

Analysis of Cat-Dog Classification Models

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1 Introduction

In this report, I present the performance metrics of several VGG model architectures for a cat-dog classification task, including the effect of Image Data Augmentation (IDA) and different learning rates. Each model is assessed based on its training time and classification accuracy. The models vary based on the number of blocks they contain, ranging from one to seven, and whether they include dropout layers or IDA.

2 Models and Training

The models consist of convolutional neural network architectures based on VGG, with blocks varying from one to seven. Each block contains a 2D convolution layer followed by a max pooling layer. The dropout models additionally have dropout layers included after each max pooling operation for regularization. Some models have also incorporated IDA. Finally, I also varied the learning rate in some models to observe its effect on performance and learning time.

3 Results

M1: 1 blocks & 4 layers VGG model **M2:** 2 block & 5 layers VGG model

M3: 3 block & 6 layers VGG model **M4:** 4 block & 7 layers VGG model

M5: 5 block & 8 layers VGG model **M6:** 7 block & 10 layers VGG model

Dropout 1: M1 model with dropout regularization.

Dropout 2: M2 model with dropout regularization.

Dropout 3: M3 model with dropout regularization.

Dropout 4: M4 model with dropout regularization.

Dropout 5: M5 model with dropout regularization.

Dropout 6: M6 model with dropout regularization.

IDA Model: M3 model with Image Data Augmentation.

Dropout IDA Model: Dropout 3 model with Image Data Augmentation.

Dropout (LR=X): Dropout 3 model with learning rate X.

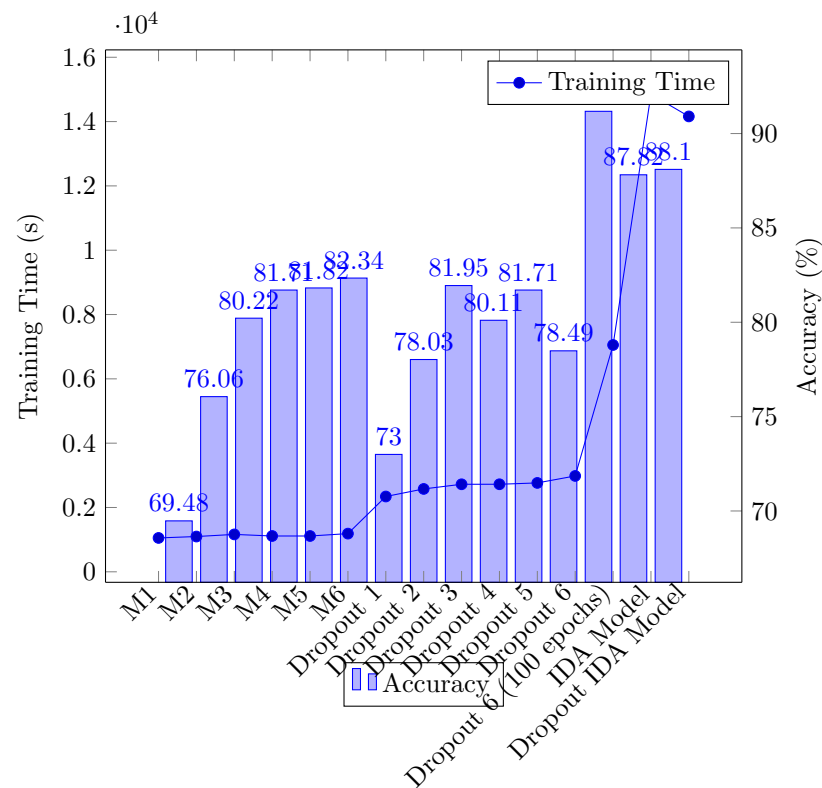
20 epochs are used for normal models, 50 epochs are used for dropout models and 100 epochs are used for IDA models and learning rate test models.

