Active Online Visual-Inertial Navigation and Sensor Calibration via Belief Space Planning and Factor Graph Based Incremental Smoothing
Supplementary Material

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This document provides supplementary material to the paper [1]. Therefore, it should not be considered a self-contained document, but instead regarded as an appendix of [1], and cited as:

"Y. Ben-Elisha and V. Indelman, *Active Online Visual-Inertial Navigation and Sensor Calibration via Belief Space Planning and Factor Graph Based Incremental Smoothing*, (Supplementary Material, ANPL-2017-02), IROS, accepted."

Appendix A: Known Regions influence - Basic Study

We examine the influence of different uncertainty levels of priori known regions on the navigation and calibration performance. We simulate the same predefined trajectory considering identical environment in terms of landmarks, while changing only the uncertainty levels of landmarks within the a priori known region (green square). The results are presented in the Figures 1-4.

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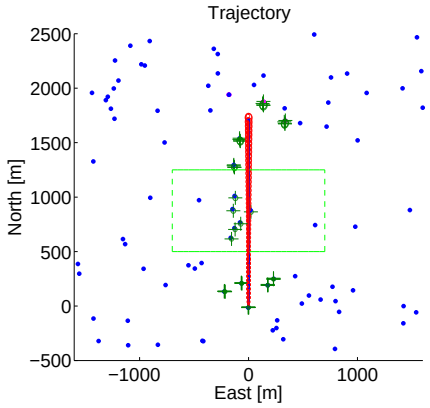

Figure 1: Straight forward trajectory with known region (green square). The unknown landmarks in the environment are the blue dots and the observed landmarks are shown with + on them.

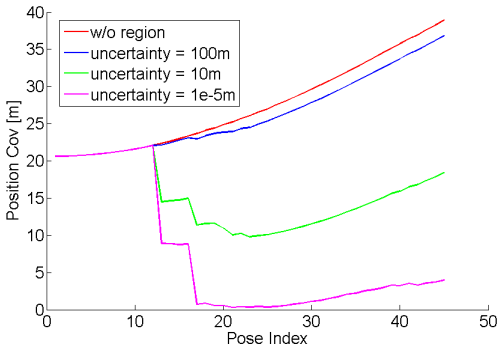

Figure 2: Position covariance results using different uncertainty levels of priori known regions

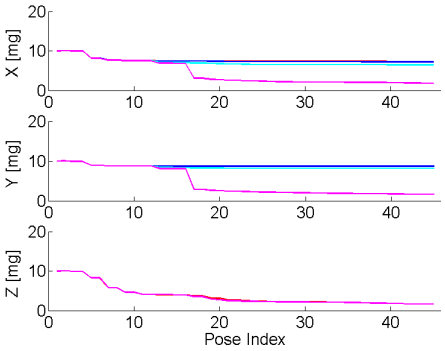

Figure 3: Accelerometers calibration covariance results using different uncertainty levels of priori known regions

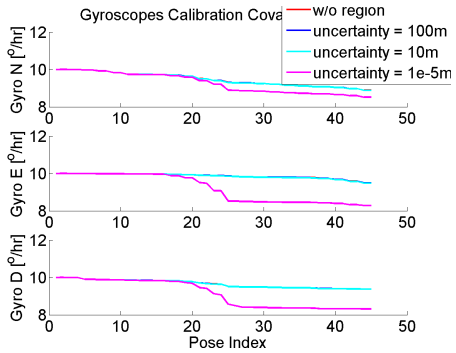

Figure 4: Gyroscopes calibration covariance results using different uncertainty levels of priori known regions

It is shown that it is possible to calibrate the IMU's accelerometers using known region with very small uncertainty. In addition using the property that known region with 'medium' uncertainty level (e.g. $\sim 10m$) influences only the position covariance, we can define an environment with different regions to examine the trade-off case between `'BSP-Calib'` and `'BSP'`.

References

[1] Y. Ben-Elisha and V. Indelman. Active online visual-inertial navigation and sensor calibration via belief space planning and factor graph based incremental smoothing. In *IEEE/RSJ Intl. Conf. on Intelligent Robots and Systems (IROS)*, 2017.