MSc Thesis Proposal – Vision-based control of an eating assistive device

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Background

Figure 1. Bestic

Undernutrition is a large problem amongst elderly. We believe that it is hard for the user him/herself to notice that they are eating too little. In Sweden many elderly lives alone with the help of home care services and there are often many different care givers involved, so to keep track of what a person is eating over the day and over time is difficult. These problems occur as well in Japan in the long-term care (LTC) system. On the other hand, Japan and Sweden share the same problem with the demographical development and both countries are robot and technical friendly. This gives a common goal to manage to take care of our elderly 2022.

The eating aid, Bestic, is made to get the food from the plate to the mouth, controlled by the user (Figure 1). The development of Bestic started as a master thesis 2004 [1]. The design concept, where contact with the users during the whole development process was considered [3], was focused on getting friendly, kitchen-aid looking shape with the following characteristics: small, quiet and portable.

In this project, we are aiming to enable Bestic to create food intake reports in order to decrease undernutrition among frail elderly by collecting data via a vision system connected to the Internet [2]. For this purpose, the authors have proposed the following objectives: Adapt the eating assistive robot to Japanese customs and meals; Create food intake reports via a vision system connected to the internet; Provide new possibilities for independence by adding new functionalities with multi-grip tools and elucidate the social system that supports frail elderly with eating difficulties (process, roles, and methods). In this master thesis, special focus will be given to design and implementation a vision-based control of the eating assistive device. Vision-based control (also known as visual servoing) servo control, using computer vision data in the servo loop to control the motion of a robot (e.g. [4]).

Objectives:

The objectives are:

- Integrate the vision system to the arm control of Bestic;
- Determine suitable control techniques for the vision-based control of the eating assistive device and implement them into the proposed system.

Tasks and tools

The thesis work should comprise the following tasks:

- Literature study on computer vision, signal processing and vision-based control techniques
- Design the proposed control strategy
- Implement the algorithm in a real-time platform
- Verify the implemented algorithm in a real environment
- Write thesis report describing the work and results

Requirements

One student in MCs programs in Electrical Engineering, Mechanical Engineering, Physics Engineering or similar is suitable for this job. The master thesis work will take 20 full working weeks (30 hp). Candidate should have a basic background in control and vision processing techniques. Good programming skills is desired. It is also important that the applicant have good writing and communication skills. Please attach a list of courses with marks and a CV in your application.

References

[1] Norén, A.L (2005). An eating-aid for persons with little or no ability to move their arms. Chalmers Master's Thesis.
[2] Lindborg, A.L., Solis, J., Saijo, M., Takeda, Y., Zhang, C. Takeda, R. (2017). Robotic assistive device with multi-grip tools and vision system for frail elderly's independent life, ICRA2017 Workshop on Advances and challenges on the development, testing and assessment of assistive and rehabilitation robots.
[3] Lindborg, A.N., Lindén, M. Development of an Eating Aid- From the user needs to a product. 12th International Conference on Wearable Micro and Nano Technologies for Personalized Health, pp.191-198 (2015)
[4] Nakadate, R., Solis, J., Takanishi, A., Minagawa, E., Sugawara, M., Niki, K. (2011) "Out-of-Plane Visual Servoing Method for Tracking the Carotid Artery with a Robot-Assisted Ultrasound Diagnostic System," in Proceedings of the International Conference on Robotics and Automation, pp. 5267-5272.

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