T-DeLearn PW02 - Exercise 3

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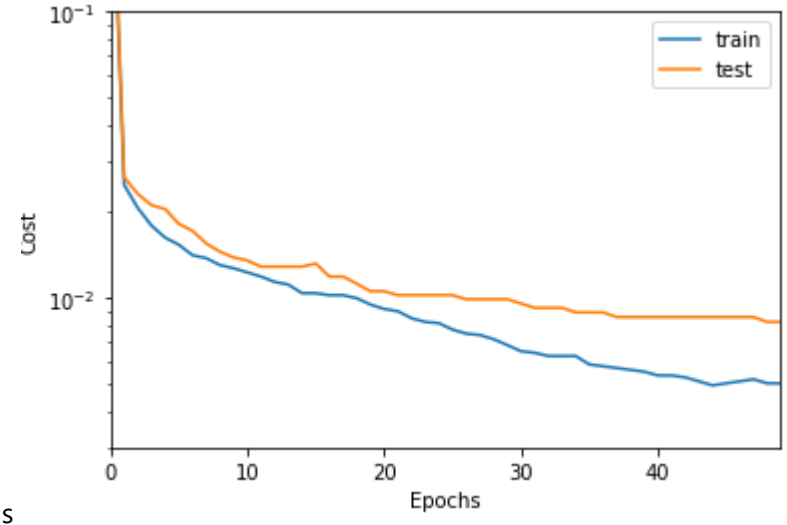
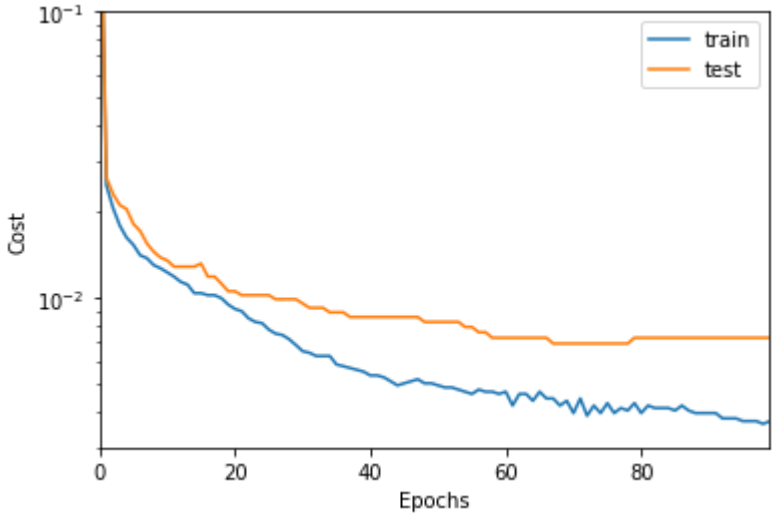
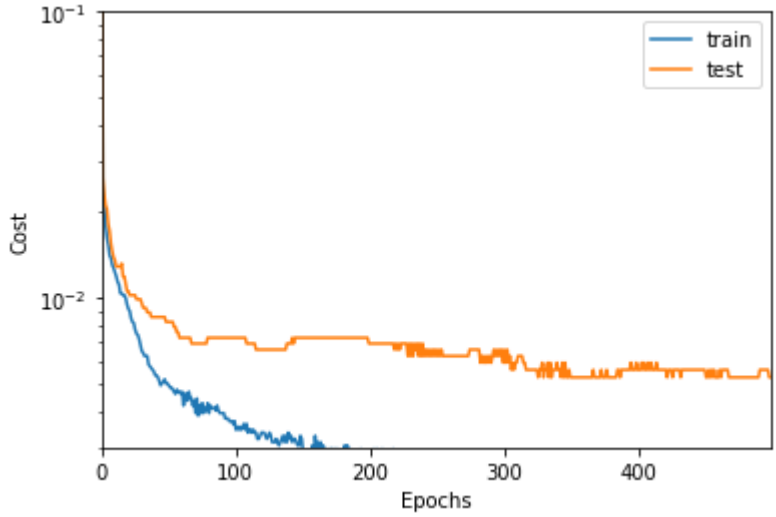
D - Analyse the dependency of the final error rate on the number of epochs. What is the goal of the learning and how many epochs make sense ?



