

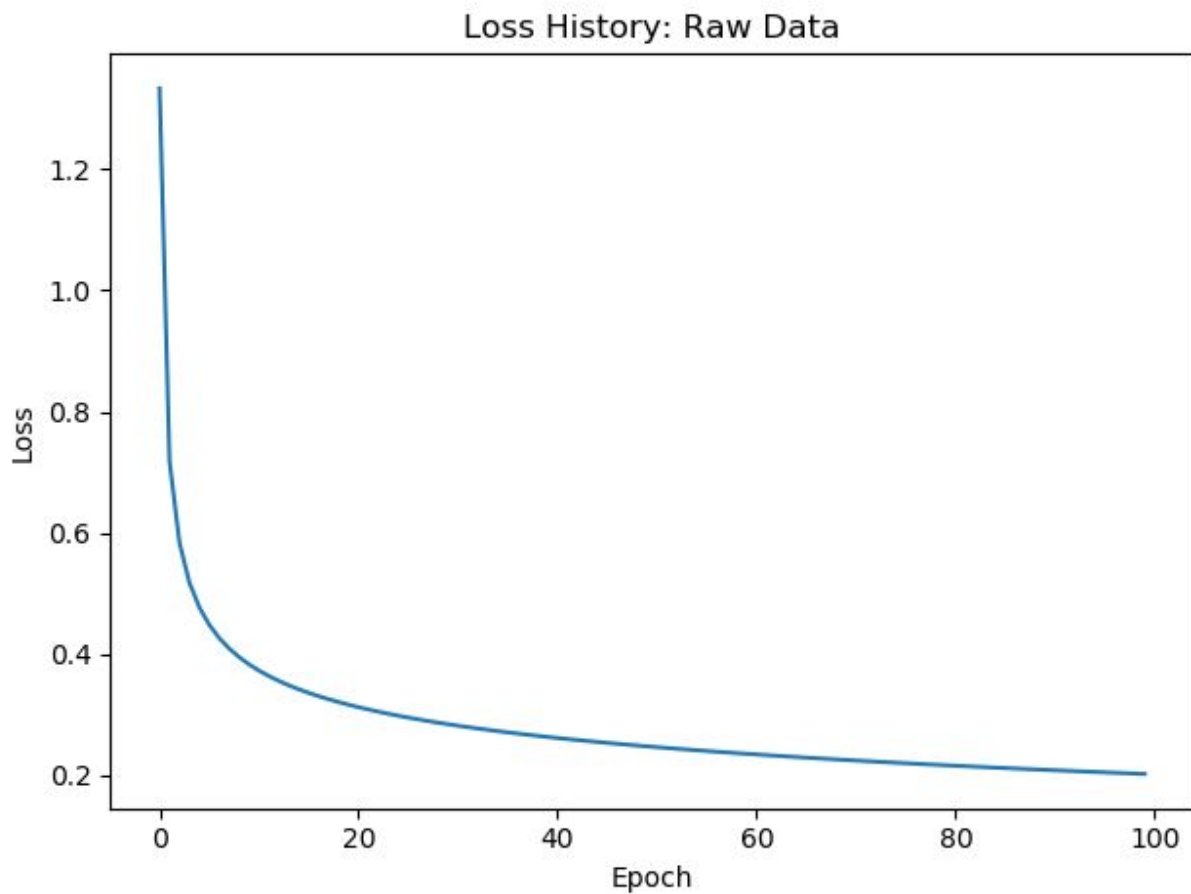
CS 453X HW3  
narosenberg  
mhwestwater

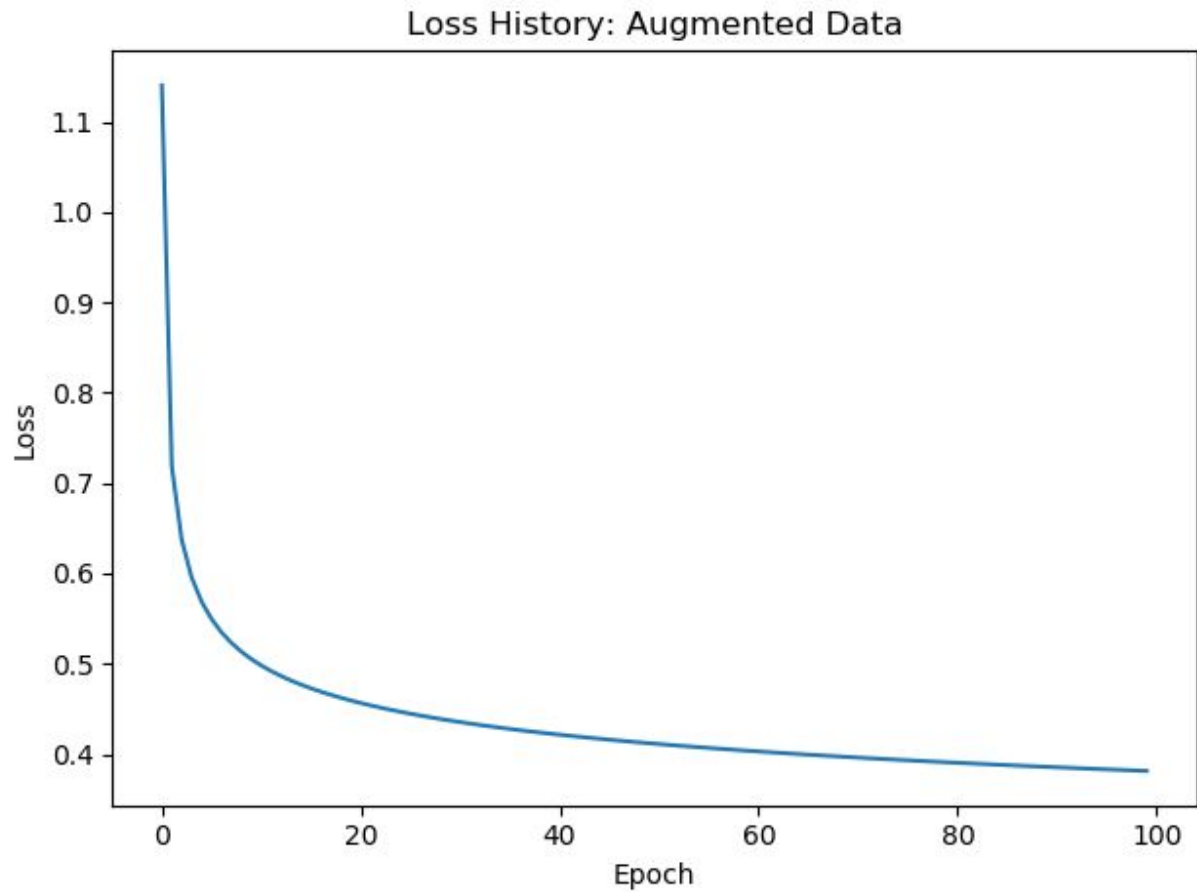
**Accuracy with raw data set**

Training accuracy: 0.98976  
Training CE: 0.19940257702422343  
Testing accuracy: 0.97576  
Testing CE: 0.42319131159548723

**Accuracy with augmented data set**

Training accuracy: 0.9790266666666667  
Training CE: 0.3764266214930651  
Testing accuracy: 0.97188  
Testing CE: 0.48037901594524

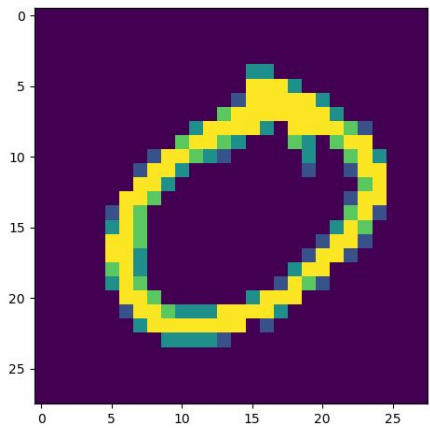




For augmentation the images were translated either up and left or right and down, sharpened by raising the value of pixels above a certain threshold, adding some random noise, rotating a random small angle, and mirroring some images if they are a 0 or 8.

Image comparisons

Raw



Augmented

