Shubodh's and Udit's SLAM Teaching

2020 RRC Summer School

🖱️ SLAM: The Big Picture — from Linear Algebra to Optimization, Frontend to Backend

2021 RRC Summer School

> 2021 page below

☂️ SLAM: The Big Picture — 2021 RRC Summer School

Ideas:

- [x] ~~Sensor fusion, Filtering vs smoothing, factor graphs, iSAM~~
- [x] ~~On manifold preintegration briefly~~
- [x] ~~How do RTAB-Map and ORB-SLAM do SLAM backend?~~
    - Do they do batch pose graph optimization? Or full landmark + pose graph? Or locally BA and globally sparse pose graph for only keyframes?
- [ ] Latest dense mapping techniques, Kinect Fusion, SVO

- [ ] Mapping datatypes: PointClouds, voxels, surfel maps, MLP(iMAP)
- [ ] NeRF, NeRF—

Theory

How do modern SLAM systems like RTAB-Map and ORB-SLAM do SLAM backend (& loop closure)?

- ORB-SLAM: TODO-for-Shubodh @May 23, 2021 2:00 PM
  - VI-D: Local Bundle Adjustment: For local consistency
  - III-D and VII-D: *Essential Graph* Optimization: *Essential Graph* is essentially keyframe... as opposed to covisibility graph which is.. (will add more soon)
- RTAB-Map: TODO-for-Udit
- TODO-for-Shubodh: maybe briefly mention loop closure in the context of topological graphs/GNNS

Sensor fusion, Filtering vs smoothing, factor graphs, iSAM

> TODO-for-Shubodh @May 11, 2021 2:00 PM

Manifold preintegration

> TODO-for-Shubodh @May 17, 2021

Latest dense mapping techniques, Kinect Fusion, SVO

> Kinect Fusion, SVO @May 22, 2021 9:00 AM

Mapping datatypes

> PointClouds, voxels, surfel maps, MLP(iMAP)

Modern methods for Reconstruction: Implicit Representation

> NeRF, NeRF—

Assignment

💡 Udit's ideas:
1. Introduction to factors in GTSAM, examples related to sfm or pose graph in python API.
2. Odometry fusion using gtsam, while odometry would also be calculated by students.
3. Calculate odometry from two sensors (lidar: ICP, Visual: PnP), now put this as odometry edges in gtsam and get the best solution for odometry by optimizing the factor graph. It would build the concepts for sensor fusion, front end, and back end.

Theory

- Some fundamental questions about SLAM
- Compare between SLAM methods?

Code

- ORB-SLAM
- GTSAM/g2o