Machine Learning
Exercise Sheet 2

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Submission until November 9th 12:00(noon) by dropping at ISMLL postbox
(please indicate in which tutorial are you participating!)

Exercise 3: Gradient Descent (10 Points)

Apply gradient descent on the function $f(x) = \frac{1}{4}x^4 + \frac{1}{3}x^3 - \frac{1}{2}x^2$ under the following configurations and plot your results (minimum and the x value) for each iteration in each problem:

a) Use step length $\alpha = 0.2$ and starting point $x_0 = -1$ and show the first four iterations. What is your minimum?

b) Use step length $\alpha = 3$ and starting point $x_0 = -1$ and show the first four iterations. What has happened and why?

c) Use step length $\alpha = 0.2$ and starting point $x_0 = 0$ and show the first two iterations. What has happened and why?

d) Do the same again with $\alpha = 0.8$ and starting point $x_0 = 0.5$ and show the first four iterations. Where is your minimum now?

What would be a possible solution to overcome the problem just identified?

Exercise 4: Linear Regression (10 Points)

Given is following data:

x_1	x_2	y
4	2	6
6	-2	0
4	-2	-2
8	2	10
2	6	12

Learn a linear regression by estimating its parameters using normal equations (i.e. the closed form solution)! Do not forget to include the bias term!