Model output statistics with deep neural networks (30 ECTS credits)

The professional service division at SMHI is looking for one or possibly two students to a master thesis project. The master thesis project will explore the possibility to apply deep learning techniques to reduce errors in weather forecasts by post-processing the output from numerical weather prediction models.

1   Background

Numerical weather forecasts basically suffer from two kinds of errors, systematic and non-systematic. It is possible to reduce the systematic errors with the help of different statistical post-processing methods. Model output statistics (MOS) is a well-established post-processing method that in its traditional form works by performing stepwise regression on combinations of output parameters from a long period of historical forecasts. One drawback with MOS is that the feature engineering process can be quite time consuming and demand detailed knowledge of the numerical weather prediction model. Deep neural networks have in a range of application eliminated the need for handcrafted features. It can therefore be interesting to examine if deep neural networks can be a viable option to "traditional" MOS.

2   Goal

The goal is to implement and test a couple of deep learning architectures for post-processing of output from numerical weather prediction models

3   Task description

- Suggest a couple of deep learning architectures based on literature studies and maybe some small scale experimenting. Could be convolution neural networks, dense networks, etc.
- Implement the suggested architectures (preferably in some Python framework such as Keras or Lasagne)
- Evaluate the forecasts produced by the suggested architectures.

4   Requirements

- Solid programming skills (preferably in Python)
- Solid skills in Linux CLI
- Solid applied math skills, especially in optimization
- Basic skills in machine learning algorithms

5   Contact information

Fredrik Karlsson
SMHI / Swedish Meteorological and Hydrological Institute
Professional services - Development
E-post / Email: fredrik.karlsson@smhi.se
Tel vx/ Phone: +46 (0)11 495 80 00