Assignment 2

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Applying Convolutional Networks (Convnets) to Image Data

Introduction:

In this example we study the performance of developing a convolutional neural network using the cats and dog’s dataset from Kaggle, determining which sample size and approach is most suitable throughout the model building stage.

Methodology:

In this we created 3 scratch models and two pre trained models.

Scratch models:

Accuracy, Validation Accuracy, Test Loss, Test Accuracy

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| Model No | Training Sample Size | Validation, Test | Accuracy | Validation Accuracy | Test Accuracy | Test Loss |
| 1 | 1000 | 500,500 | 97.85 | 76.40 | 69.20 | 62.83 |
| 2 | 1500 | 500,500 | 99.15 | 74.50 | 72.50 | 60.83 |
| 3 | 2000 | 500,500 | 99 | 72.80 | 68.80 | 63.04 |

Pre-Trained Models:

Accuracy, Validation Accuracy, Test Loss, Test Accuracy

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| Model No | Training Sample Size | Validation, Test | Accuracy | Validation Accuracy | Test Accuracy | Test Loss |
| VGG Model -1 | 1000 | 500,500 | 97.20 | 97.60 | 96.10 | 0.49 |
| VGG Model-2 | 1500 | 500,500 | 98.45 | 99 | 97.68 | 0.20 |

A graph of a graph

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A graph of a training and validation accuracy

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These are the results of three models constructed from the ground up, demonstrating that the larger the training sample size, the more accurate the model.

The best way to avoid overfitting is to change the training sample and use optimization techniques. It is not always possible to expand the training sample, so Data augmentation is a way to maximize training data.

When the model is smaller, i.e., in terms of how many learnable parameters there are in the model (i.e., how many layers and how many units in layers there are), the amount of overfitting is significantly reduced. By limiting the weights to very small values, you can reduce or prevent overfitting by normalizing the way the weight values are distributed. This makes the network less complex.

For optimization purposes, I have integrated learning rate and dropout approaches. The accuracy of the new model was higher than that of the prior model due to its bigger sample size and use of optimizers.

Conclusion:

In brief, the size of the training sample plays a crucial role in improving model accuracy by preventing overfitting. To further improve the model's performance, hyper-tuning elements like dropout strategy, and data augmentation are used.

1. A rather low accuracy of 70.90 is found in the Model 1 unregularized Model of Cats and Dogs example, which has 1000 training samples, 500 validation samples, and 500 test samples. This demonstrates overfitting because of the small training sample.
2. While maintaining the sample size at 500, we may be able to enhance the model's performance by mixing multiple methodologies. I used three different approaches on the model to do this: a) Drop out Technique.

b) Drop-Out technique and data augmentation.

1. It was found that the model that was trained using the dropout technique and data augmentation performed better.
2. Train with additional data: Training with more data improves accuracy. We tried increasing the training samples to 1500 and 2000, and the accuracy increased.
3. When the models were pretrained, the accuracy increased to about **98%.**

Adding more data always helps increase data training, which boosts accuracy. As a result, we can see how a pre-trained network can be helpful in creating a better model with less data and greater accuracy due to the extensive training it received in the past.