T-DeLearn PW02 - Exercise 3

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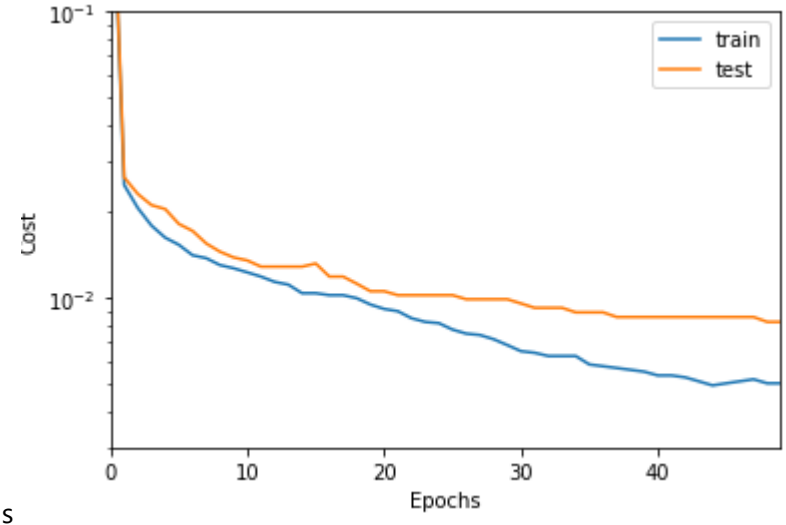
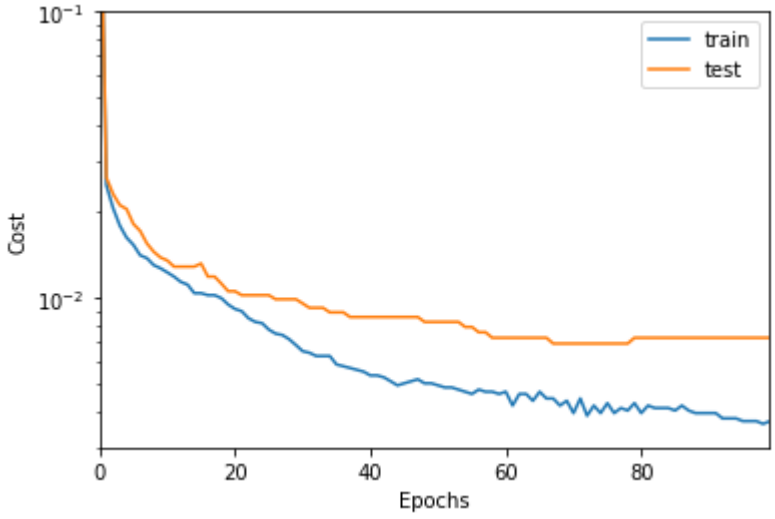
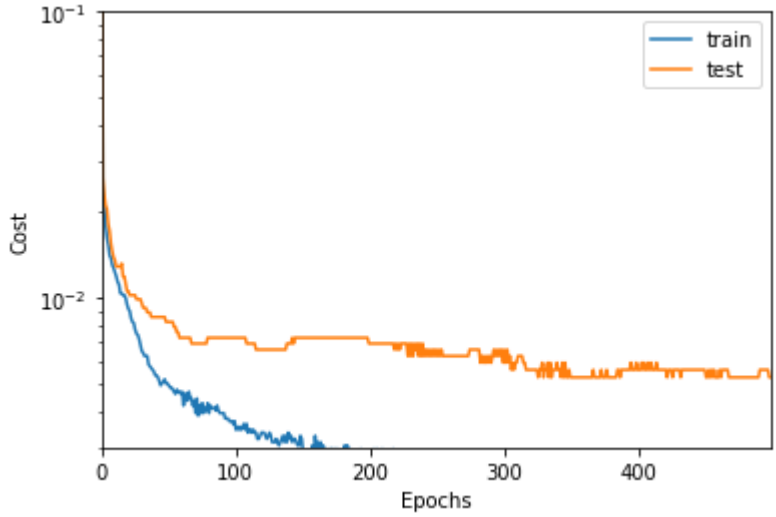
D - Analyse the dependency of the final error rate on the number of epochs. What is the goal of the learning and how many epochs make sense ?



