KEYNOTE TALK

Wednesday, December 16, 2015

8:30 AM – 9:30 AM / Ballroom 5

ISVC 2015: 11th International Symposium on Visual Computing

Machine vision for robotic bin-picking: Sensors and algorithms

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Abstract

For over four years, at MERL, we have worked on the robot "bin-picking" problem: using a 2D or 3D camera to look into a bin of parts and determine the pose, 3D rotation and translation, of a good candidate to pick up. We have solved the problem several different ways with several different sensors. I will briefly describe the sensors and the algorithms. In the first half of the talk, I will describe the Multi-Flash camera, a 2D camera with 8 flashes, and explain how this inexpensive camera design is used to extract robust geometric features, depth edges and specular edges, from the parts in a cluttered bin. I will present two pose estimation algorithms, (1) Fast directional chamfer matching-- a sublinear time line matching algorithm and (2) specular line reconstruction, for fast and robust pose estimation of parts with different surface characteristics. In the second half of the talk, I will present a voting-based pose estimation algorithm applicable to 3D sensors. We represent three-dimensional objects using a set of oriented point pair features: surface points with normals and boundary points with directions. I will describe a max-margin learning framework to identify discriminative features on the surface of the objects. The algorithm selects and ranks features according to their importance for the specified task which leads to improved accuracy and reduced computational cost.

Speaker Bio-Sketch: Oncel Tuzel is a senior principal member of the research staff in Mitsubishi Electric Research Laboratories, Cambridge. He received his BS and the MS degrees in computer engineering from the Middle East Technical University, Ankara, Turkey in 1999 and 2002 respectively, and the Ph.D. from the computer science department at Rutgers University in 2008. Prior to his Ph.D., Oncel worked as a lead software engineer for four years in Ankara, Turkey developing 3D games and simulations. His research interests are broadly in computer vision, machine learning and robotics. His current research topics include deep learning and structured learning for scene labeling and object classification, learning based image enhancement and reinforcement learning. He has co-authored over 40 peer-reviewed publications and holds 25 patents. His work has received the best paper runner-up award in 2007 IEEE Conference on Computer Vision and Pattern Recognition (CVPR), honorable mention award in 2015 Robotics Science and Systems Conference (RSS), and the 2014 R&D 100 award-- awarded to 100 most innovative technology introduced in 2013.