Project Parameter Estimation, 2020 HS
Block 1 „Scanner Calibration“
Assignment 3, October 2, 2020

Tasks

The following tasks are to be accomplished as group work (except task 1) within assignment 3 of this block until October 16, 2020, 9 am:

1. Read and annotate (comment, highlight, …) Krarup (1980), as provided on Notabene. The purpose of the reading is to understand (i) the main idea of the “Danish method“ introduced in that paper and (ii) to understand how it can be implemented in the framework of a standard adjustment process. Careful reading should prepare you for discussion of outlier detection in class on Oct 16.

   The discussion will be along the questions listed at the end of this assignment. In order to have a solid basis for discussion, and enable fair awarding of points write down your answers to these questions and send the answers to AW as a PDF file before the above deadline. You can extend or modify the answers during the in-class discussion. Aspects which you do not bring up in class but which are written in this PDF document will be counted as contributions to the discussion.

2. If you have not done so yet, document the architecture of your software as a graphic.

3. If you have not done so yet, document the observation equations which you use by writing them completely and explicitly into a (Word, LaTeX, overleaf, …) document. You may split the equations into parts (like in Lichti, 2007) by using appropriate but clearly and fully defined symbols (better than Lichti, 2007), and explicitly stating the units and dimension of each term. It must be possible for a software engineer without geodetic background and without any other source than just this documentation to implement the evaluation of the non-linear observation equations, i.e. to create a function which calculates the values of the observations given the values of the parameters and the values of potentially required fixed quantities.

4. Report the calculation of the partial derivatives required in the observation matrix (“A-matrix”) in the same document. If you use the analytical approach, give all required equations fully and clearly, as above. If you use the numerical approach, give a flow-diagram of the software used to calculate the partial derivatives; document the value(s) of the numerical increment of the parameters to be used and explain clearly how you decided, which value(s) to use.

5. Continue with implementation and testing of the software for estimating the 4 APs and the EOs of all scans with variable number of scans.

6. Bring the documentation (steps 2, 3 & 4) to the class on Oct 16 in a form in which you can share it during class (take into account readability with screen sharing) and be prepared to explain all terms, quantities and (if any) figures given in that documentation. Be also prepared to show the Matlab code (screen sharing) and explain problems you encountered and solved, problems you did not yet solve (plus how you identified there is a problem), and any indications that everything/something works correctly.

Next class

On Oct 16 we will (i) discuss the paper Krarup (1980), (ii) discuss your architecture and model choices (documentation), (iii) discuss potential problems, (iv) discuss how outlier detection can be included in your software architecture.

Questions to be addressed after reading Krarup (1980):

1) What is the core idea of the outlier detection and mitigation approach proposed in the paper?

2) Which strong points do you see in the content of this paper?

3) Which strong points do you see in the format/style of the paper?

4) Which weak points do you see in this paper (content and/or format)?

5) Which aspects (except the different content/topic) of the paper are strikingly different from Lichti (2007) which you had read before? What do you think are main reasons for these differences?

6) Which other approaches to outlier detection and mitigation are established (e.g. in geomatics/geodesy) or can be found in the literature (not necessarily mentioned in this paper)? How does the proposed approach relate to those (e.g., is it equivalent or a special form of one of them or different from all of them)?

Notes:

- Answering question 6 may require a bit of independent literature research and critical reflection.
- The answers should be short. They should all fit on a single page A4, font size >= 10pt, normal line spacing. They are needed to document your insights from reading as a basis for discussion and in case you do not have a chance to express the related thoughts first in the discussion.