W. YAN. ***Robot navigation for assisted living.*** *Gerontechnology 2012;11(2):xxx;*
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Purpose

As the field of robotics matures, elderly people can increasingly benefit. For example, the KSERA project proposes a mobile robot that serves as a communicative interface as part of an ambient-assisted-living (AAL) home. Robotic navigation, in particular mutual positioning between the robot and the person, is one of the prerequisites enabling the robot to serve the person. However, indoor robot navigation is still a challenging task due to the high complexity and possible dynamic changes within homes. The system should safely interact with users without requiring expert knowledge and costly or distributed sensors in the home; the system should also be easy to install and to maintain.

Method

We have developed a hybrid probabilistic neural model simultaneously tracking a person and a robot using a single ceiling-mounted camera with a fish-eye lens.[1] Based on vision technologies, different visual cues are computed and integrated in a Sigma-Pi-like network.[2] A short-term memory mechanism modeled via particle filters enhances the robustness of the tracking system. Using the person's location obtained from the tracking system, a cognitive map is built for robot navigation. While updating the cognitive map, an inverse control model of possible navigation within the map is trained. The robot will plan the path to approach a person based on the cognitive map and navigate naturally. Since the robot's navigation is not based on a geometrical model, our system can work without camera calibration. Instead, it maps the room by the person's ordinary movement without any extra knowledge.

Results & Discussion

A detailed case study has been conducted to evaluate the model. As shown in Fig. 1 left, a person and a robot are localized simultaneously in a home environment. A cognitive map is built up based on the person's movement (Fig. 1 right), and the navigation is planned by searching for the brighter units in the map, which leads to the robot approaching the person. Since the entire system only needs a simple ceiling-mounted camera as sensor input, and the room mapping can be done in a simple way, we conclude that our system is appropriate for in-door robot navigation in an ambient home.

References

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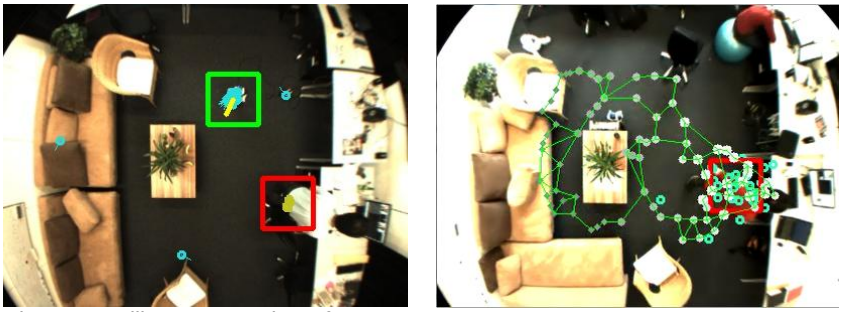

Figure 1. Ceiling-camera view of an apartment
Left: A person (at red box) and a robot (at green box) are localized. The green spots are particles for the robot and the yellow for the user.
Right: The units and the links of the built cognitive map.