Bachelor/Master Thesis

Pose Graph Optimization Based on Differential Geometry

Description:

Pose graph optimization is the technique to estimate/optimize a robot pose chain from relative pose measurements, thus plays essential role in a wide range of applications such as graph-based Simultaneous Localization and Mapping (SLAM), Structure from Motion (SfM), etc.. However, partially due to the fact of the nonlinear manifold structure of rigid body motion and the underlying measurement noise, the optimization problem itself has strong non-convexity. Differential geometry and in particular Riemannian geometry provide powerful mathematical tools to investigate nonlinear manifolds, enabling us to tackle manifold optimization problems with better consideration of its local structure. This thesis is aimed to propose a novel optimization framework for pose graph parameterization and optimization leveraging Riemannian geometry. More specifically, the thesis is devided into the following working packages:

1. Theoretical investigation of SE(3) parameterizations and corresponding manifold structures using Riemannian geometry
2. Extension of existing manifold optimization algorithms with consideration of manifold local structure
3. Development of a novel pose graph optimization framework
4. Evaluation with published datasets under different application scenarios, e.g., SLAM or SfM

Requirements:

- Background of computer science, mathematics or other engineering majors.
- Good knowledge of optimization and hands-on experience with computer vision/point cloud is expected.
- Very good knowledge of C++ is essential.
- Knowledge of ROS is recommended.
- Strong self-motivation, reliability and critical mind are expected

The thesis can be tailored to Hiwi-job as preperation for the beginning stage.

Further information
(also for related topics of Hiwi-job/Bachelor or Master thesis) can be found from:
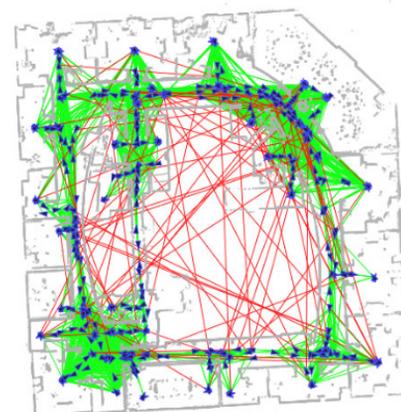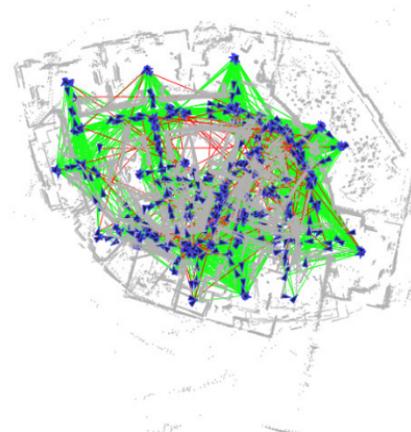

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