

# Laboratory 4

DL-MAI

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## Introduction

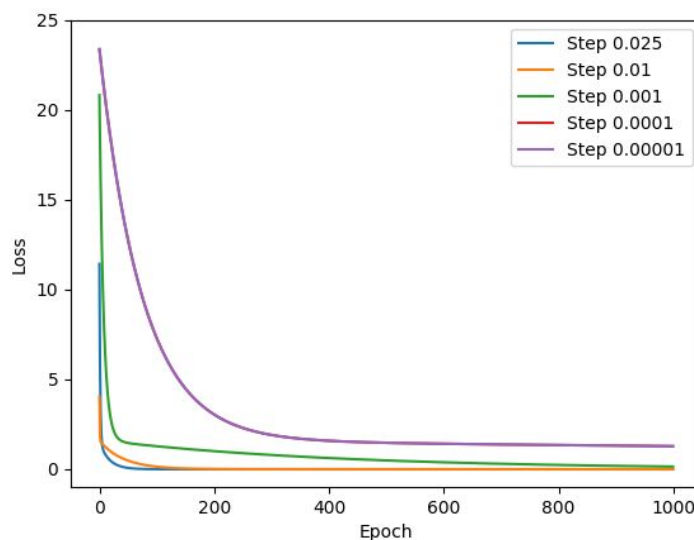
In this practice we perform several experiments with TensorFlow. The code related to this work is public and available at github<sup>1</sup>.

## Exercise 1

### GradientDescentOptimizer With Different Steps

Final loss in each case:

- Step 0.025:  $4.01457e-13$
- Step 0.01:  $5.69997e-11$
- Step 0.001: 0.148283
- Step 0.0001: 1.282
- Step 0.00001: 1.282



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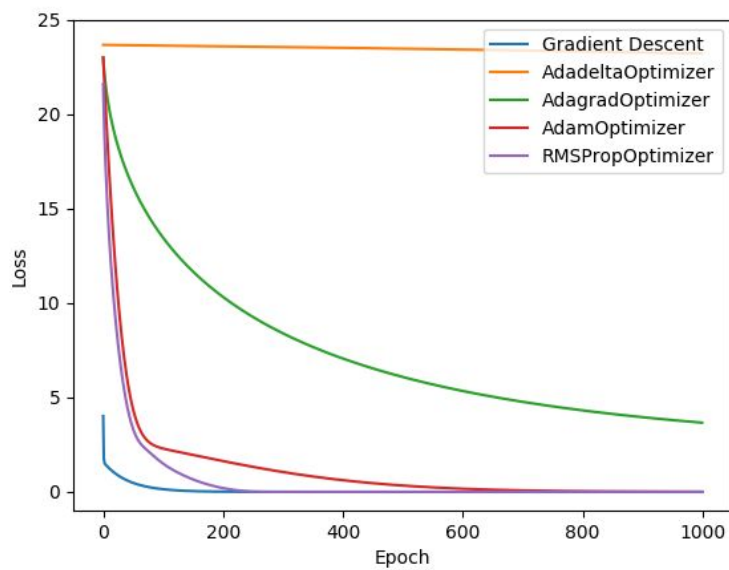
<sup>1</sup> <https://github.com/juanlao7/tensorflow-examples>

## Other Descent Methods

All with a learning rate of 0.01; the remaining options are left with their default values.

Final loss obtained:

- Gradient Descent:  $5.69997e-11$
- AdadeltaOptimizer: 23.2035
- AdagradOptimizer: 3.6652
- AdamOptimizer: 0.00452471
- RMSPropOptimizer: 0.00135

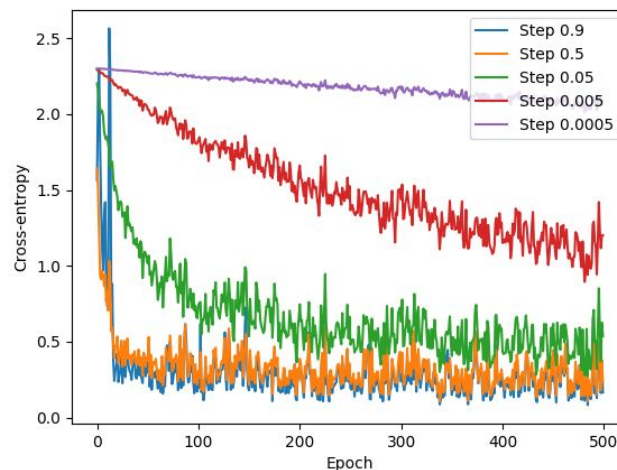


## Exercise 2

### GradientDescentOptimizer With Different Steps

Final cross-entropy in each case:

- Step 0.9 : 0.165404
- Step 0.5 : 0.232922
- Step 0.05 : 0.535708
- Step 0.005 : 1.20225
- Step 0.0005 : 2.08769

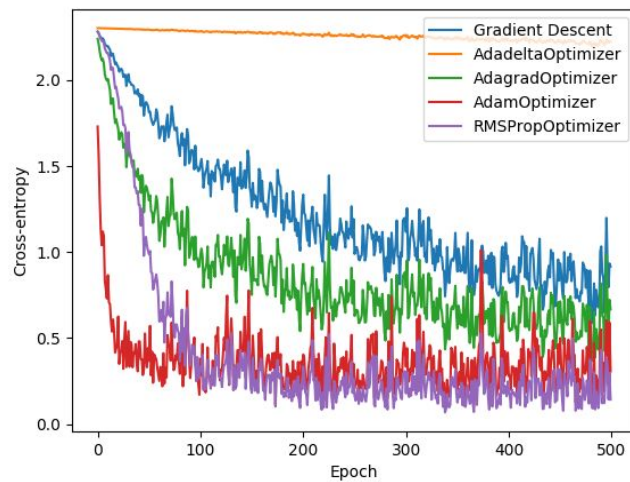


### Other Descent Methods

All with a learning rate of 0.5; the remaining options are left with their default values.

Final cross-entropy obtained:

- Gradient Descent : 0.916577
- AdadeltaOptimizer : 2.22276
- AdagradOptimizer : 0.667224
- AdamOptimizer : 0.305625
- RMSPropOptimizer : 0.142205



## Exercise 3

We get an accuracy of 99.28% with the following changes:

- Perform 30 epochs of 50 batches instead of 1 epoch of 50 batches.
- Use the RMSProp optimizer with a learning rate of 0.0001.

## Exercise 4

Execution times:

- 1 GPU: 4 minutes, 17 seconds.
- 2 GPU's: 2 minutes, 20 seconds.
- 4 GPU's: 1 minute, 24 seconds.