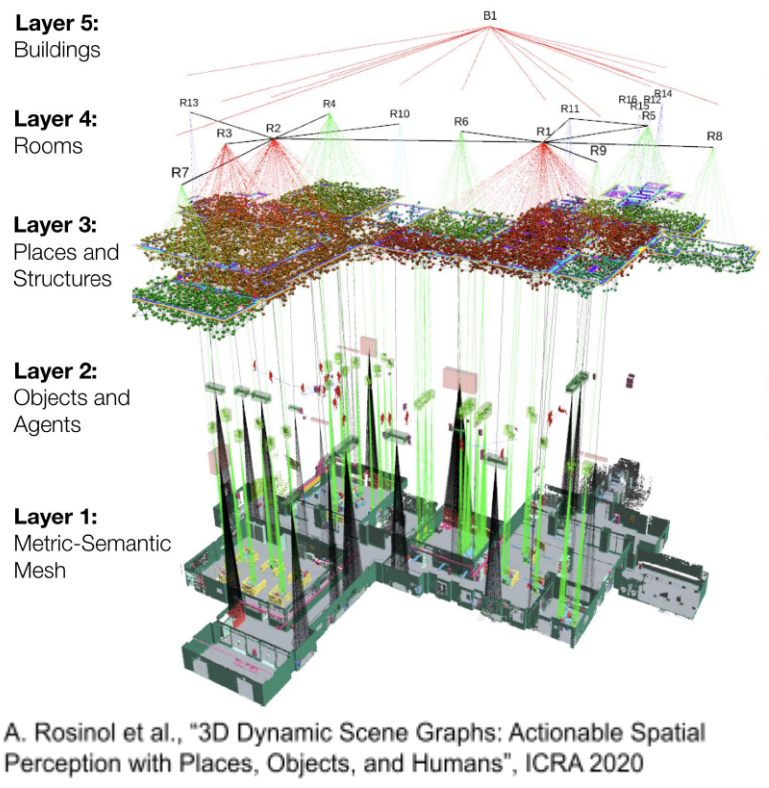
ETH
Eidgenössische Technische Hochschule Zürich
Swiss Federal Institute of Technology Zurich

Incremental 3D Scene Graph Construction for high-level Planning and Mapping

Semester Project / Master Thesis



A. Rosinol et al., "3D Dynamic Scene Graphs: Actionable Spatial Perception with Places, Objects, and Humans", ICRA 2020

Supervisors

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Description

Scene understanding is a crucial component to high-level planning and interaction in autonomous systems. A possible representation to capture the semantic meaning of objects and their relations are 3D scene graphs.

Traditional approaches typically focus on extracting a 3D scene graph from a given map, either using learning-based or geometric methods. However, in these cases the representation can not be used on-line, e.g. for an object search task, and are not suitable for potentially dynamic scenes.

In this project, the goal is to incrementally extract and build a 3D scene graph representation during robot operation and integrate this information with a dense mapping framework. This includes primarily the definition of the relevant attributes and hierarchical abstractions to be captured with the scene graph, a front-end to extract the scene graph from sensory and or mapping data, as well as the development of a method to incrementally merge these observations into the current graph.

Work packages

- Literature review.
- Development of a front-end to extract 3D scene graphs from sensory and/or map data.
- Development of a method to incrementally build a single graph from these observations.
- Evaluation of the proposed system.

Requirements

- Highly motivated and independent student.
- Strong interest in Robotics and Computer Vision.
- Programming skills in C++/Python are mandatory.
- Experience with ROS, Deep Learning, and other frameworks are a plus.