Foreground object removal and hole-filling for Google maps street view

Arturo Flores
Department of Computer Science
University of California, San Diego

1 Project Description

The goal of this project is to automatically remove foreground objects (people, cars, trees, etc) from Google maps street view images. Since multiple vies from different angles are available, the holes left behind after foreground object removal will be filled using this redundant data. This would allow for an unobstructed view of the background objects (buildings, houses, empty lots, etc). This may also reduce the privacy concerns by removing identifiable objects such as cars or persons from Google maps street view.

This project was originally inspired by [1]. In this paper, in addition to camera images, they also had a series of 2D surface scans obtained by a laser scanner. Histogram analysis of pixel depths was used to classify a pixel as a background or foreground pixel.

In this project, we will attempt to remove foreground objects when only camera images are available. We will use the motion segmentation method by Wills et al[3]. To reconstruct the background layers, we will use a method similar to the one described in [2].

In this project, we will attempt to answer the following questions:

- Can the motion segmentation method in [3] be succesfully applied to identify and remove foreground objects in Google maps street view data?
- How should the algorithm be modified to deal with multiple occlusions and occlusions at different layers?
- How can we use the redundant image data to fill in holes after foreground object removal

This project will use and build upon the methods described in [3]. Source code for the algorithm are reported to be available, though the link appears to be dead at the moment. The author of [3] will be contacted to see if source code is available. The Google maps API will be used to acquire data.

2 Milestones

- Ongoing: Become familiar with the Google maps street view API. Establish a framework to work with street view image sequences and apply the methods described in this proposal.
- Week 1-3: Obtain a working copy of the algorithm described in [3] from the paper author. If a working copy is not available, reimplement the algorithm in Matlab.
- Week 4: Find suitable image sequences from Google maps street view to apply the unmodified motion segmentation algorithm.
- Week 5-6: Implement an occlusion reconstruction algorithm similar to the one described in [2]. Modify it to take advantage of the omni-directional image data available in Google maps street view.
- Week 7-8: Make necessary modifications to algorithms to deal with occlusions at multiple layers and irregularities in Google maps street view data.

- Week 9-10: Finalize and test the algorithms on extended Google maps street view image sequences.

3 Qualifications

I am a second year graduate student. I have taken various graduate level machine learning courses at UCSD. Additionally, I have also taken CSE 252B (Computer Vision II) and am currently enrolled in CSE 252A (Computer Vision I).

References

[1] C. Frueh, S. Jain, and A. Zakhor. Data processing algorithms for generating textured 3D building facade meshes from laser scans and camera images. *International Journal of Computer Vision*, 61(2):159–184, 2005.

[2] M. Irani and S. Peleg. Image sequence enhancement using multiple motions analysis. In *1992 IEEE Computer Society Conference on Computer Vision and Pattern Recognition, 1992. Proceedings CVPR'92.*, pages 216–221, 1992.

[3] J. Wills, S. Agarwal, and S. Belongie. A feature-based approach for dense segmentation and estimation of large disparity motion. *International Journal of Computer Vision*, 68(2):125–143, 2006.