Exam Assignment

Advanced Machine Learning (MSc CS)
IT University of Copenhagen

Fall 2019

1 Learning Goals

In parallel to working towards the general learning objectives of the Advanced Machine Learning Course, you are intended to

- Become familiar working with a scientific article in machine learning
- Implement and apply a recent machine learning method
- Evaluate and report the method performance and compare it to those published in the scientific article

2 Formalities

The exam project report must be submitted electronically via LearnIT no later than 14.00 on 20th December.

Groups You have to work in groups of 2–3 people. The group formation happens during the first week of the project, and one person from each tentative group must send a list of group members for approval to the course manager latest on Wednesday 13th November. The course manager reserves the right to modify the grouping if it is necessary.

What should be handed in? You must hand in both a report (see below) and the source code you have developed to solve the project.

Honesty Codex By submitting your project, you confirm that you have not submitted this project elsewhere and that you did not copy (plagiarise) foreign ntent without proper reference.

3 Problem Statement

Your task as a group is to select and implement, evaluate and report a machine learning method from one of the following papers scientific papers:

- *Double Q-learning*, 2010
- *LSTM Neural Networks for Language Modeling*, 2012
- *Support Vector Machines (SVMs) versus Multilayer Perception (MLP) in data classification*, 2012
- *Convolutional Neural Networks for Sentence Classification*, 2014

- *Generalized Autoencoder: A Neural Network Framework for Dimensionality Reduction*, 2014
- *Generative Adversarial Nets*, 2014
- *Recurrent Convolutional Neural Networks for Scene Labeling*, 2014
- *Human-level control through deep reinforcement learning*, 2015
- *Analysis of k-means clustering approach on the breast cancer Wisconsin dataset*, 2016
- *Capturing Financial markets to apply Deep Reinforcement Learning*, 2019

If the paper you selected presents experiments on several data sets, you do not need to evaluate all of them but you can choose a subset or even only one of them. If you want to solely use other dataset, which is not used in the considered paper, you must contact the course manager to ask for an approval.

4 Implementation and Code

Your implementation has to be in Python. You may make use of any standard Python libraries and the numerical libraries NumPy and SciPy. *The only machine learning library you may make use of is TensorFlow* (without using Keras, or any other similar high-level API).

Your code should be organised such that is easy to read, i.e. you have to use descriptive names for files, functions, variables, etc. The code may be organised in regular Python source files (.py files) or in Jupyter notebooks.

If you take inspiration from or copy code developed by other people, it is important that you document this in your report.

5 Hand-In

The report must be in PDF format and have a front page that meets the ITU requirements.[1] Your code must be handed in as a single file (either a zip or tar archive). Only one person for each group should hand in the project (report and code).

The report must contain no more than 2,000 words and be no longer than a total of 10 pages including figures, tables, code snippets, references and appendixes, but excluding the ITU front page. The project must be typeset with at least 11pt font size and margins (both horizontal and vertical) of at least 2cm. The number of words and the methods used for counting must be stated at the beginning of the report.

Note that the hand-in should be self-contained: although you are required to master your code for the oral exam. Your oral presentation should correspond to the structure of your write-up. The report should consist of precisely the following sections.

1. **Introduction.** Here you provide the context for the problem and re-state the brief.
2. **Methods.** Here you define and describe your methods, with precise mathematics where applicable.
3. **Experiments.** Here you describe your data source and provide the numerical the results of your method over the data. The results refer to numerical performance evaluation that you need to carry out.
4. **Discussion.** Here you reflect and discuss the results against the original question's setting and the results published in the scientific article selected. Here you also discuss shortcomings of your methodology/data.

[1] Found at `https://itustudent.itu.dk/study-administration/exams/submitting-written-work`

5. **Conclusions.** Here you provide a couple of sentences summarising the results of the project and indicating how the methods/data could be improved.

   References. This is a numbered reference list of the works you cite in the report, of the key methods referred. This section is not counted in the page limit.