# Computer Vision
# Exercise Sheet 8

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## Exercise 1: Jacobian (10 Points)

Given the minimization objectives (a) transfer distance in one image and (b) symmetric transfer distance, compute the Jacobians. (10 points)

## Exercise 2: Iterative Minimization (10 points)

Apply gradient descent on the function $f(x) = \frac{1}{4}x^4 + \frac{1}{3}x^3 - \frac{1}{2}x^2$ with following configurations:

- Use step length $a = 0.3$ and starting point $x_0 = -1$ and show the first four iterations. What is your minimum? (2 points)
- Use step length $a = 2$ and starting point $x_0 = -1$ and show the first four iterations. What has happened and why? (2 points)
- Use step length $a = 0.3$ and starting point $x_0 = 0$ and show the first two iterations. What has happened and why? Do the same again with $a = 0.8$ and starting point $x_0 = 0.5$ and show the first four iterations. Where is your minimum now? (4 points)

## Exercise 3: Levenberg-Marquardt (10 Points)

You are provided with four generic measurements of a process $(t_i, y_i)$ with $i = 1, 2, 3, 4$. Given $t_i$, the $y_i$ values can be approximated with the equation $m(x_i, t_i) = e^{t_i x_1} + e^{t_i x_2}$.

Your goal is, with this information, to approximate $x_1$ and $x_2$ parameters with the Levenberg-Marquardt algorithm. Describe in detail the pseudo code you would use to indicate the equation and dimensions of the matrices/vectors $J, J^T, g, H$ and $d$ for the given example. You don't need to compute inverse matrices. If you want to indicate that the matrix should be inverted, you can indicate it as follows: $A$ matrix you computed, $A^{-1}$ inverse of $A$.

Hint: Write at least a sentence for each step of the algorithm giving the requested additional information and explain input and output parameters $e, x_0$ and $\epsilon$ as well.