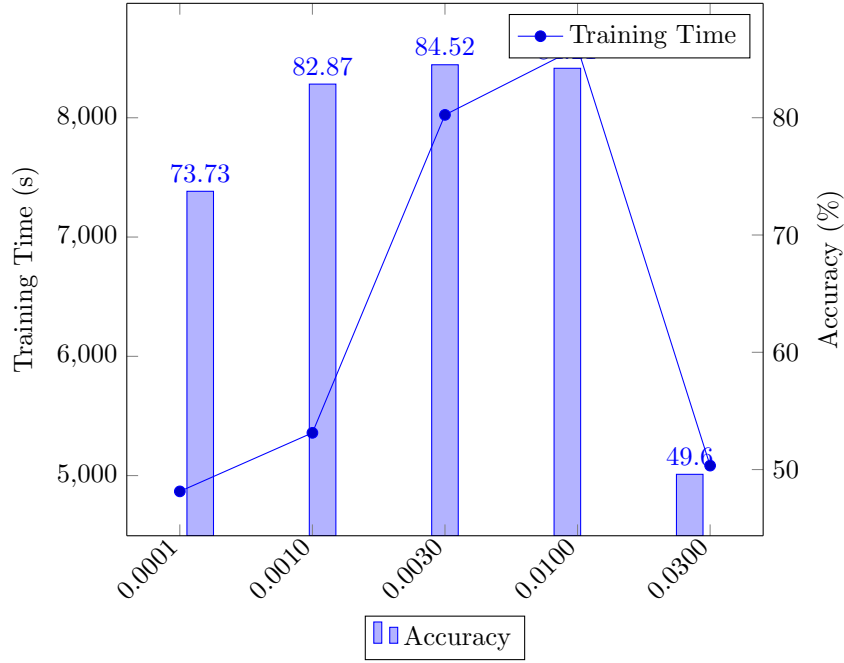
The following table lists the training time and accuracy for each model:

| Model | Training Time (seconds) | Accuracy (%) |
|------------------------|-------------------------|--------------|
| M1 | 1053.07 | 69.475 |
| M2 | 1096.75 | 76.059 |
| M3 | 1162.90 | 80.216 |
| M4 | 1113.49 | 81.707 |
| M5 | 1113.34 | 81.818 |
| M6 | 1187.38 | 82.342 |
| Dropout 1 | 2341.55 | 72.997 |
| Dropout 2 | 2576.91 | 78.026 |
| Dropout 3 | 2721.81 | 81.945 |
| Dropout 4 | 2722.27 | 80.105 |
| Dropout 5 | 2763.94 | 81.707 |
| Dropout 6 | 2980.78 | 78.486 |
| Dropout 6 (100 epochs) | 7053.15 | 91.179 |
| IDA Model | 14849.57 | 87.815 |
| Dropout IDA Model | 14160.34 | 88.101 |
| Dropout (LR=0.0001) | 4867.64 | 73.727 |
| Dropout (LR=0.0010) | 5358.49 | 82.865 |
| Dropout (LR=0.0030) | 8024.23 | 84.515 |
| Dropout (LR=0.0100) | 8587.45 | 84.214 |
| Dropout (LR=0.0300) | 5083.72 | 49.595 |

Table 1: Training time and accuracy for each model.

Below is the graphical representation of the above data:





4 Conclusion

This report presents results from a cat-dog classification task using several VGG-based models, including variations in the number of blocks, dropout regularization, Image Data Augmentation (IDA), and different learning rates. The results demonstrate how these factors affect training time and model accuracy. In general, models with dropout layers and IDA have higher training times due to the increased complexity and the additional data generated for training. The highest accuracy was achieved by the dropout 6 model with 100 epochs. In addition to that by looking at the tests on the 3-layer model, we can say that the image data augmentation models significantly increase the performance, and if I applied it on the dropout 6 model, we could achieve much better results (It didn't due to length of training times). About the learning rates, their performance can be better interpreted by looking at the graphs inside the results folder and when we look at that graphs the the fastest and most consistent learning rate for our model is 0.01 lower lrs than that are slower and 0.03 is not learning successfully.