Extended Abstract on Mobile Robotics

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1 Introduction and problem statement

Detecting and tracking people on a mobile robotic platform with real time requirements and hardware constraints is an upcomming issue. Knowing the positions of people over time is important for many applications that focus on human - robot interaction, e.g. autonomously following a person.

The following work summarizes five papers on this topic to introduce the available hardware / algorithms and its utilization for people tracking.

2 Short summary of the Papers to Investigate

2.1 OpenPTrack

The first paper [1] introduces OpenPTrack. OpenPTrack is a framework built with the Robotic Operating System (ROS) and enables the user to utilize and calibrate a network of multiple RGB-D cameras. Detection of people happens in a distributed fashion while the tracking is done in a single node that processes all detections from the network.

2.2 Person Tracking and Following with 2D Laser Scanners

In this paper [2] an approach that utilizes depth sensors - such as laser or RGB-D - for sensing its surroundings is introduced. The implementation is provided as open source ROS package which can be used with any depth sensing based hardware on a height of 30cm. A retraining of the human-confidence learning algorithm may be necessary when different sensor resolutions are used.

Detection and tracking works with moving and non-moving persons in cluttered enviroments. It is independet of light conditions, works in close proximity to the tracked person and does not need an *a priori* occupancy grid map of the surroundings.

2.3 Computationally Intelligent System for Thermal Vision People Detection and Tracking in Robotic Applications

This work [**?**] uses thermal vision and ultrasonic sensors. It uses the distinct thermal profile of people to detect and track them. This is independet of light conditions. Aquiring the position of a human in an thermal image is realized by segmentating the image in Regions Of Interests (ROIs). Data of the thermal sensor represents differences in the thermal energy of objects in an enviroment. Thresholding

this data then allows to extract segments of interest. As most thermal image segmentation algorithms fail to provide real time perfomance a new algorithm is introduced.
Utilizing fuzzy membership functions that determine how strongly a RGB color belongs to the fore- or background it is possible to have a fast and reliable segmentation algorithm. Applying such fuzzy logic on RGB color instead of greyscale images provides much better results. A disadvantage is that this method won't yield good results in situations where more precise tracking is required, e.g. for body joints.
A neuro-fuzzy classifier then determines if a segment is human or not.
This approach provides fast and reliable tracking of one person. It is able to detect and track multiple persons but - depending on the interactions between these people - loses track easily.

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References

[1] M. Munaro, A. Horn, R. Illum, J. Burke, and R. B. Rusu, "Openptrack: People tracking for heterogeneous networks of color-depth cameras," in *IAS-13 Workshop Proceedings: 1st Intl. Workshop on 3D Robot Perception with Point Cloud Library*. Citeseer, 2014, pp. 235–247.

[2] A. Leigh, J. Pineau, N. Olmedo, and H. Zhang, "Person tracking and following with 2d laser scanners," in *2015 IEEE International Conference on Robotics and Automation (ICRA)*, May 2015, pp. 726–733.