Sweeper: Sweet Pepper Harvesting Robot

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Abstract:

The talk will describe the research and development of the Ben-Gurion team in the Sweeper project which just concluded Oct, 30 2018. Sweeper was a 3.5 year ICT Robotic Use Cases project in the H2020 program. SWEEPER's main objective was to put the first generation greenhouse harvesting robots onto the market. Until now this has never been achieved and the aim was to ensure Europe's leading role in agricultural robotics.

The talk will include a review of the detection and localization algorithms developed for the harsh outdoor illumination conditions. Despite extensive research conducted in machine vision for harvesting robots, practical success in this field of agrobotics is still limited. We will discuss the sensor selection procedures and the advantages and disadvantages of the different algorithms developed along the project.

Next we will discuss the issue of visibility in greenhouse conditions under the assumption of a perfect detection algorithm. Previous research has shown that only 40-60% of the fruits are visible from a single viewpoint. The talk will provide insights into methodologies for statistical modeling of fruit detectability and multiple viewpoint analysis. Finally, the possibility of dynamic viewpoint calculation will be discussed in the context of profitability of the robot and harvesting cycle times.

The research was performed by a joint collaboration of the intelligent robotics lab of Prof. Yael Edan from the department of Industrial Engineering and Management and the interdisciplinary computational vision lab of Prof. Ohad Ben-Shahar from the department of Computer Science. The two PhD students (Polina Kurtser and Boaz Arad) from both labs lead the development of the discussed algorithms and their implementation in the project and they will co-share the presentation.

Polina Kurtser is a postdoctorate student in the Department of Industrial Engineering and Management, Ben-Gurion University of the Negev. She has just submitted her Ph.D thesis "*Dynamic Sensing and Task Planning for an Autonomous Harvesting Robot*" and holds a M.Sc in Industrial Engineering and a B.Sc in Bio-Medical Engineering both from Ben-Gurion University of the Negev. Her research focuses on statistical modeling for data analysis, dynamic sensing and task planning, signal processing and computer vision in robotic and medical applications.

Boaz Arad is a co-founder and CTO of the startup company "Voyage 81". Currently completing his academic duties as a Ph.D. student at the BGU Interdisciplinary Computational Vision Laboratory, Boaz holds a M.Sc. and B.Sc in computer science, both from BGU. Alongside Prof. Ben-Shahar, Boaz collected and curated the largest natural hyperspectral image database published to date. For his work on hyperspectral data recovery he was awarded the EMVA "Young Professional Award 2017" as well as the Zlotowski Center for Neuroscience "Best Research Project of 2016" award.

http://www.sweeper-robot.eu/