Software and Tools for Computational Engineering
RWTH AACHEN UNIVERSITY
Software and Tools for Computational Engineering
Prof. Dr. rer. nat. Uwe Naumann

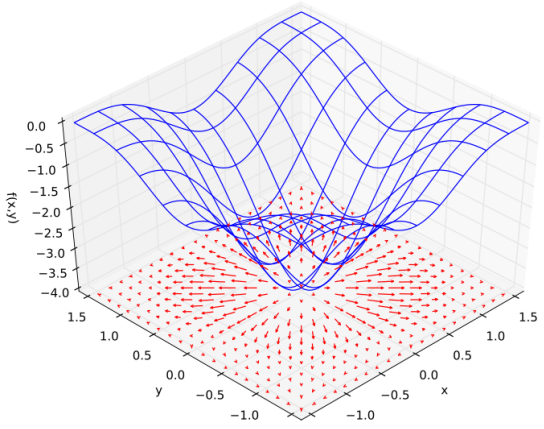
Master Thesis / Bachelor Thesis / Student Researcher Position

Algorithmic Differentiation in Machine Learning

Description: Many methods in machine learning are based on numerical optimization and Monte Carlo algorithms. Numerical optimization uses derivative information in the form of the gradient (and Hesse matrix) of the objective function. Markov chain Monte Carlo uses the derivatives of the sampled probability distribution. At our institute we develop the libraries that can be used for the required derivative computations (algorithmic differentiation).

$$\begin{pmatrix} \frac{\partial^2 f}{\partial x_1 \partial x_1}(x) & \frac{\partial^2 f}{\partial x_1 \partial x_2}(x) & \cdots & \frac{\partial^2 f}{\partial x_1 \partial x_n}(x) \\ \frac{\partial^2 f}{\partial x_2 \partial x_1}(x) & \frac{\partial^2 f}{\partial x_2 \partial x_2}(x) & \cdots & \frac{\partial^2 f}{\partial x_2 \partial x_n}(x) \\ \vdots & \vdots & \ddots & \vdots \\ \frac{\partial^2 f}{\partial x_n \partial x_1}(x) & \frac{\partial^2 f}{\partial x_n \partial x_2}(x) & \cdots & \frac{\partial^2 f}{\partial x_n \partial x_n}(x) \end{pmatrix}$$

Goal: Algorithmic differentiation techniques are currently adopted by the machine learning community at a rapid pace. The goal of your thesis is to apply some of the more advanced algorithmic differentiation techniques to make specific machine learning algorithms more efficient.



Profile: You should be comfortable with using C/C++, know some probability theory and be open to learning about numerical optimization or Monte Carlo methods.

If you are interested in a bachelor or master thesis or a student researcher position (up to 19 hours a week) on this topic, please do not hesitate to contact us!

Contact: Jonathan Hüser
ITC, Seffenter Weg 23, Room 229
hueser@stce.rwth-aachen.de