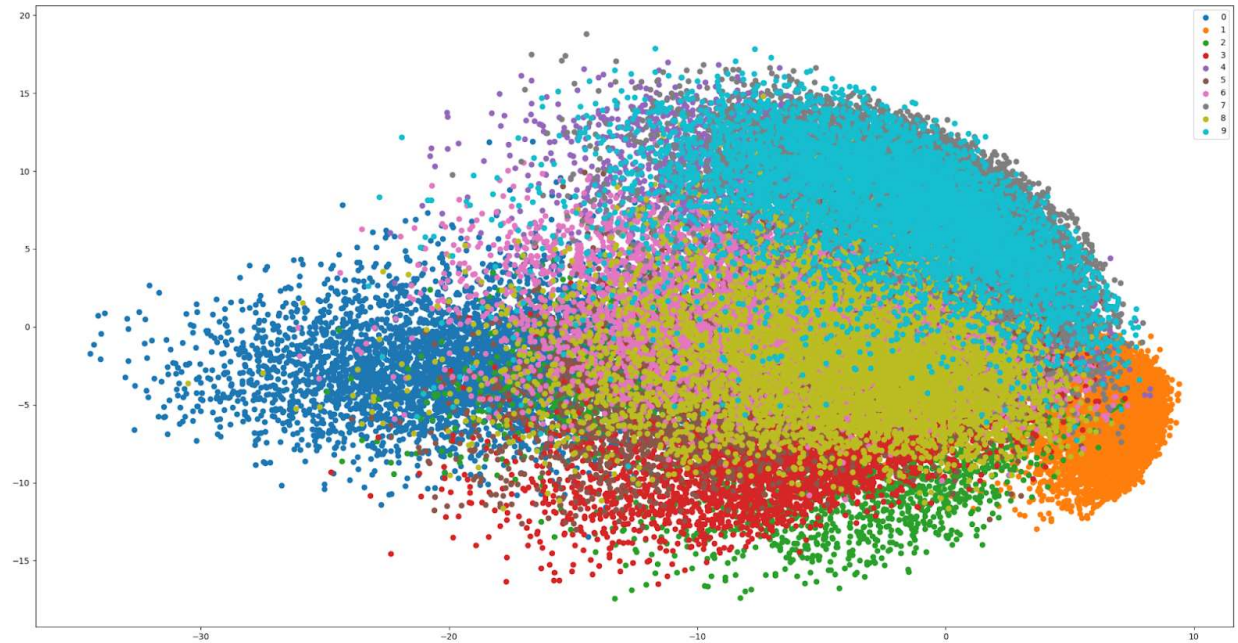


CSCI 5525: Homework #4

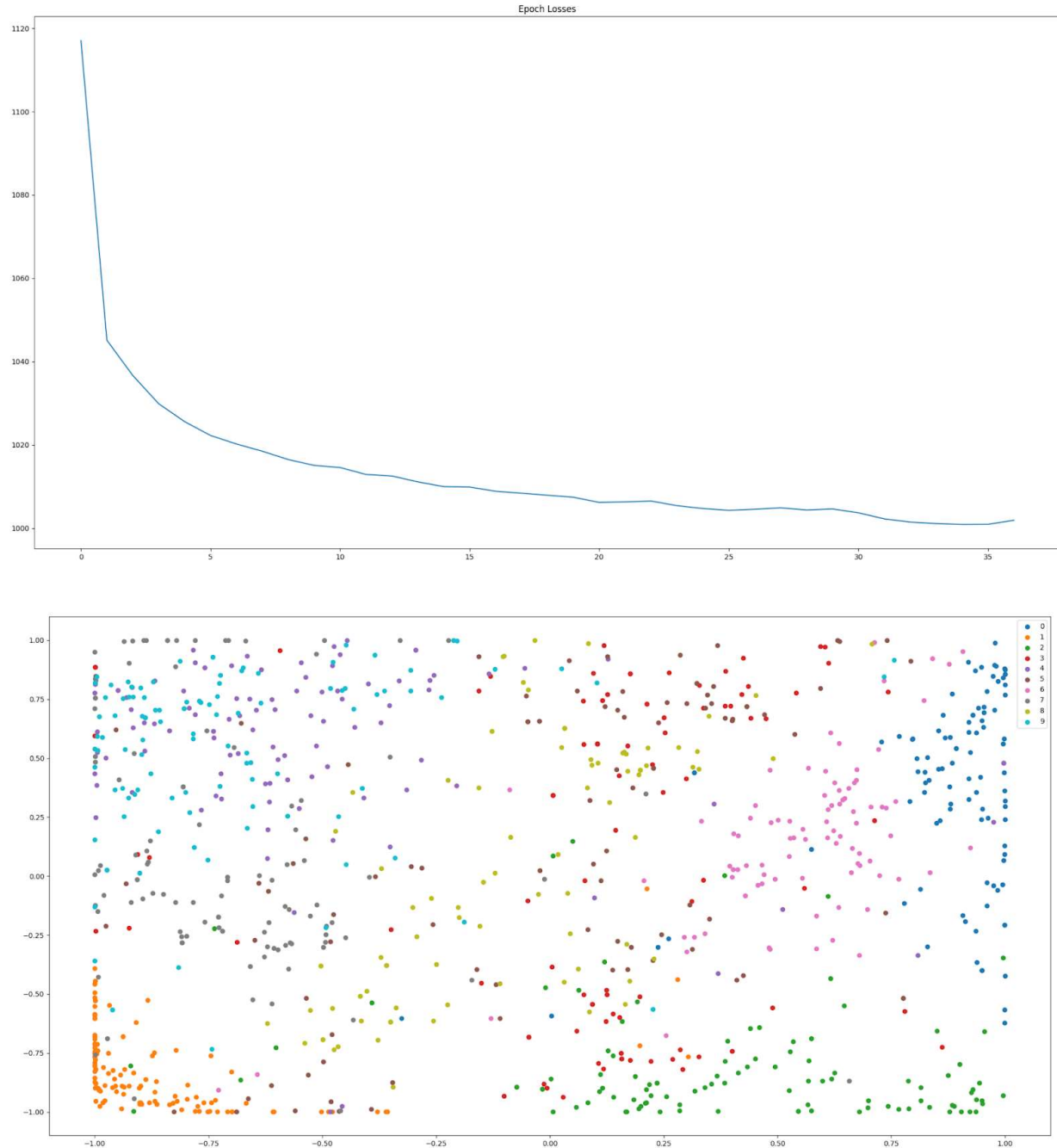
Noah Hendrickson

Problem #1:



