From ORBSLAM3 to Dense Reconstruction

Project Management and Software Development
for Medical Applications

General Info

Contact Person: Mahdi Hamad

Contact Email: mahdi.hamad@tum.de

Project Abstract

The goal of the project is to build a dense surface reconstruction of 3D scenes using a sparse point clouds extracted from ORBSLAM3 algorithm [1].

Background and Motivation

The problem of simultaneous localization and mapping (SLAM) has been one of the most actively studied problems in the robotics community over the past decade. The availability of a 3D map of the robot's workspace is an important requirement for the autonomous execution of several tasks including localization, planning, and navigation.

We aim to apply ORBSLAM3 in a surgical setting, where cameras are attached to the robot and the robot scan the room. Therefore, it is very important to obtain a 3D surface reconstruction of the room. This project will focus on the the mapping part of the SLAM only. Using the 3D map, RGB-D images and camera poses provided by ORBSLAM3 we want to reconstruct the surface of the 3D scene. Previous works [2] and [3] reconstruct dense point clouds only with no surface reconstruction and do not use ORBSLAM3.

Student's Tasks Description

- The student will apply the available code of ORBSLAM3 on our data and get the sparse 3D map
- Compute a dense point cloud from the sparse one
- Reconstruct the 3D surface using the dense point cloud

Technical Prerequisites

Necessary: C++, ROS, development under Ubuntu, knowledge of computer vision, know how to read code and modify it.

Beneficial, but not required: Basic knowledge of PCL (Point Cloud Library) library, basic knowledge of surface reconstruction

References

[1] Campos, Carlos, et al. "ORB-SLAM3: An accurate open-source library for visual, visual-inertial and multi-map SLAM." arXiv preprint arXiv:2007.11898 (2020).

[2] "3D Mapping with an RGB-D Camera", F. Endres, J. Hess, J. Sturm, D. Cremers, W. Burgard,IEEE Transactions on Robotics, 2014

[3] Mur-Artal, Raul, and Juan D. Tardós. "Orb slam2: An open-source slam system for monocular, stereo, and rgb-d cameras." IEEE Transactions on Robotics 33.5 (2017): 1255-1262.

Please send the completed proposal to javier.esteban@tum.de, ardit.ramadani@tum.de, mf.azampour@tum.de and zl.jiang@tum.de. Please note that this proposal will be evaluated by the BMC coordinators and will be assigned to a student only in case of acceptance