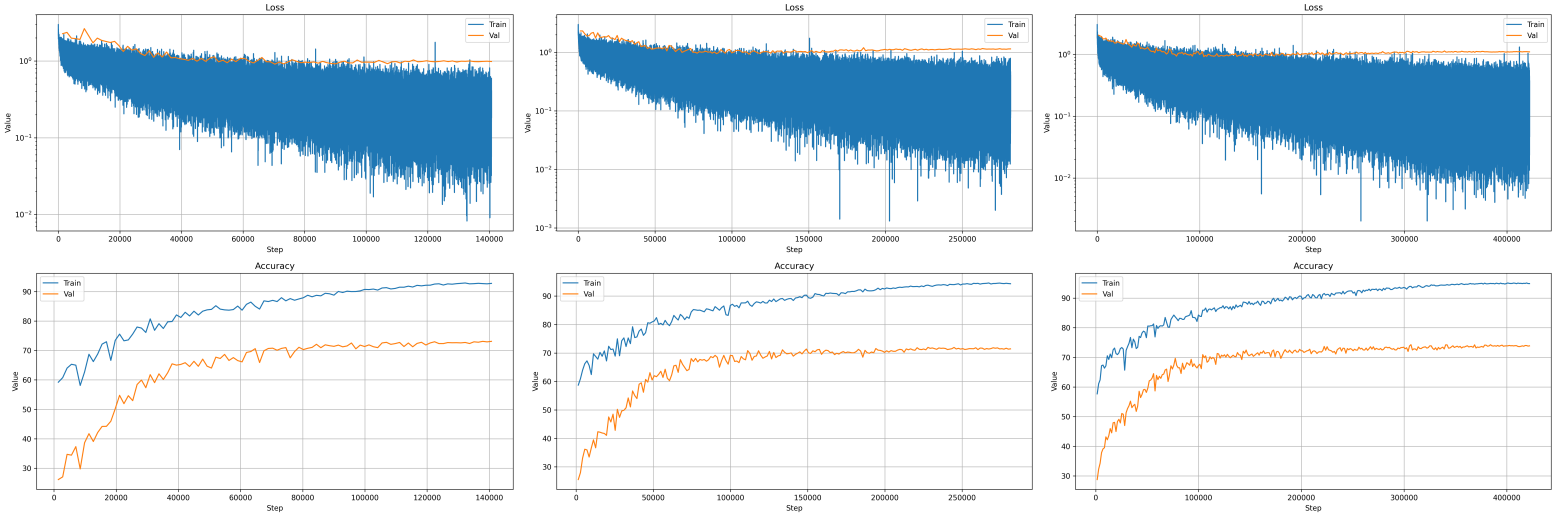
Project 2: Convolutional Neural Networks

Question 1: Image Classification

After tuning the hyper-parameters, I report the loss and accuracy curves with epochs of 100, 200, and 300 in Figure 1. The validation accuracy is 73.10%, 71.46%, and 73.88%, respectively. I submit the model weights with the highest validation accuracy and use the model to predict the test set.



(a) Epoch = 100 (b) Epoch = 200 (c) Epoch = 300

Figure 1: Q1 results.

Question 2: Visualizing the filters

I present all the filters from the first layer in Figure 2. These filters typically capture simple patterns such as edges and textures. Some filters in Figure 2 resemble common features in airplanes, automobiles, and birds.

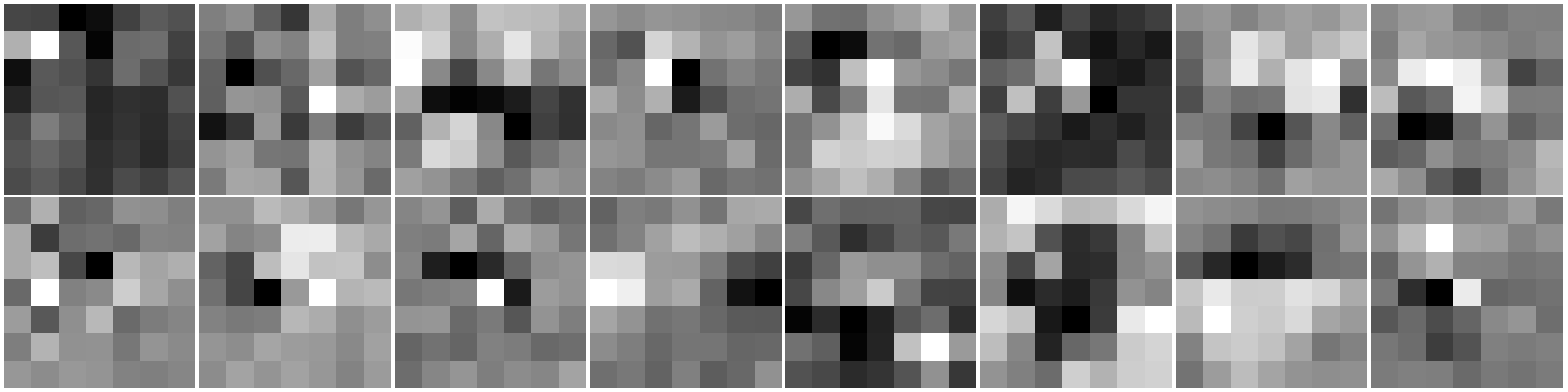


Figure 2: Q2 results.

I present all the bar plots corresponding to filters from the first and the final convolutional layers in Figure 3 and Figure 4, respectively. From the perspective of variance across the classes, the filter in the first layer has similar activations across all classes, and the variance is very small. This indicates that the filter in the first layer likely detects generic features across multiple classes. On the contrary, the filter in the final layer has high variance, which indicates that the filter is class-discriminative and specialized in detecting features specific to certain categories.