50 epochs



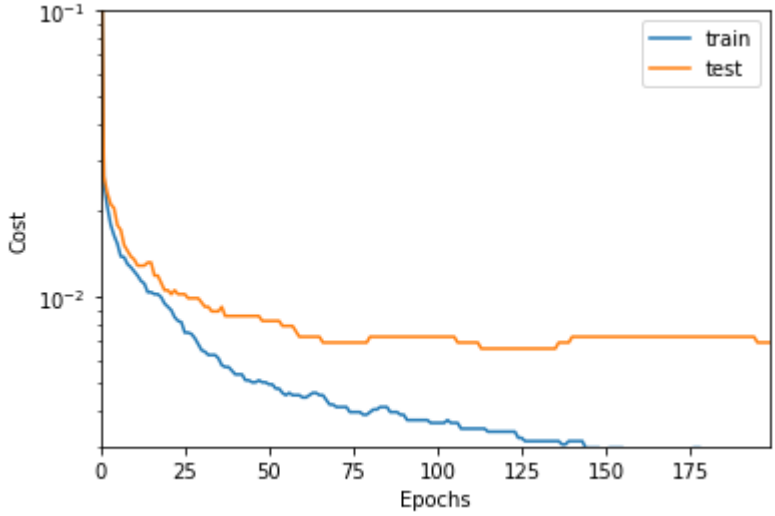
100 epochs



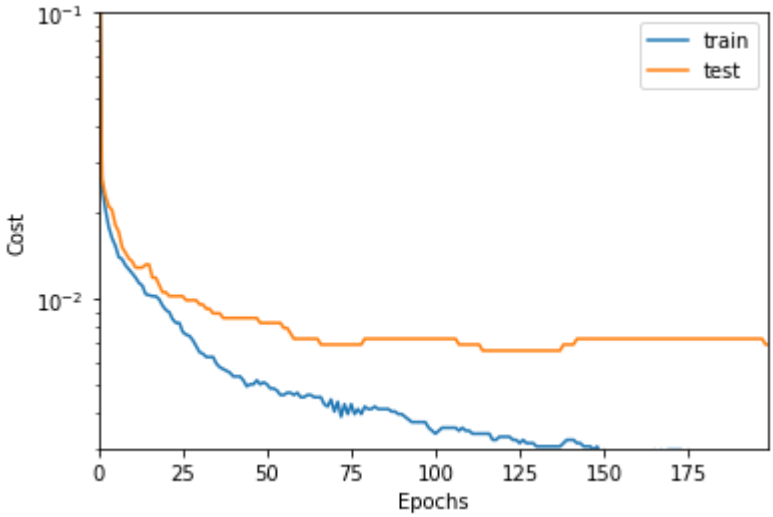
500 epochs

We can see that the error on the test set drops to 0 just before the 200 epochs. For the test error we can see that it stops decreasing also around 200 epochs. 200 epochs seems to be a good choice.

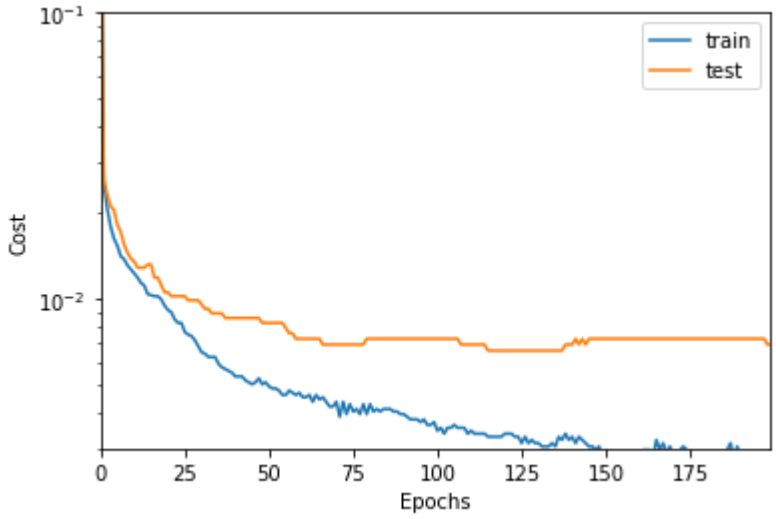
E - Analyse the dependency on the learning rate by trying different values, Describe what you observe. How large can you choose the learning rate until the learning breaks down ?