50 epochs



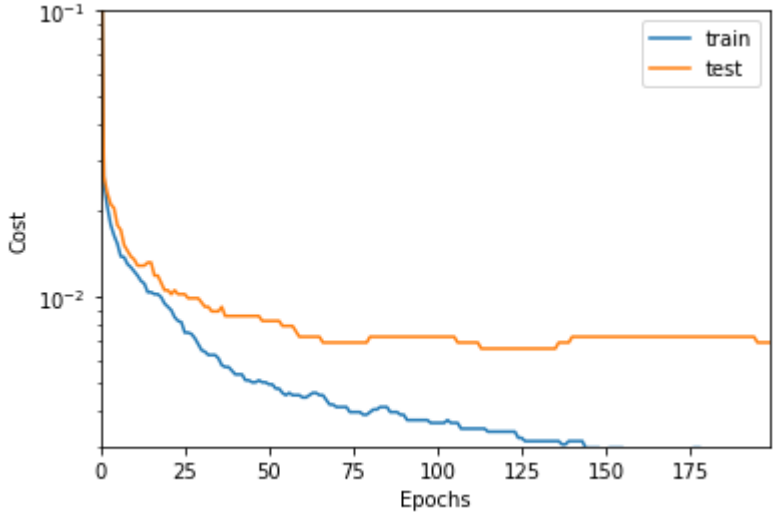
100 epochs



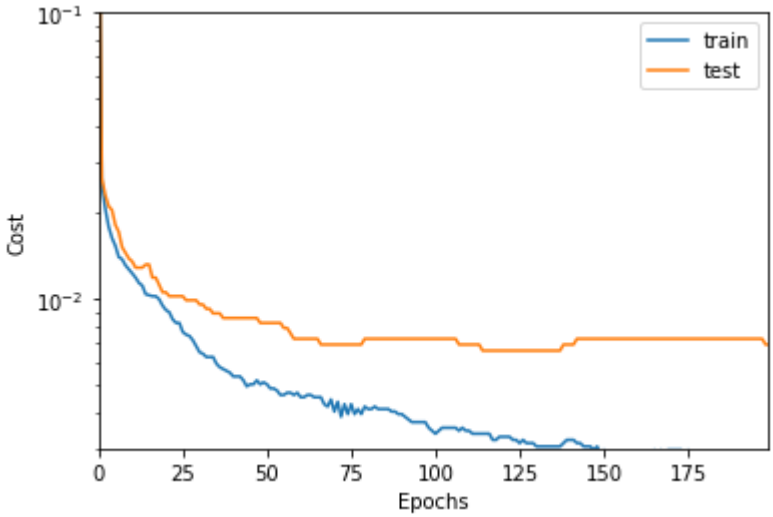
500 epochs

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.

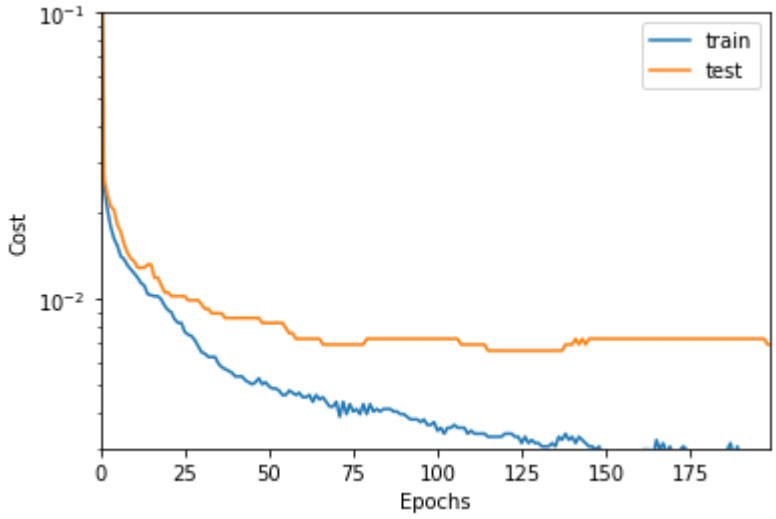
E - Analyse the dependency on the learning rate by trying different values, Describe what you observe. How large can you choose the learning rate until the learning breaks down ?



