3D SCENE MODELING AND UNDERSTANDING FROM IMAGE SEQUENCES

Hao Tang, CUNY Graduate Center
Assistant Professor, BMCC /CUNY

Wednesday December 05, 2012, NAC 7/225, 12:30 pm – 1:30 pm

Abstract:

A new method for 3D modeling is proposed, which generates a content-based 3D mosaic (CB3M) representation for long video sequences of 3D, dynamic urban scenes captured by a camera on a mobile platform. In the first phase, a set of parallel-perspective (pushbroom) mosaics with varying viewing directions is generated to capture both the 3D and dynamic aspects of the scene under the camera coverage. In the second phase, a unified patch-based stereo matching algorithm is applied to extract parametric representations of the color, structure and motion of the dynamic and/or 3D objects in urban scenes, where a lot of planar surfaces exist. Multiple pairs of stereo mosaics are used for facilitating reliable stereo matching, occlusion handling, accurate 3D reconstruction and robust moving target detection. The outcome of this phase is a CB3M representation, which is a highly compressed visual representation for a dynamic 3D scene, and has object contents of both 3D and motion information. In the third phase, a multi-layer based scene understanding algorithm is proposed, resulting in a planar surface model for higher-level object representations. Experimental results are given for both simulated and several different real video sequences of large-scale 3D scenes to show the accuracy and effectiveness of the representation. We also show the patch-based stereo matching algorithm and the CB3M representation can be generalized to 3D modeling with perspective views using either a single camera or a stereovision head on a ground mobile platform or a pedestrian. Applications of the proposed method include airborne or ground video surveillance, 3D urban scene modeling, traffic survey, transportation planning and the visual aid of navigation and perceptual of blind people.

Bio-sketch

Hao Tang received his B.S. degree from Beijing Polytechnic University, Beijing, China, in 1992, and the M.S. degree from the City College of New York in 2003, both in computer science. He is now an Assistant Professor/Instructor at BMCC/CUNY, and a Ph.D. candidate at the Graduate Center of the City University of New York (expected graduation: Feb, 2013). Since 2003, he has been a research assistant in the City College Visual Computing Laboratory, working on video surveillance and 3D computer vision. He is a student member of IEEE.