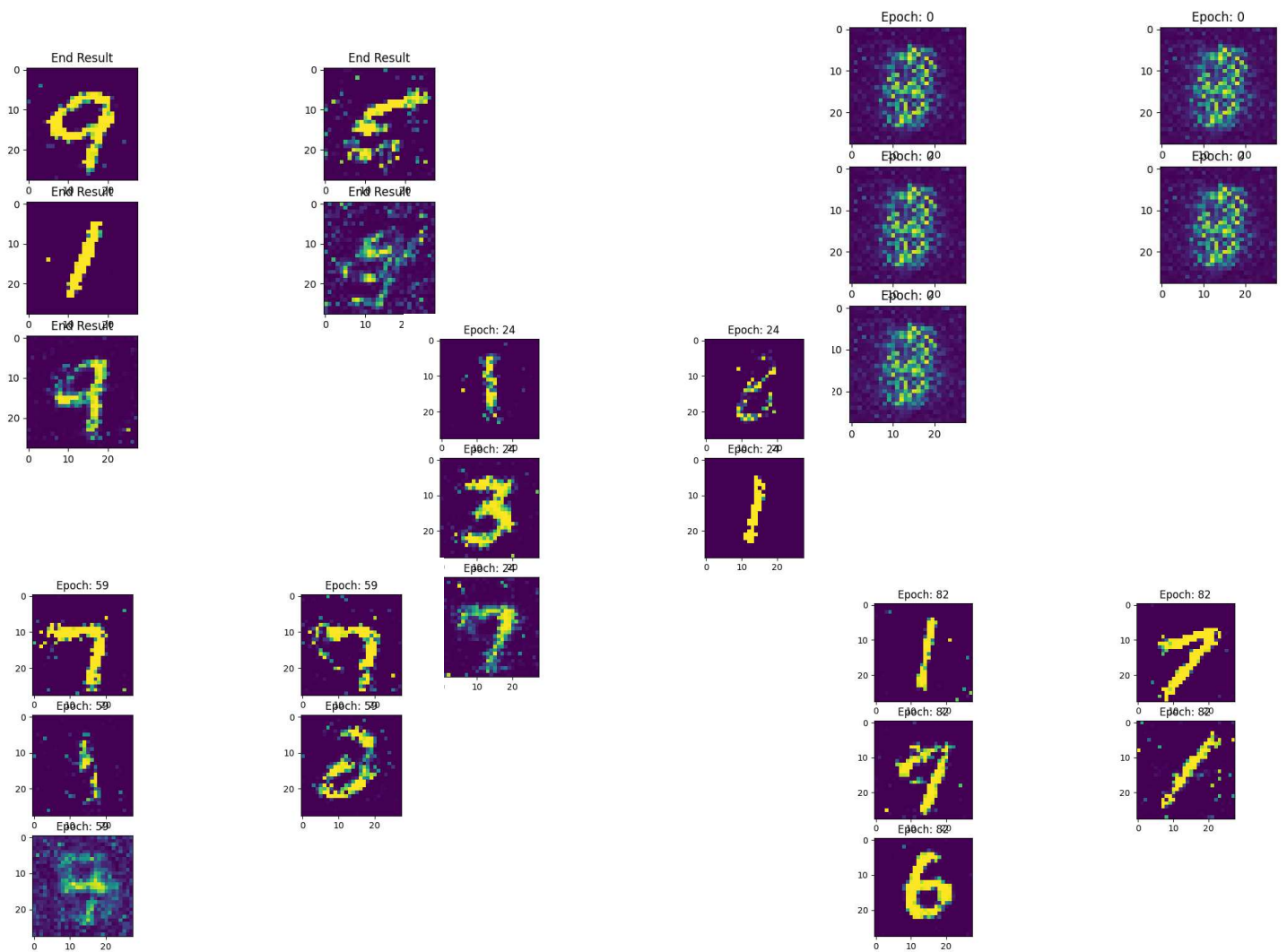
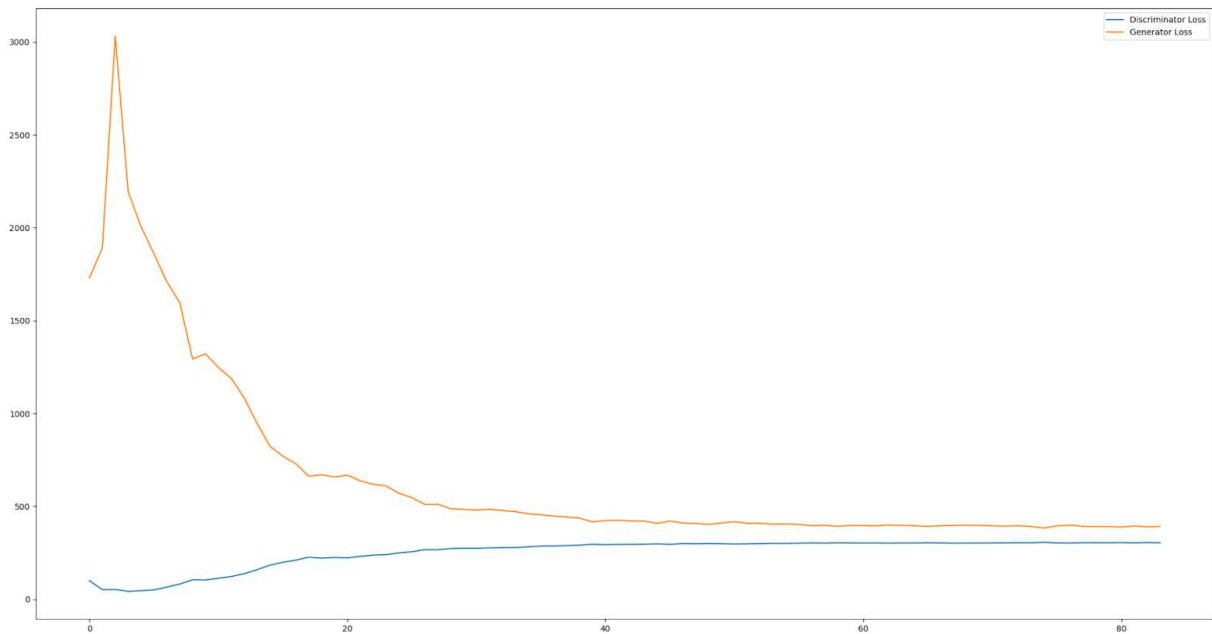
The above plot is the results of the PCA on the MNIST dataset with the colors labeled on the top right. From this labeling, we can see that PCA did a relatively good job separating the 0's and 1's of the dataset. 7's and 9's were separated pretty well too but not between each other. 2's and 3's are in a very similar situation to 7's and 9's. The rest just kind of overlap a bunch with the others. 0's and 1's being separated well makes sense because of how kind-of-unique they are among the letters. We can also see the similarities generally between 7's and 9's thus it makes sense they overlap a bunch. The same can be said somewhat about 2's and 3's.

Problem #2:



The above images are the loss from over the epochs and the results of 1000 test samples run through the encode portion of the autoencoder. From the second image, we can see that, like PCA, the autoencoder was quite easily able to differentiate between 1's and 0's. Additionally, 2's and 6's were separated quite well. 7's, 9's, and 4's all kind of overlapped with many being contained in the upper left corner of the graph. 3's and 5's were also fairly overlapping and 8's were just kind of all over the place. The overall separation seems to be much more than the PCA decomposition though.

Problem #3:



As we can see above, there are clearly generated images such as 1,7,6,9,3, and a couple that are close to 5's. The generated images start out in epoch 0 as just kinda fuzzy masses. You can see some shape coming through but it's still too vague. Even just by epoch 24, we can see full numbers being formed. Epochs 24 all the way through 100 just show more improvement, somewhat slowly. The images from epoch 82 are very distinguishable as numbers. The end results still have some weird looks to them but the 9, 1, and 5 are fairly clear. The trained model produces much clearer images after the training, but they're still sometimes blotchy.