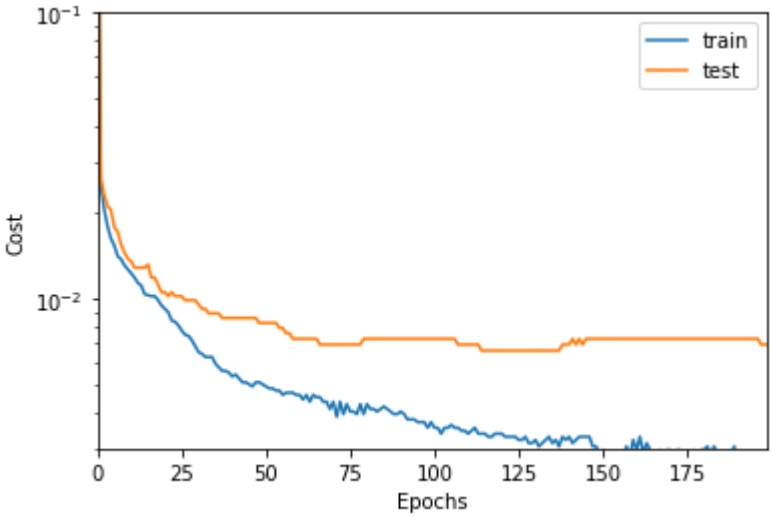
alpha=0.01



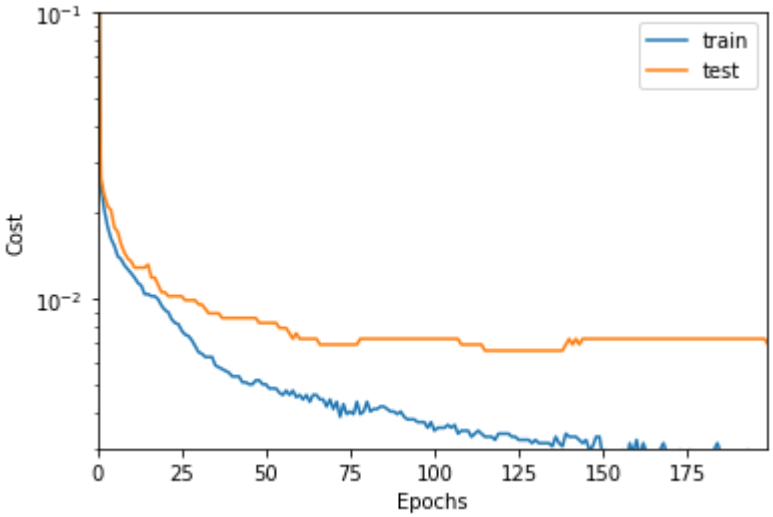
alpha=0.05



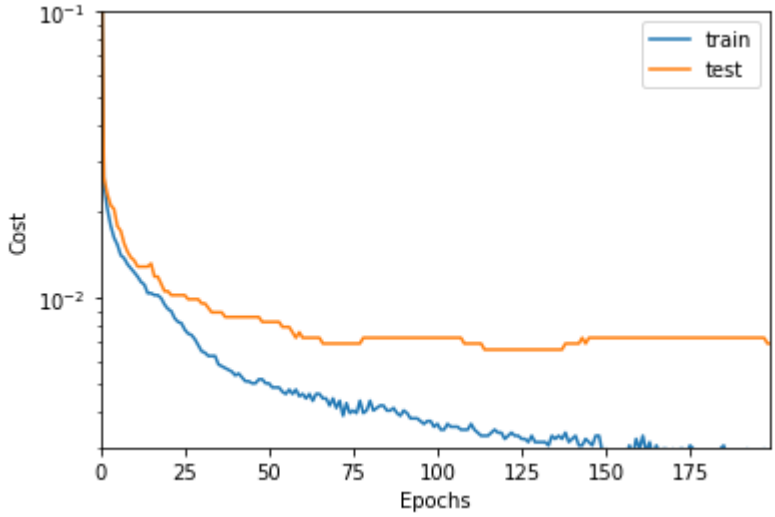
alpha=0.1



alpha=1



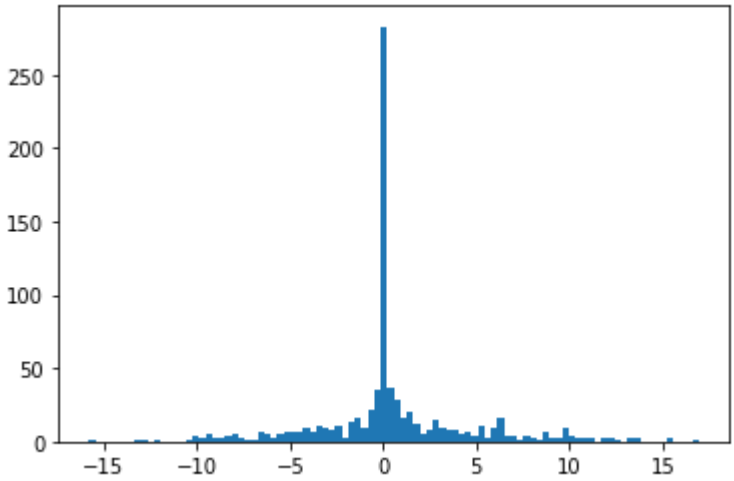
alpha=5



alpha=10

We can see that learning rates greater than 0.05 are slightly more difficult to converge to 0.

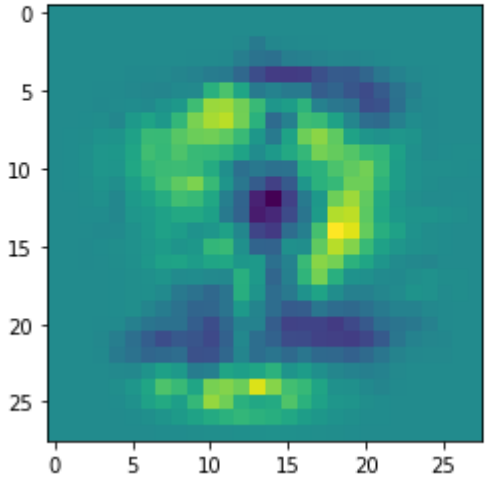
F - Plot a histogram of the weights finnaly obtained from learing. A strong peak at zero remains. Why ? You may understad this when plotting the weights as an image.



