NRI: Collaborative Research: Autonomous Quadrotors for 3D Modeling and Inspection of Outdoor Infrastructure
Award #1637875

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Driven to Discover℠

Goals

- To develop technologies to collect visual and inertial data necessary for constructing, offline, high-accuracy 3D maps of the structure for civil and industrial infrastructure
- to introduce algorithms for online processing including localization, path planning and obstacle avoidance.

Partners

1) Junaed Sattar (PI, U Minnesota)
2) Philippos Mordohai (co PI, Stevens Institute of Technology)
3) Peter Seiler (co PI, University of Michigan)

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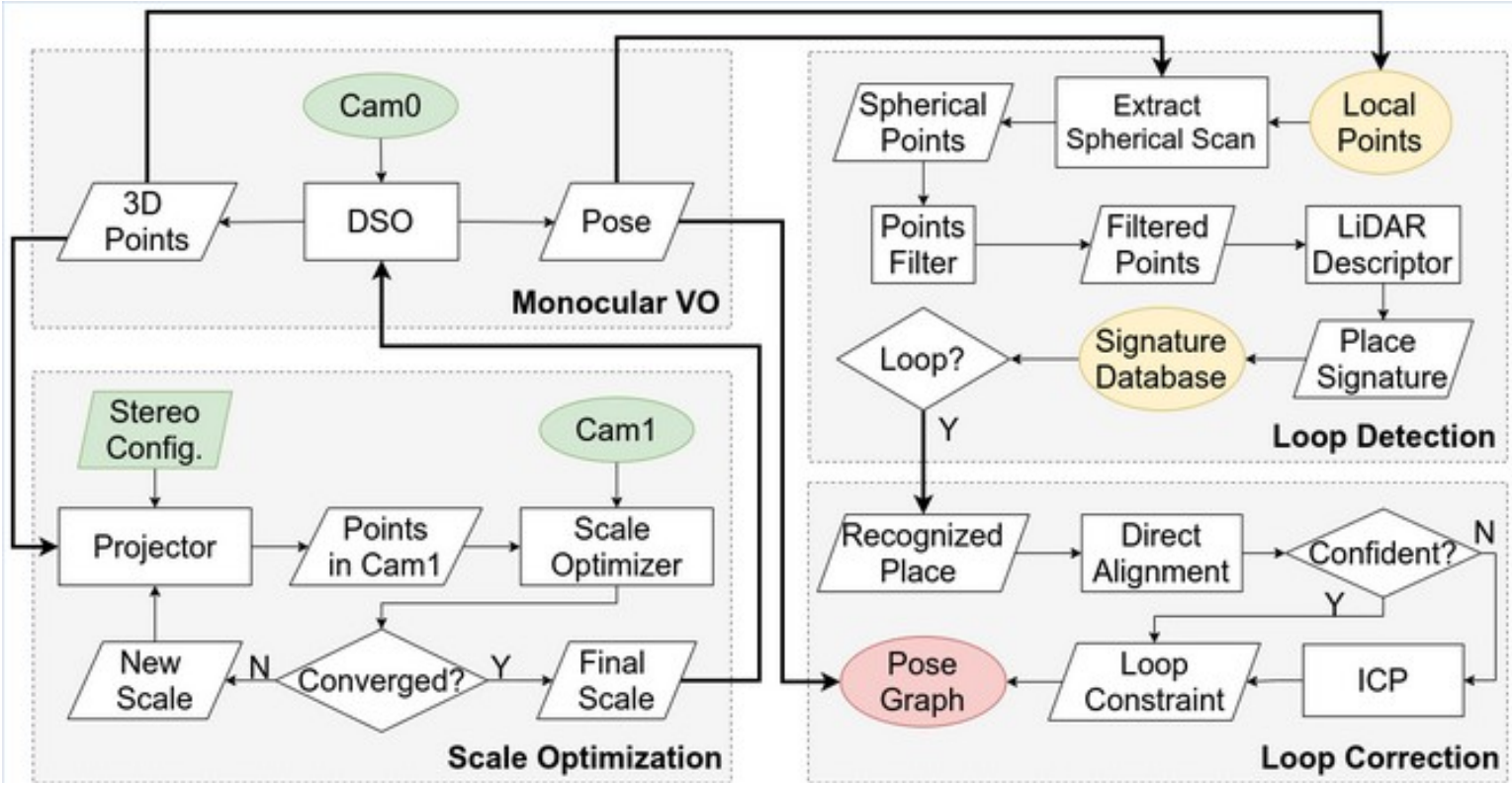
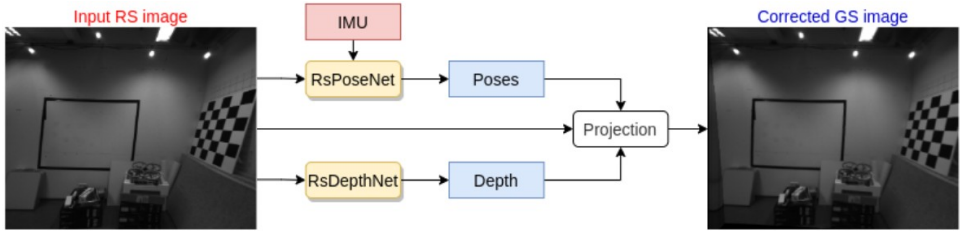
In 2021-2022

