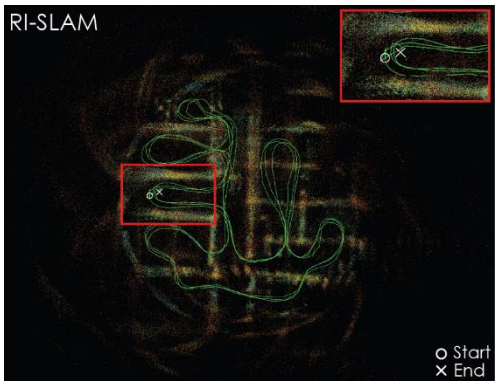
Developing Radar-Centric Methods for Use in Estimation

Abstract: Vision and LiDAR perception sensors have been greatly explored for localization and estimation task and thus can provide very accurate estimation. However, the limitation of these modalities is clearly observed during degenerate conditions. FMCW (Frequency Modulated Continuous Wave) radar sensors offer promising perception possibilities in situations which would be detrimental for both the previously mentioned modalities. This potential, however, is limited by unintuitive, sparse data output. This project and thesis aim to improve existing radar-inertial methods by investigating and taking advantage of properties inherent to radar sensors (e.g. by statistical modeling of the false positive reflections as well as doppler and RCS-aware scan matching). Ultimately building a full SLAM solution, thereby increasing long term estimation accuracy and mapping capabilities.



Tasks:

- Study and understand FMCW radar technology along with application state estimation frameworks (EKF and factor graph).
- Investigate statistical characteristics of sensor signals for filtering and uncertainty modeling.
- Develop scan-matching methods considering intrinsic properties of the sensing modality.
- Modify existing algorithms to benefit from characteristics particular to these sensors.
- Evaluate the performance with real-life data.
- Deployment on real hardware (aerial robot).

Literature (indicative):

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Relevant Project Information

- **SENTIENT Project - Funding Agency:** Research Council of Norway

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