

STINT-KOSEF
Sweden/Korea workshop proposal:
Research on Human-Augmented Mapping

1 Introduction

In human-augmented mapping (HAM), a human and a robot interact to establish a correspondence between how the human perceives the spatial organization of the environment, and what the robot autonomously learns as a map. This helps to bridge the difference in perspective: robots usually construct metric maps, whereas humans adopt a more topological/semantic approach to spatial organization. Being able to overcome this difference is crucial for interactive, mobile service robots.

Human-augmented mapping can take many forms and there are many interesting aspects of it. Besides creating a shared representation between user and robot the user can also help the robot with resolving ambiguities.

2 Activities at KTH

CAS at KTH has a significant bouquet of activities in the area of human-augmented mapping. The sections below lists some of them.

2.1 Wizard of Oz User Studies

Today's robots have many limitations and studying how humans should interact with the robots of the future is therefore difficult. One way to deal with the is to perform so called Wizard of Oz studies where some functionality of the robot is controlled by a human.

Human interaction with a service robot requires a shared representation of the environment for spoken dialog and task specification where names used for particular locations are depending on personal preferences. A question is how such human oriented models can be tied to the geometric robotic models needed for precise localization and navigation. In [1] a pilot study that investigates how humans present a familiar environment to a mobile robot is presented. The study is set up within our concept of Human Augmented Mapping, for which we assume an initial "guided tour" scenario to teach a robot its environment.

2.2 Clarification Dialog

In [2] an approach to dialog based interaction for resolution of ambiguities encountered as part of Human-Augmented Mapping (HAM) is presented. The focus is on issues related to spatial organization and localization. The dialog pattern naturally arises as robots are introduced to novel environments. The paper discusses an approach based on the notion of Questions under Discussion (QUD). The presented approach has been implemented on a mobile platform that has dialog capabilities and methods for metric SLAM. Experimental results from a pilot study clearly demonstrate that the system can resolve problematic situations.

2.3 Including objects into the map

Linking semantic and spatial information has become an important research area in robotics since, for robots interacting with humans and performing tasks in natural environments, it is of foremost importance to be able to reason beyond simple geometrical and spatial levels. In [3] we considered this problem in a service robot scenario where a mobile robot autonomously navigates in a domestic environment, builds a map as it moves along, localizes its position in it, recognizes objects on its way and puts them in the map. For detecting objects we use the Canon VC-C4 pan/tilt/zoom camera. The zoom allows us to detect objects even if they are relatively far away. An interesting question for SLAM is how to design the representation of space such that geometric information from the laser scanner and the presence of object can both be included.

References

- [1] E. A. Topp, H. Hüttenrauch, H. I. Christensen, and K. S. Eklundh, “Bringing together human and robotic environment representations - a pilot study,” in *Proc. of the IEEE/RSJ International Conference on Intelligent Robots and Systems (IROS’06)*, (Beijing, China), Oct. 2006.
- [2] G.-J. M. Kruijff, H. Zender, P. Jensfelt, and H. I. Christensen, “Clarification dialogues in human-augmented mapping,” in *Proc. of the 1st Annual Conference on Human-Robot Interaction (HRI’06)*, (Salt Lake City, UT), Mar. 2006.
- [3] S. Ekvall, P. Jensfelt, and D. Kragic, “Integrating active mobile robot object recognition and slam in natural environments,” in *Proc. of the IEEE/RSJ International Conference on Robotics and Automation (IROS’06)*, (Beijing, China), 2006.