- Minnesota:
  - Fast Direct Stereo Visual SLAM (Mo, Islam, Sattar)
  - IMU-Assisted Learning of Single-View Rolling Shutter Correction (Mo, Islam, Sattar)
  - Continuous-Time Spline Visual-Inertial Odometry (Mo, Sattar)

Fast Direct Stereo Visual SLAM

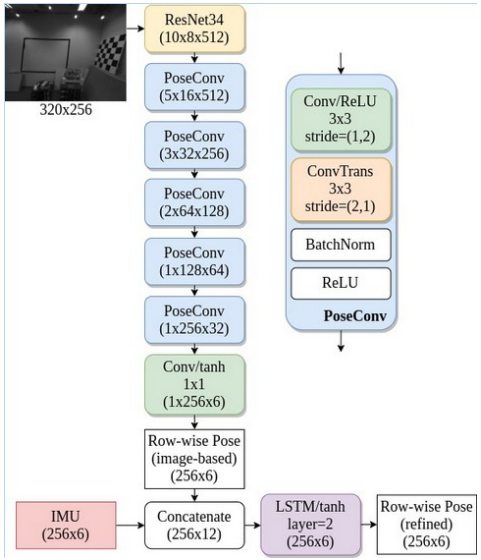


IMU-Assisted Learning of Rolling Shutter Correction

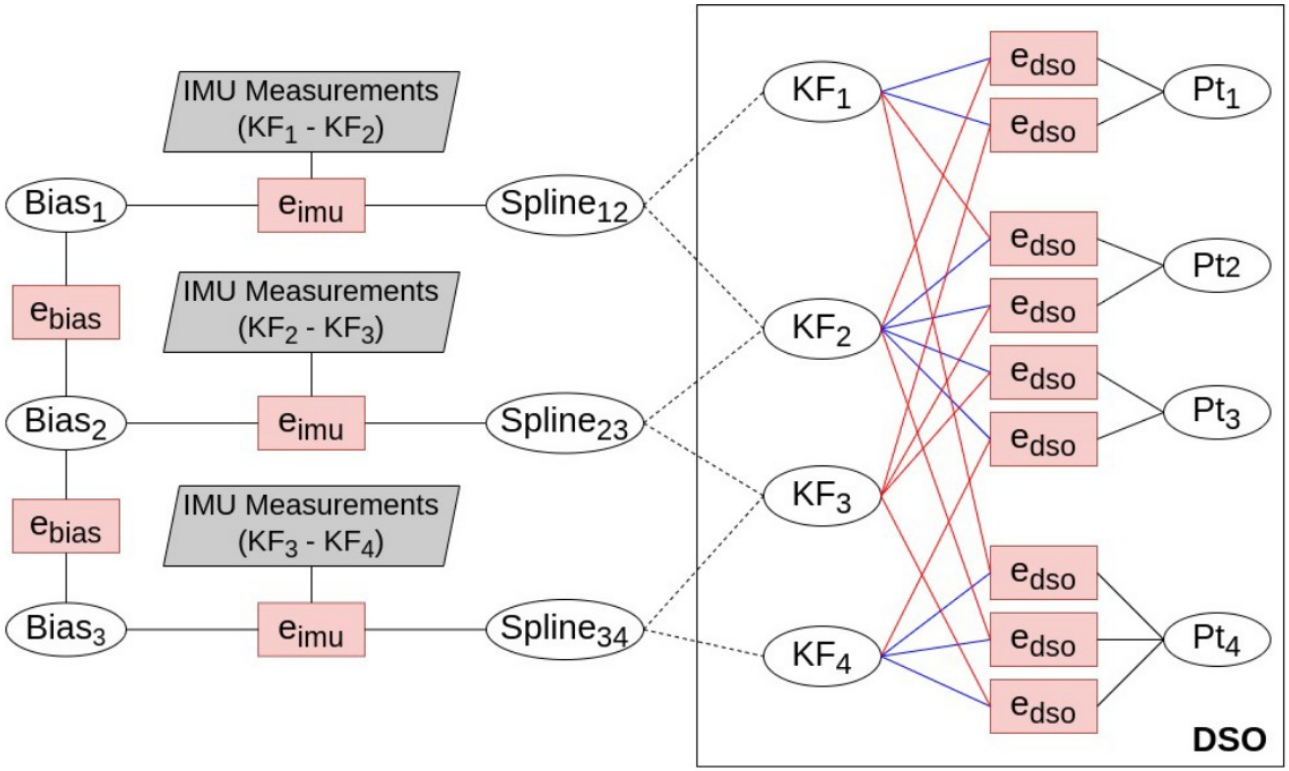


$$EPE(I) = \frac{1}{|I|} \sum_{\mathbf{u} \in I} \left|\left| \Pi(\mathbf{u}, d, \mathbf{T}') - \mathbf{u}_{GS_1}(\mathbf{u}) \right|\right|_2,$$

$$\Pi(\mathbf{u}, d, \mathbf{T}') = \mathbf{K}_{RS} \mathbf{T}' \begin{bmatrix} d\mathbf{K}_{RS}^{-1} \begin{bmatrix} \mathbf{u} \\ 1 \end{bmatrix} \\ 1 \end{bmatrix}.$$



Continuous-time Spline VIO



Thank you!