ELEC 475 Lab 4: YODA

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## Step 3:

Our model is based on the Resnet-18 model with the last layer being altered to go from an output of 1000 to an output of 2. In addition, a dropout layer with 50% activation was added before a last fully connected layer was added to the model going from 2 input to 2 outputs. The following hyperparameters were used to train our model:

* Optimizer – Adam
* Scheduler – lr\_scheduler.ReduceLROnPlateau
* Loss function – Cross Entropy
* Learning rate – 0.0001
* Weight decay – 0.001
* Patience – 2
* Min Learning Rate – 0.001
* Gamma – 0.9
* Epochs - 50

The models accuracy as well as confusion matrix result was tested against the training dataset as well as the validation dataset. The table below outlines the final results of the training.

|  |  |
| --- | --- |
| Metric | Result |
| Training Accuracy | 99.68% |
| Validation Accuracy | 96.71% |
| Training True Positive | 70969 (24.64%) |
| Training True Negative | 216123 (75.05%) |
| Training False Positive | 475 (0.16%) |
| Training False Negative | 433 (0.15%) |
| Validation True Positive | 16245 (22.85%) |
| Validation True Negative | 52501 (73.85%) |
| Validation False Positive | 992 (1.40%) |
| Validation False Negative | 1350 (1.90%) |
| Final Loss | 0.135 |

A graph with blue lines and orange lines

Description automatically generated

Figure : Loss plot for training and testing dataset

## Step 4:

Our method to get the IoU for each predicted “Car” ROI worked well primarily due to the accuracy of our model being so high. It was able to predict the correct ROIs. The final average IoU for all images in the validation dataset was 0.117 or 11.7%. We believe this result is limited due to the size of the bounding boxes. If more anchors were used and the bounding boxes covered smaller areas the percentage of the truth box would take up more of the bounding box.

## Discussion:

The performance of the system had a very high training and testing accuracy, which corresponds to the high True Positive and Negative values, and low False Positive and Negative values found in the confusion matrix. However, despite the high accuracy, the model itself encountered various issues.

Firstly, the final model doesn’t have a very smooth convergence rate. This is expected due to the nature of the test set having less data than that of the training, which causes more sensitivity in the test loss. However, what was unexpected was that the loss for the test data converged lower than that of the training data, which shows overfitting. While training earlier iterations of the model, it would often have significant issues with overfitting the data. The model was initially trained using ResNet with untrained weight, which resulted in overfitting. ResNet’s default weights were then imported into the encoder and used for training, which once again resulted in overfitting. Then finally a 2 x 2 fully connected layer (FC) was added at end, resulting in current output. The reason these changes improved the output is because through using a trained model, the system was able to better classify the general feature of cars, as opposed to the very specific features. Furthermore, the addition of the FC added more nonlinearity and robustness to the output. While overfitting is still present, it is much less significant than the previous iterations, and it converges closer to that of the training dataset.