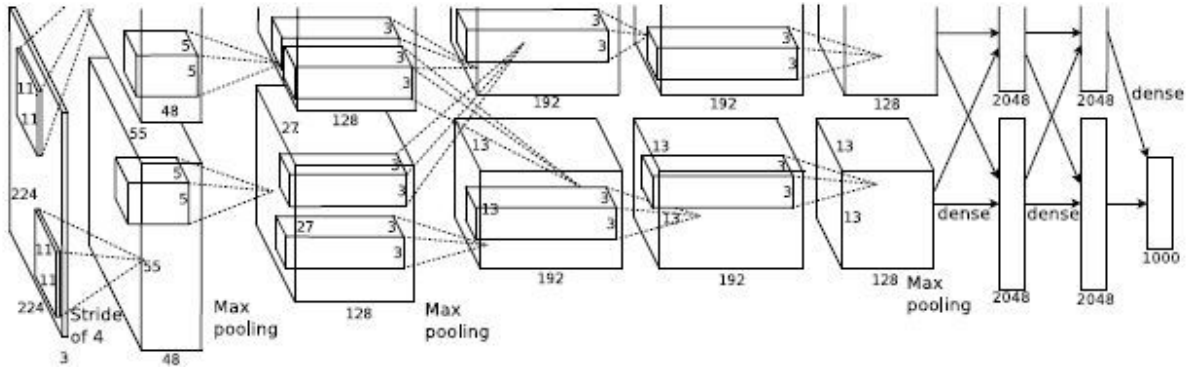
ALEXNET ARCHITECTURE

AlexNet was the winner of the 2012 ImageNet LSVRC-2012 competition. Some special features of AlexNet that were introduced at that time were -

- A speed increase of 6 times was achieved by using ReLU instead of tanh to introduce non-linearity.
- To reduce overfitting, instead of normal regularisation a dropout layer was added.
- The size of the network was reduced by overlapping pooling. Although, there was a decrease in speed.



Architecture of AlexNet

AlexNet has 5 conv layers and 3 fully-connected layers. ReLU is applied after very convolutional and fully connected layer. Dropout is applied before the first and the second fully connected year. The network has 62.3 million parameters, and needs 1.1 billion computation units in a forward pass.

METHODOLOGY

The AlexNet code was trained on a flowers dataset containing 6 million images.

The model was trained under 4 different cases : -

- **Case 1 :** Original AlexNet model
- **Case 2:** The stride of the first Conv layer was changed from 4 to 5 and all the pooling layers were changed from stride 2 to stride 3
- **Case 3:** Same as Case 2 but the dropout values were decreased from 0.5 to 0.4
- **Case 4:** Add drop-connect layers instead of dropout layers.

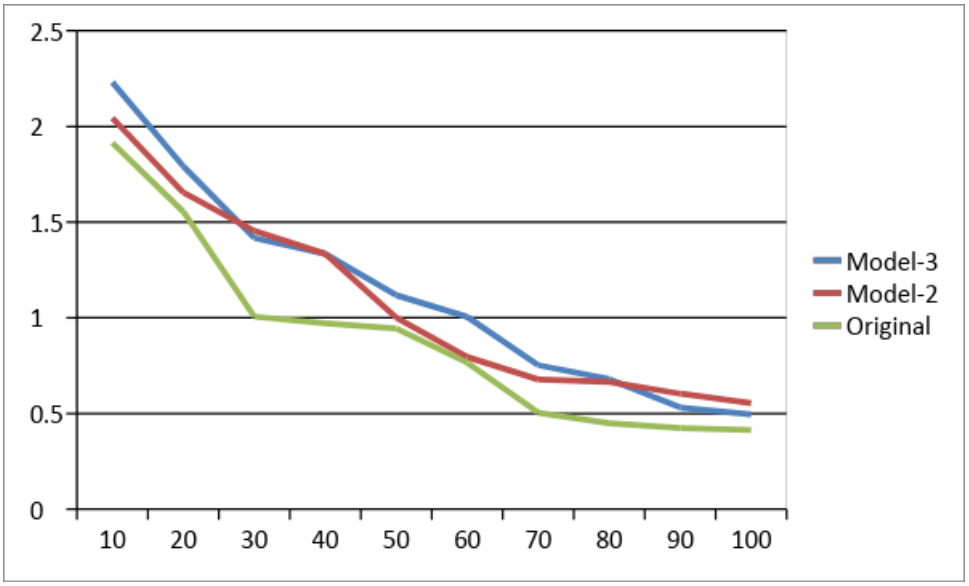
The AlexNet code was written using Keras on python which has all the layers required for the CNN inbuilt. Since, the drop-connect layer was not predefined, we defined it manually using the following code -

```
def dropconnect(W, p):
    return tf.nn.dropout(W, keep_prob=p)*p
```

