Deep Learning **(Due: 14/05/20)**

Assignment 3

Instructor: Siamak Mehrkanoon

Assignment Policy: Read all the instructions below carefully before you start working on the assignment, and before you make a submission.

- Please include your names and student IDs with your submission.
- You can do this assignment alone or in group of 2. Please submit no more than one submission per group.
- You have one week to work on the assignment.
- Please submit a short description of what you have done. including used methods, results, discussion, conclusion and references. The report should not exceed 4 pages. Please also submit the your code along with your Short description. Put both of them in a zip file named "*yournames_assignment*1.*zip*", e.g. "*Alex_Julia_assignment*1.*zip*".
- In order to give everyone the same amount of time, late submissions are not allowed unfortunately. Unless it is discussed in advance.

1 Dataset and Tasks

You are given a real-life weather dataset. You can find it in the *dataset.mat* file. The data is hourly measurements of weather features in 4 different locations. The five measured variables are: Wind speed in 0.1m/s, Wind direction in degrees (360 North, 90 East, 0 No wind), Temperature in 0.1C, Dew Point in 0.1C, Air Pressure in 0.1hpa. The dataset has the shape (Time steps x Cities x Features). Use the last 168 samples (one week recording) for test case and the remaining ones for training your model. Scale your data before training and scale them back to be able to compare your predictions with real measurements.

Think about what kind of neural networks model could be useful for time series data. Although RNN is an option, but it is possible to use other models such as CNN discussed in the course lectures. Try your chosen model and compare its performance in terms of absolute mean squared error with real test records. (google it if you are not yet familiar with this error metric!).

(a) Implement a (deep) neural networks model for "Temperature" prediction of the last city. Temperature is the third variable.

(b) The model should run in a recursive fashion. Meaning the predictions of temperature should be send back and used for up-comping ahead predictions. For other variables you may use the real measurements. We have discussed this type of modelling in the class and you have implemented for a univariate time series in one your assignments. Run your model to predict the temperate of the last city for one week (i.e. your model should predict the temperature for 168 samples in a recursive fashion). Note that you are not allowed to use the real 168 temperature samples in your model.

(c) Can you come up with a strategy to determine or visualise which features among the 5 measured features might be more relevant for the outputs of the model. In addition, experiments how many previous time steps you need to feed in to your network to give you the best possible answer you can obtain by your model?

(d) Use visualisation techniques to visualise your results in addition to reporting the obtained numbers in a Table for comparison purpose.

(e) Just: Good Luck and Enjoy Learning!