Practical work 07 – 31/10/2019
Deep Learning Frameworks

Objectives

The main objective of this PW is to further explore the capabilities of Tensorflow by inspecting and completing an MLP-model implemented so that it can be run in eager execution mode and by analysing the results in Tensorboard. Furthermore, you will investigate different possibilities to configure the training (initializer, regularizer, optimizer).

Submission

— **Deadline** : Monday 11th of November, 22 :00 (noon)

— **Format** :

  — Zip with report and iPython notebook.

Exercice 1 MLP in Eager Mode

The basis of this exercise is the Jupyter notebook `nn_dynamics_stud.ipynb` and the get started guide for Tensorboard. The notebook is a bit less documented - but we want you to go into the depth of the code to understand what is going on.

The notebook should allow you to run a model in eager mode (no computational graphs are compiled, no `tf.function` decorators are needed. Furthermore, it will write certain output quantities to disk which then will be used by tensorboard to display.

Proceed as follows :

a) Inspect the notebook and understand what the notebook should do. You may need to consult the online resources for how to use Tensorboard.

b) Complete the gaps so that the notebook provides what it is supposed to.

c) Perform a test run with a model consisting of three hidden layer plus a softmax layer. Use Glorot initialisation. Check the activations and convince yourself that these are far from being saturated.

d) Perform a next run with the same model but this time using no scaled stdev for the initial parameters.Check the activations and convince yourself that these are significantly in the saturation region.

e) Provide some of your findings in form of a pdf including screenshots from your Tensorboard session.

f) Now try further models with higher complexity and explore some of the complexity of the dynamics in the learning process. Report about some of your finding in the pdf.

Exercice 2 Keras Model

In this exercise, you will create a Keras model and play with different settings. The basis here is the Jupyter notebook `mlp_keras_stud.ipynb`.

Proceed as follows :

a) Inspect the code in the notebook and complete it. Configure a test run (baseline) without dropout, with SGD and fixed learning rate and default parameter initialisation.

b) Now implement dropout for the hidden layers. Make sure that the dropouts apply to the logits. Perform a test run and compare it with your baseline. Inspect the results in Tensorboard. Provide a screenshot in a pdf report.

c) Now configure a learning rate schedule so that at different ranges of epochs different fixed learning rates apply. Example :

   — for epoch 0-20 : lr=0.1

   — for epoch 21-40 : lr=0.05

   — for epoch 41-70 : lr=0.01

d) (OPTIONAL) Try implementing a callback that allows you to visualize the learning rate per epoch in Tensorboard.

Exercice 3 Optional : Review Questions

No review questions so far.