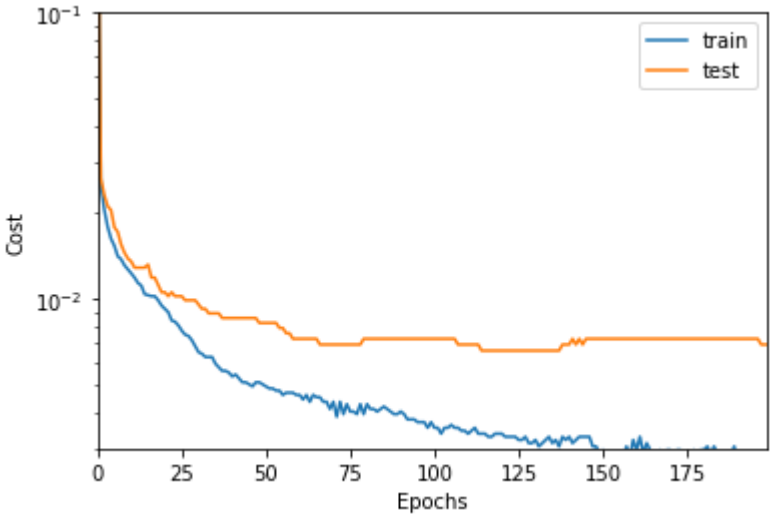
alpha=0.01



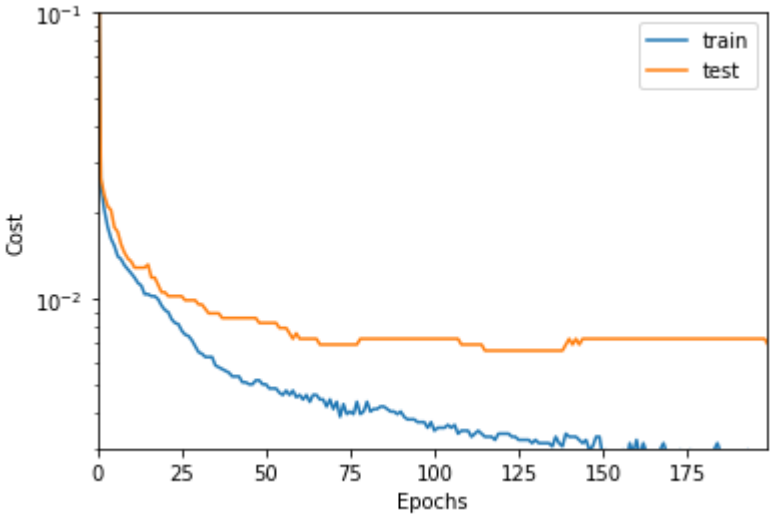
alpha=0.05



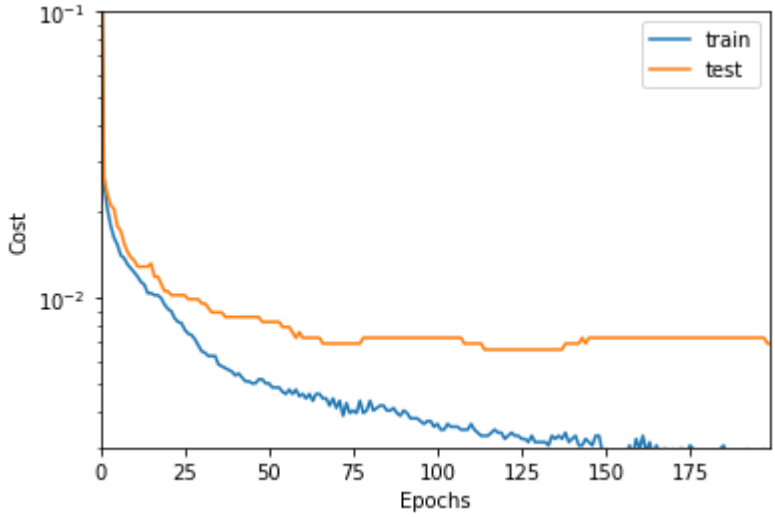
alpha=0.1



alpha=1



alpha=5

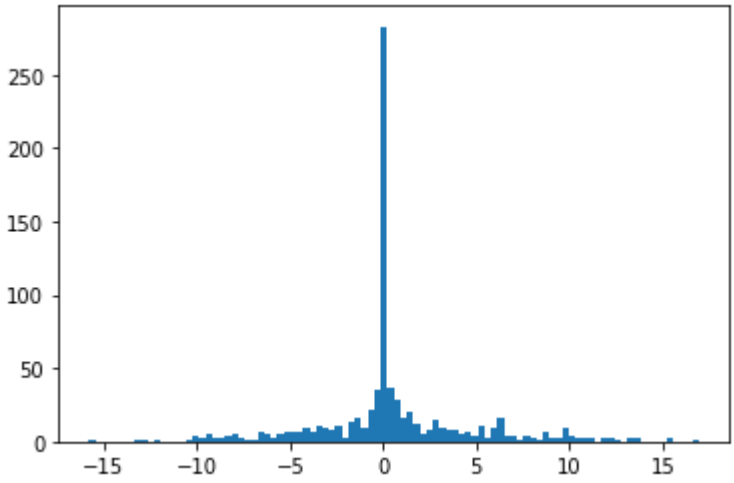


alpha=10

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

F

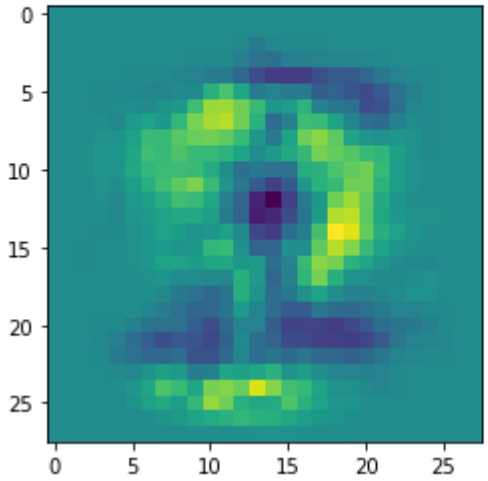
Plot a histogram of the weights finnaly obtained from learing. A strong peak at