

Mechanical & Aerospace Engineering

seminar

3D Object Detection and Pose Estimation for Manipulation:
from Single Images to Active Viewpoint Selection

February 7, 2014 at 1:30pm in LL2

abstract

In this talk, we address the problem of detection and localization of 3D objects in cluttered scenes. Object exemplars are given in terms of 3D models without any appearance cues. Deformable part-models are trained on clusters of silhouettes of similar poses and produce hypotheses about possible object locations. Objects are simultaneously segmented and verified inside each hypothesis bounding region using the chordigram descriptor. A final iteration on the 6-DOF object pose minimizes the distance between the selected image contours and the actual projection of the 3D model. While we demonstrated successful grasps based on single images we believe that selection of class and pose could be optimized if we explore the capability of active viewpoint selection. When an initial static detection chase identifies an object of interest, several hypotheses are made about its class and orientation. We plan a sequence of viewpoints, which balances the amount of energy used to move with the chance of identifying the correct hypothesis. We formulate an active hypothesis testing problem, which includes camera mobility, and solve it using a point-based approximate POMDP algorithm. Experiments using a 3D model database and an RGB-D sensor show a significant improvement both in detection and pose estimation. This is joint work with Menglong Zhu, Matthieu Lecce, Cody Phillips, Kosta Derpanis, Nikolay Atanasov, Jerome Le Ny, and George Pappas.

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biosketch

Kostas Daniilidis is Professor of Computer and Information Science at the University of Pennsylvania where he has been faculty since 1998. He obtained his undergraduate degree in Electrical Engineering from the National Technical University of Athens, 1986, and his PhD in Computer Science from the University of Karlsruhe, 1992, under the supervision of Hans-Hellmut Nagel. He was Associate Editor of IEEE Transactions on Pattern Analysis and Machine Intelligence from 2003 to 2007. He founded the series of IEEE Workshops on Omnidirectional Vision. In June 2006, he co-chaired with Pollefeys the Third Symposium on 3D Data Processing, Visualization, and Transmission, and he was Program co-Chair of the 11th European Conference on Computer Vision in 2010. He has been the director of the interdisciplinary GRASP laboratory from 2008 to 2013 and he is the Associate Dean for Graduate Education of Penn Engineering since 2013. He is an IEEE Fellow.

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