Modern Optimization Techniques - Exercise Sheet 4

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Solutions (1 pdf) need to be handed in until **Thursday, December 1st, 2016 at 12:00 (noon!)**

Exercise 1: The pure Newton Method (14P)

The pure Newton Method is the Newton Method presented in the last lecture, with a fixed step size of $\mu = 1$. For the following two functions, compute their derivatives and second derivatives, write down the Newton Update Formula and execute on your computer 10 iterations of the Newton Method without using the convergence criterion for the two given starting points. Discuss what is happening!

a) $f_1(x) = -\log x + x \qquad x \in \mathbb{R}^+$ for an initial $x = 1.9$ and $x = 2.1$

b) $f_2(x) = \log(e^x + e^{-x}) \qquad x \in \mathbb{R}$ for an initial $x = 1$ and $x = 1.1$

Exercise 2: Newton Method for a Linear Regression (6P)

The loss function of the linear Regression has the following form:

$$\mathcal{L}(A, x, y) = \sum_{i=1}^{m} (x^\top a_i - y_i)^2$$

a) Compute the Hessian $\nabla_x^2 \mathcal{L}(A, x, y)$!

b) Does it make sense to use the curvature information here? Discuss your answer!