zero remains. Why ? You may understad this when plotting the weights as an image.



Weights Histogramms

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

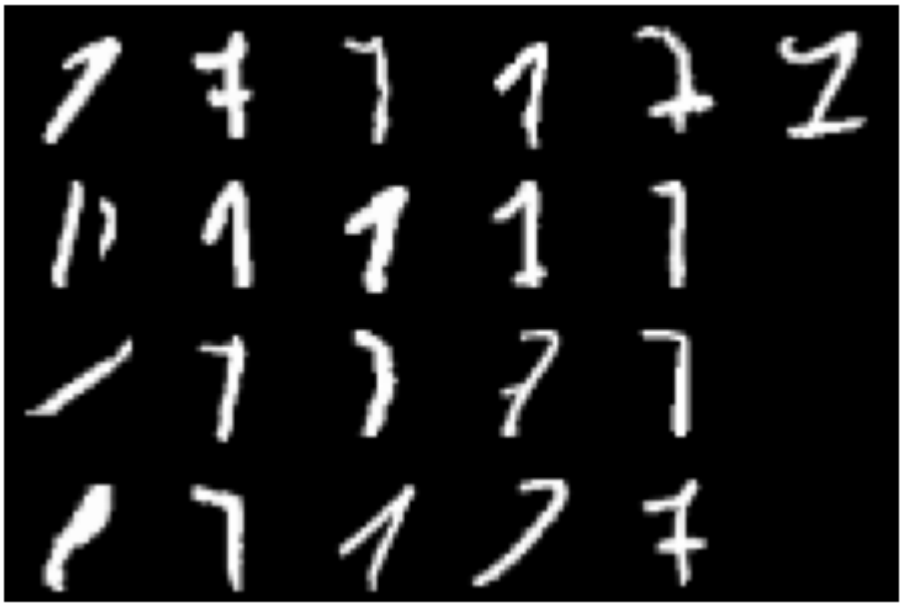
```
<matplotlib.image.AxesImage at 0x17864210d00>
```



Weights Image

We can see that the many 0 come from the black background on the edge of the numbers.

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.