Week 2 – Least Squares Fitting (Mort)

Theory: Least squares fitting, Gauss-Newton and Levenberg-Marquardt Methods

Literature: Nocedal and Wright: Numerical Optimization, second edition, Springer, 2006.

Chapter 10 (pp. 245-269).

Exercises: 10.1 10.2 10.3

Programming case:

In your report you should:

- · Describe how the LM algorithm ensures convergence when the Gauss Newton fails
- Discuss quality of the solution compared to the solution from last week
- document your solution by including source code

Implementation:

Re-implement the program from last week to solve the posing problem using the Levenberg-Marquardt method. You will need to implement the update formula as well as an outer loop in which you update the Lambda parameter and reject or accept iterations

document your solution by providing e.g.:

- convergence plots of the solution with a discussion of what they tell us
- frame graps of the interactive solver

@ EXERCISES

- **10.1** Let J be an $m \times n$ matrix with $m \ge n$, and let $y \in \mathbb{R}^m$ be a vector.
- (a) Show that J has full column rank if and only if J^TJ is nonsingular.
- (b) Show that J has full column rank if and only if J^TJ is positive definite.
- 10.2 Show that the function f(x) in (10.13) is convex.
- 10.3 Show that
- (a) if Q is an orthogonal matrix, then ||Qx|| = ||x|| for any vector x;
- (b) the matrices R in (10.15) and R in (10.17) are identical if Π = I, provided that J has full column rank n.