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Praxis der Forschung:
Towards Efficient Large-scale Dense SLAM

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Simultaneous Localization and Mapping (SLAM) denotes the technique of ego-motion tracking and constructing or updating a map of unknown surroundings at the same time. It plays a central role in a variety of application scenarios, such as autonomous driving, virtual/augmented reality etc. In order to endow better autonomy and interaction capability for mobile robots, detailed perception of the environments is desired. This requires to perform the mapping with sufficiently high reconstruction resolution and accuracy, as well as good processing efficiency for real-time interaction and decision-making.

In this project, novel techniques of performing real-time dense SLAM for large-scale scenario are to be developed. In particular, we focus on real-time 3D reconstruction using the GPU, based on which advanced machine learning techniques will be applied for scene understanding. More specifically, the project is composed of the following work packages.

Work Packages:

- Literature review of existing real-time dense SLAM frameworks and 3D reconstruction systems using GPU.
- Development and implementation of a dense SLAM system which has real-time processing speed and is able to fuse information from multiple sensory modalities (e.g., LiDAR, cameras).
- Endowing the proposed system with scene understanding ability based on cutting-edge machine learning approaches.
- Evaluation based on real-world dataset and experiments in multiple application scenarios, e.g., large-scale scene reconstruction, 3D object detection, etc.

Prerequisites:

- Highly self-motivated and willing to take on challenges.
- Having solid coding skill with C++/Python and good mathematical foundations.
- Experience with computer vision/graphics and machine learning is a plus.

At least one joint publication is planned as one of the goals of the project. The topic will be tailored individually in the initial meeting.

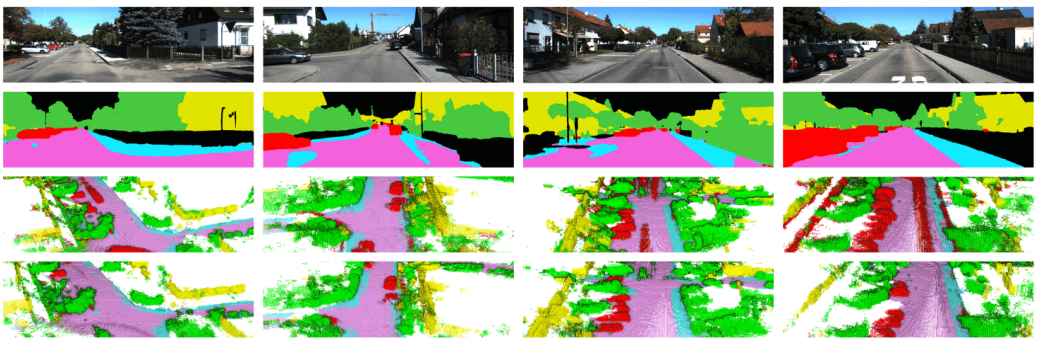

Figure 1: An example of semantic mapping (Courtesy Jongmin Jeong et al.)