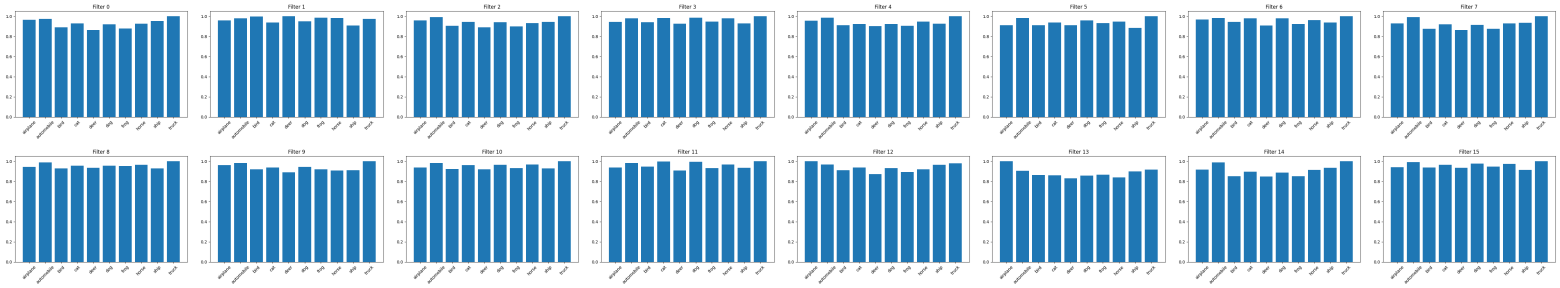


Figure 3: Q3 results for the first layer.

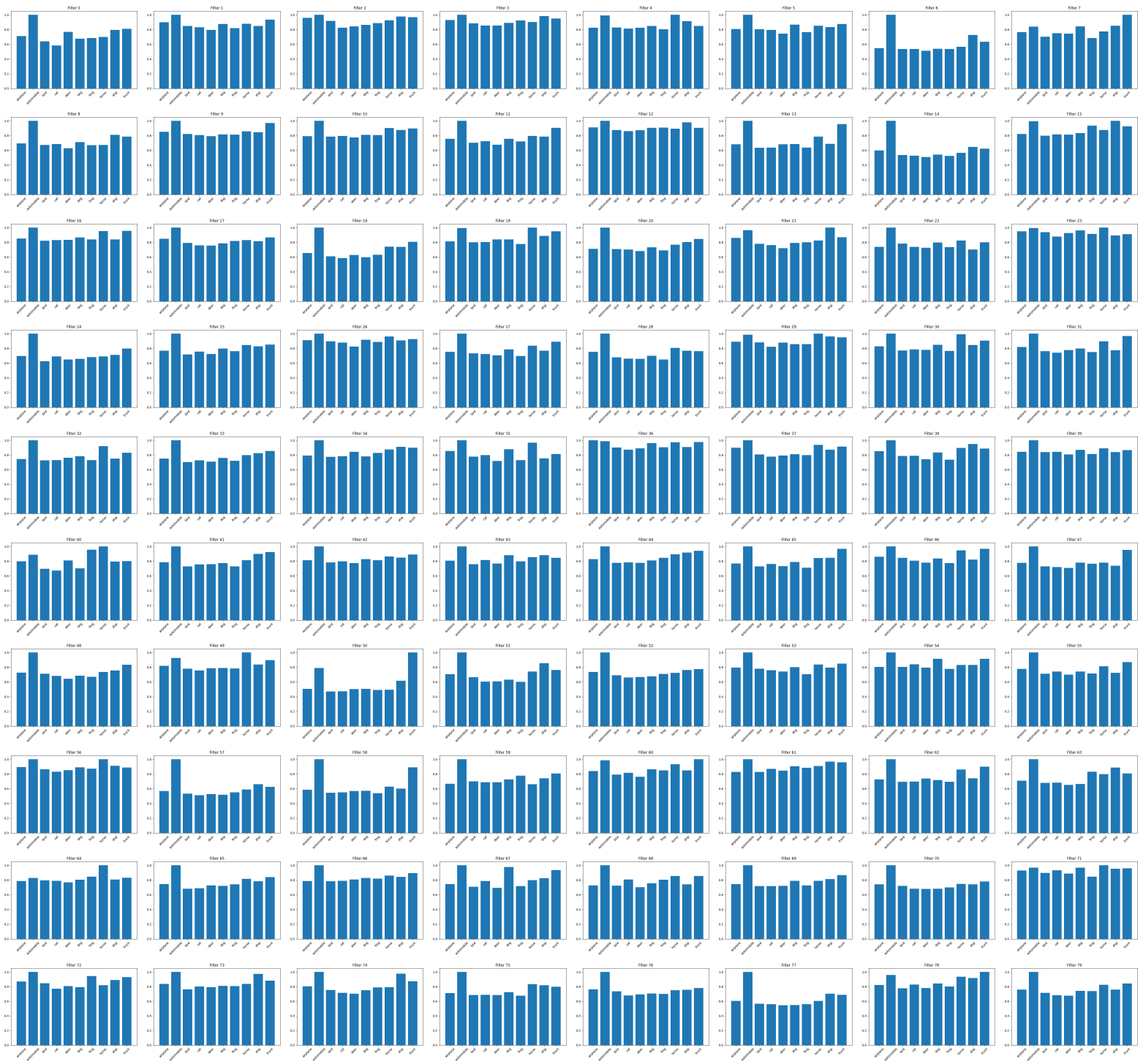


Figure 4: Q3 results for the last layer.