Weights Histogramms

```
plt.imshow(gradD.w.reshape((28,28)))
```

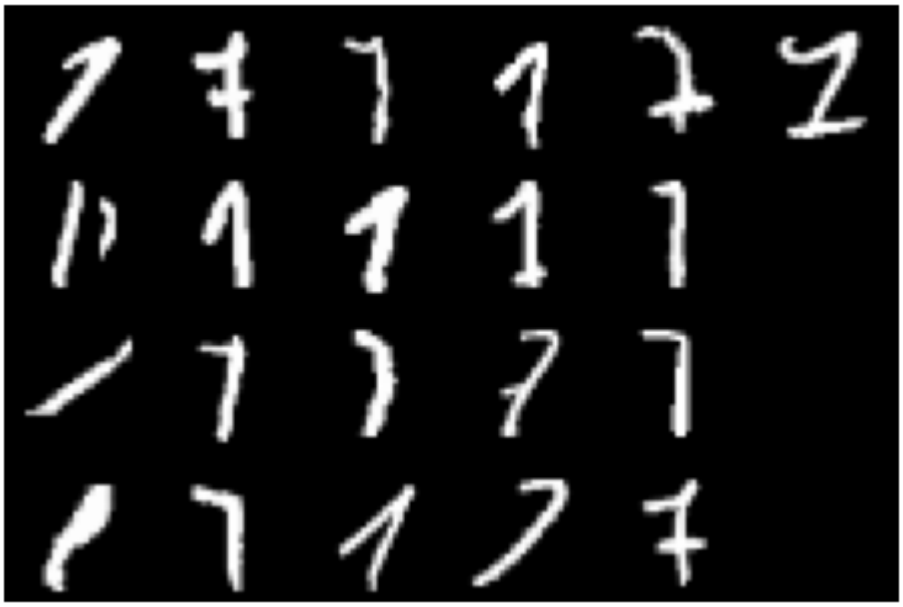
```
<matplotlib.image.AxesImage at 0x17864210d00>
```



Weights Image

We can see that the many 0 come from the black background on the backgrounf around the numbers.

F - Also compare this image with the misclassifed test images. Try to explain



We can see that most of the errors come from numbers that even a human would not be able to classify between a 1 and a 7. Typically the image on the second line of the first column is very hard to classify.