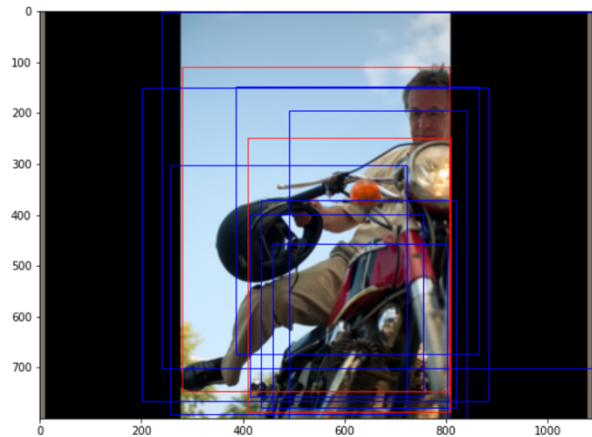
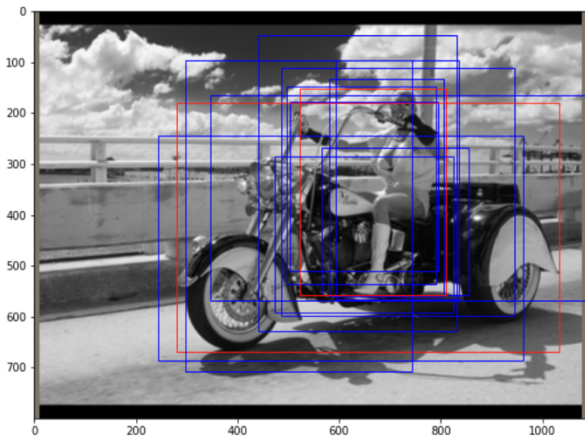
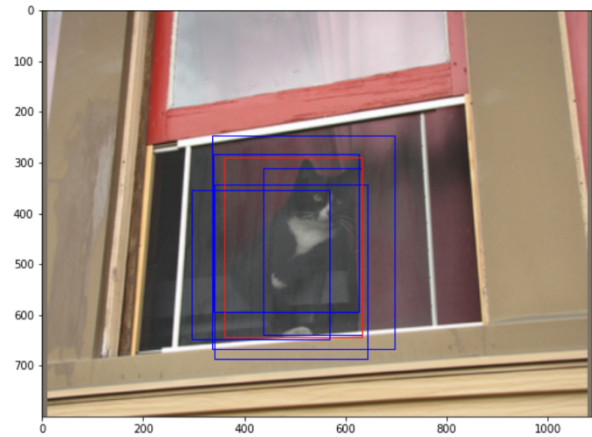
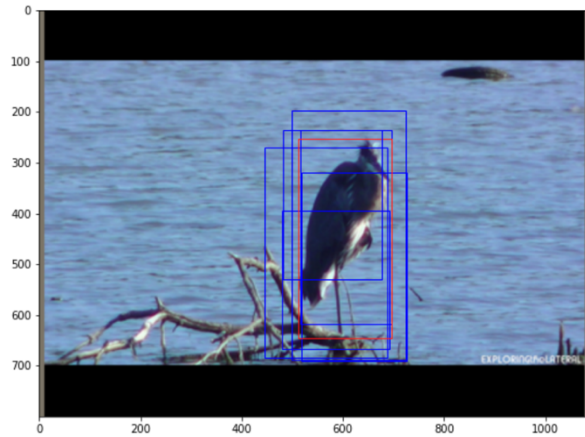
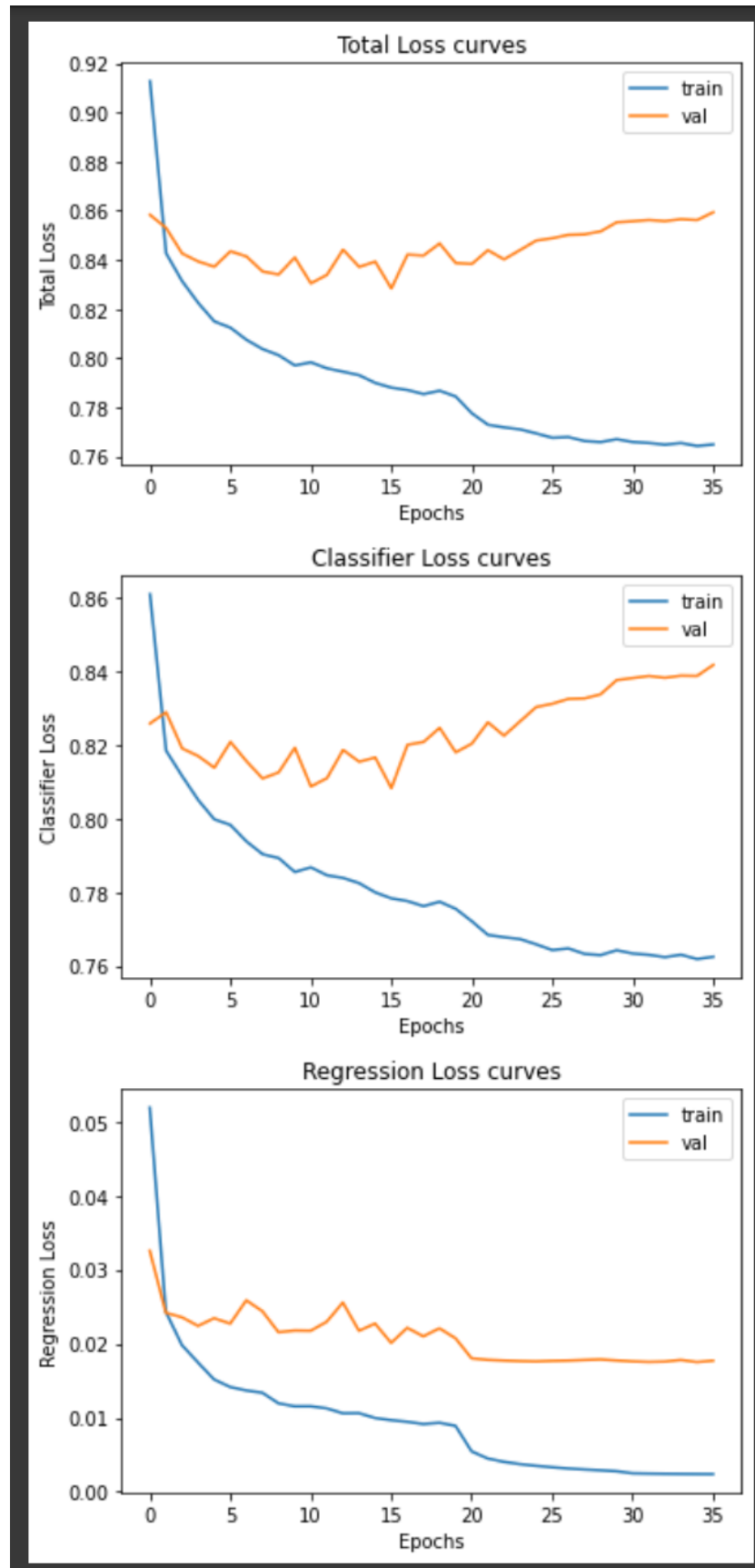


