FACULTY OF ELECTRICAL ENGINEERING CTU IN PRAGUE

Image Matching for Dynamic Scenes

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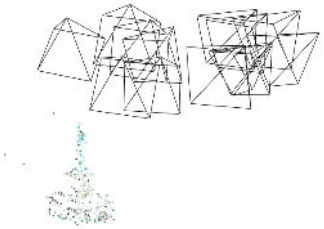
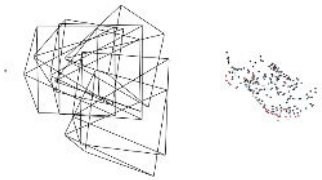
Sparse 3D Reconstruction

24 input images

ground



paper statue



shoe

Motivation

In computer vision, image matching is an important task which is employed as an intermediate step, *e.g.*, in 3D reconstruction and image retrieval. Majority of the existing works assume a static scene as it is an easier problem. Nevertheless, the real world is dynamic and it is, therefore, crucial to consider it. For instance, assuming a static scene in feature matching extracts only the largest motion and discards all others as outliers.

The Approach

1. Fast method for detecting multiple homographies from tentative matches
   - Inspired by [Vedaldi and Zisserman. Object instance recognition]
   - Speeded up by an order of magnitude
2. Merging homographies into motion groups based on two ideas
   - A composition of two homographies should be a planar homology
   - It should be possible to fit an epipolar geometry to the matches
3. Fusing two-view groups to n-view groups via agglomerative clustering
4. Recovering cameras and sparse point clouds of individual objects
   - Inspired by static incremental reconstruction systems [Snavely. Bundler] and [Wu. VisualSfM]

Implementation

C++ library for structure-from-motion systems designed to be fast, reliable and easy to extend.

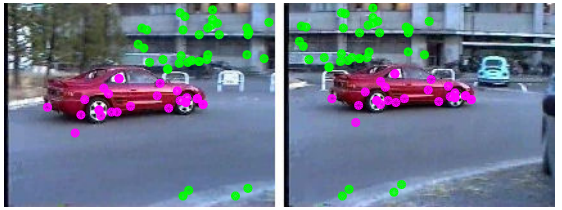
Experiments

The proposed image matching approach was compared with sequential application of well known and widely used RANSAC on 6 image pairs. The results were always better or comparable to RANSAC.

Feature Matching

An image pair where RANSAC estimating fundamental matrices was not capable of separating matches of the background and those of the car whereas our method correctly detected two groups.

Sequential RANSAC



Ours