This code returns a drop-connect layer which drops weights with probability p.

OBSERVATIONS

The plot for Loss v/s Epoch is given by : -



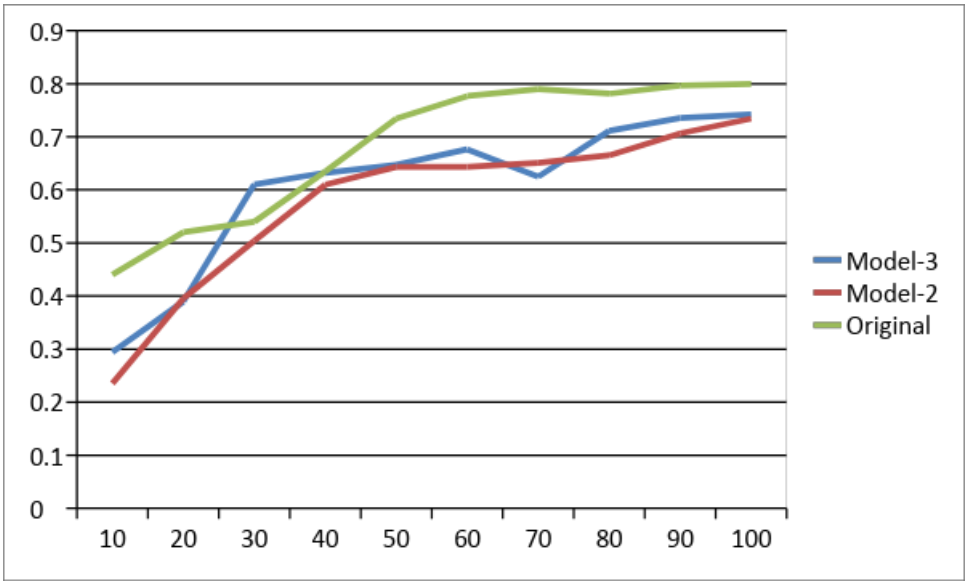
LOSS V/S EPOCH

As we can see that the original model had the minimum loss throughout and the loss function decreased better than the other two models. As stride was increased in case of Model-2, the loss values are higher and the loss function converges slowly. This can be due to the fact that increased stride may have led the model to miss some features.

In case of Model-3, the dropout was decreased in addition to increased stride which led to even higher values of loss function for the most part. For Model - 4, when we added

drop-connect instead of dropout, the loss decreases with respect to the model with dropout i.e. Case-3. Otherwise, the training time was similar to the Case-3 model.

The plot for Validation Accuracy v/s Epoch is given by : -



VALIDATION LOSS V/S EPOCH

We can clearly observe from the graph that the original AlexNet model had the highest accuracy at the same epoch number when compared to the other two models. This is in line with the lower loss function values observed for the original model with respect to the other two. Model-2 had lower accuracy than the original model but still higher than Model-3 where the dropout values were decreased. Model-3 has the lowest accuracy observed amongst the three but was still at 74.27%. For Model-4 i.e. the one with the drop-connect layer, the validation accuracy increased by about 2% when compared with Case-3.