ADVANCED MACHINE LEARNING
(BA-64061-001)
Assignment 3: Convolution
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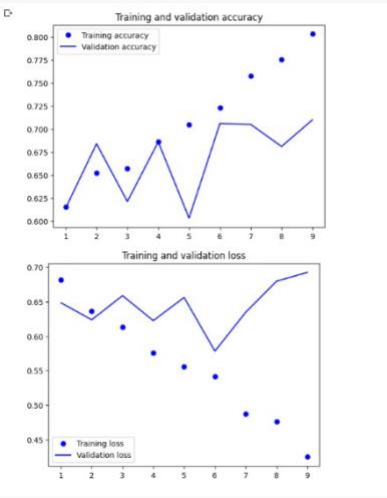
1. Consider the Cats & Dogs example. Start initially with a training sample of 1000, a validation sample of 500, and a test sample of 500. Use any technique to reduce overfitting and improve performance in developing a network that you train from scratch. What performance did you achieve?

1. Training sample size=1000, validation=500, test sample=500

Training sample size	Validation Accuracy	Test Accuracy
1000	59.4	55.4



2. Increasing training sample sizes and keeping validation and test sets as constant and used optimization techniques to improve accuracy.

Validation Accuracy	Test Accuracy
74.7	80.2
76.90	78.3

In this case, we have raised the training sample size to 3000 and tuned the model using dropout and augmentation techniques. As a result, the model's accuracy has improved.

3. Tuning the model using optimization techniques and changing the training sample size to find the ideal training sample size to get best prediction results.

Training sample	Validation Accuracy	Test Accuracy
5000	83.60	83.1
5000	84.30	83.7
10000	89.5	87
10000	85.3	89.9
12000	97.8	97
12000	91.4	92.1

However, at a certain level (12000) the test and validation accuracy started to decrease after using augmentation techniques, indicating that the model's learning rate is too high. Currently, we have increased the sample size to various sizes and can observe an improvement in accuracy over the previous sample. The model may typically overfit small datasets, so we chose 10000 as the ideal training sample.

4. Using pretrained model, finding optimal epochs and finding best accuracy using optimization techniques.

Pretrained model

Training sample	Validation accuracy	Test accuracy
1000	96	96.5
1000	97.1	97.5

Because the pretrained model outperforms the scratch model with a smaller sample size, we can see that it is strongly advised for better performance.

5. Now, we check on different training samples to know how accuracy has been changing.

Training sample	Validation accuracy	Test accuracy
3000	96.3	98.2
5000	97.0	97.2
10000	98.1	99.1
12000	99.6	99.7

According to the results above, trained models often provide better accuracy than scratch models, and the best accuracy is attained at 12000, which is the maximum dataset I have chosen, with a 99.7% accuracy rate.

CONCLUSION:

- Based on our data, we can conclude that accuracy is greatly influenced by the network and training sample choices, which indicates their dependability.
- The performance of CNN is greatly influenced by the network choice and training sample selection. To get the best results, significant thought and testing must go into choosing the right training data and structure.
- The size, organization, and activation functions of the network, as well as its complexity and the amount of training data available, all affect the structure of CNN.
- •However, the precise examples used to train the network depend on the selection of training samples. They are classified as cats, dogs, cats, and so on in this instance of picture categorization.
- If the training sample is high, CNN may become too noisy and struggle to learn patterns. Conversely, if the training sample is low, CNN may overfit and perform poorly on unseen data.
- Additionally, we can observe that the test accuracy has been decreasing in the scratch model when it reaches to a certain level, which means that the model is too complex for that model, whereas pre-trained model accuracy has been increasing as the sample size increases.

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