**Convolution Neural Networks**

**Assignment 2-Report**

**Shivani Haridas Pitla**

**Introduction:**In this report, we will evaluate the performance of building a convolution neural network considering the Cats and Dogs example. By changing and finding out which sample size and technique is more helpful during the model-building stage.

**Methodology:**

We have built 6 models under Scratch Models and 3 Models under Pre-Trained Modelsusing various configurations. These configurations include a different number of layers, different numbers of nodes, optimizers, dropout rates, and other parameters.

**Validation Accuracy, Test Accuracy, and Test loss: (Scratch Models)**

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **Model no** | **Training sample size** | **Validation and Test sample size** | **Validation  Accuracy** | **Test Accuracy** | **Test Loss** |
| Model 1 | 1000 | 500,500 | 0.73 | 0.71 | 0.57 |
| Model 1a | 1000 | 500,500 | 0.71 | 0.78 | 0.45 |
| Model 1b | 1000 | 500,500 | 0.71 | 0.75 | 0.52 |
| Model 1c | 1000 | 500,500 | 0.77 | 0.82 | 0.43 |
| Model 2 | 5000 | 500,500 | 0.98 | 0.87 | 0.40 |
| Model 3 | 10000 | 500,500 | 0.92 | 0.90 | 0.27 |

**Validation Accuracy, Test Accuracy, and Test Loss: (Pre-Trained Models)**

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **Model no** | **Training Sample Size** | **Validation and test sample size** | **Validation  Accuracy** | **Test Accuracy** | **Test Loss** |
| Model 4 | 1000 | 500,500 | 0.976 | 0.97 | 0.27 |
| Model 5 | 5000 | 500,500 | 0.98 | 0.973 | 0.10 |
| Model 6 | 10000 | 500,500 | 0.98 | 0.985 | 0.076 |

**Observations:**

* The unregularized Model of Cats and Dogs example with a training sample of 1000, validation sample of 500, and test sample of 500 gave a very low accuracy of 71%. This represents Overfitting as the training size is small.
* By using different techniques, we can optimize the performance of the model and keep the sample size the same, which is 1000. For this, I have used three techniques in the model which are.

1. Dropout Method
2. Data Augmentation
3. Data Augmentation and dropout method.

* It was observed that the model trained using data augmentation and dropout method gave improved accuracy.
* Train with more data: Training with more data helps to increase accuracy. We tried to increase the training samples to 5000 and 10000 gave improved accuracy.
* When we increased the training sample size to 5000 the validation accuracy increased to 98%. Here I have included Maxpooling, Data augmentation, and dropout method with a dropout rate of 0.5 and Early stopping.
* When we further increased the training sample size to 10000 the validation accuracy was at 92%.
* When compared to the unregularized model the regularized models seemed to provide improved accuracy.
* When the models with training sizes 1000, 5000, and 10000 were pre-trained, we can observe that both the validation and test accuracy has been improved.
* Overall, the training sample size of 5000 gave the highest accuracy in both scratch and pre-trained models.

**Conclusion:**

To conclude we can say that the size of the training sample plays an important role in improving the accuracy of the model as it solves the problem of overfitting. And also, the hyper tuning parameters like max-pooling and data augmentation, and dropout method also help in improving the performance of the model further.

When the models were pre-trained we can observe a huge spike in the accuracy so we conclude that pretraining the model also plays a significant role along with the training sample size of the model.