## 1) Image Plots:

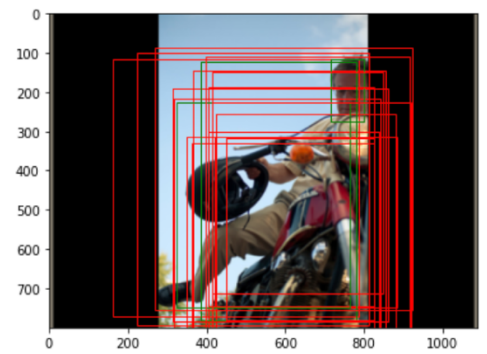
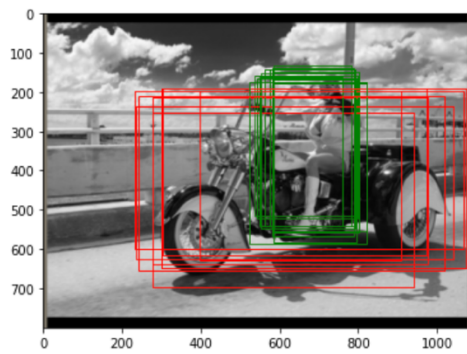
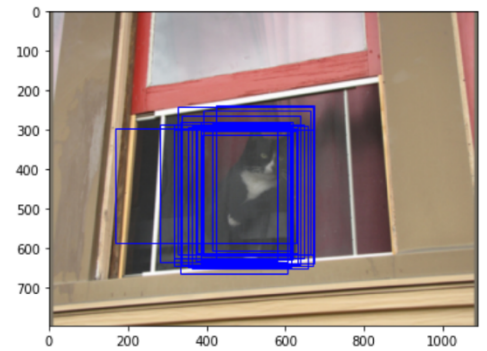
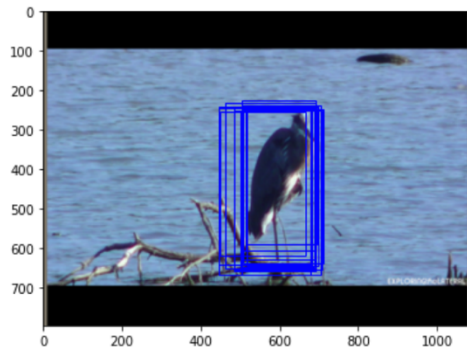


## 2) Training and Validation Curves:



3)

Top 20 Boxes, Class legend: Animal=Blue, Vehicle=Red, Person=Green

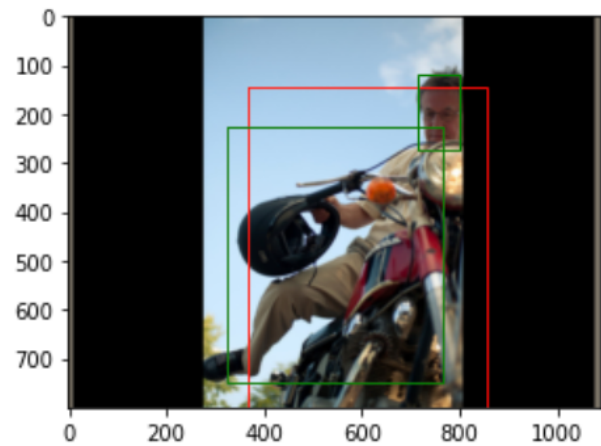
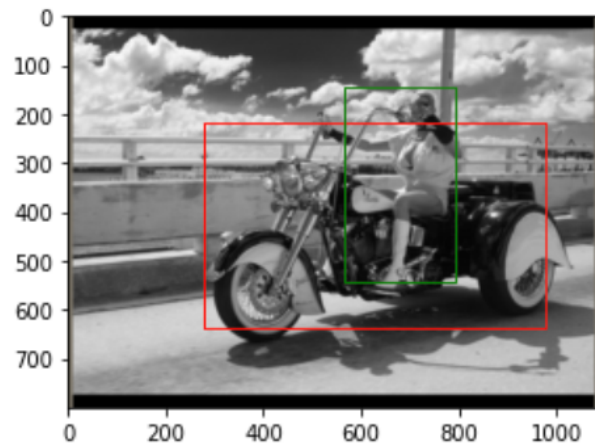
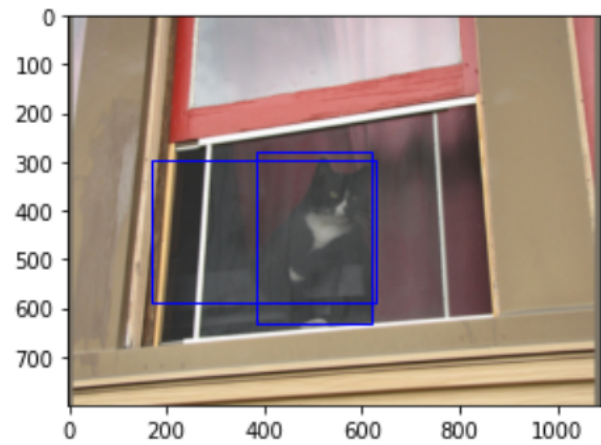
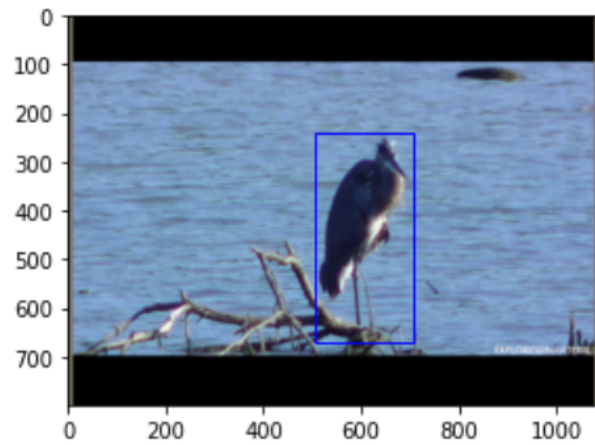


4) mAP values:

Validation mAP: 0.6022569333545947  
Validation Vehicle AP: 0.6180097993491926  
Validation Person AP: 0.6007525610008374  
Validation Animal AP: 0.588008439713754

5)

Postprocessed Predictions, Class legend: Animal=Blue, Vehicle=Red, Person=Green



- 6) We chose a learning rate schedule of 0.001 for the first 20 epochs, 0.0001 for epochs 21 to 30, and 0.00001 for the final 6 epochs. We determined this as the optimal learning rate schedule after running training several times with different learning rate settings and observing the convergence rate in the loss plots. We chose the Adam optimizer for faster convergence compared to SGD. We did not make any changes to the model architecture. We also did not make any changes to the number of proposals fed into the Box Head (200). We weighted the regression loss relative to the classification loss by a factor of 10. For the postprocessing, we experimented with several settings and found that using a threshold of 0.8 for low confidence suppression, keeping 200 boxes pre-NMS, and keeping 3 boxes post-NMS gave us reasonable mAP and AP values on our validation dataset. These are the hyperparameters we used for making model predictions on the holdout dataset. The visualizations and metrics suggest that our model demonstrates reasonable performance in object detection. However, we believe we could significantly improve upon performance by experimenting with different weightings between the regression and classification loss functions; we did not have time to test different values and just chose a value that seemed intuitive.

Overall, the biggest challenge for us in this project was implementing the ground truth creation and multi-scale ROI-Align in a way that maintained the same order of bounding box proposals. This took a lot of debugging to get right.