ESE580 Final Project: Structure from Motion

Preliminary Report

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Introduction

Structure from Motion involves a plethora of key steps. Each of these step refines the estimated camera positions and the 3D points being reconstructed from the images. I have implemented most of the components and I am working on a way to track matches through multiple images and the 3D structure. My nonlinear optimizations are also giving me trouble so I am attempting to complete the pipeline with the non-linear optimization steps. I realize this will give inaccurate results, but once the pipeline is in place, I believe I will have a better understanding and will be able to implement the non-linear optimizations.

Progress

RANSAC

I have implemented RANSAC to robustly remove outliers from the matches provided to us. I found that there were very few outliers and that RANSAC selected most of the points as inlier after 100 iterations.

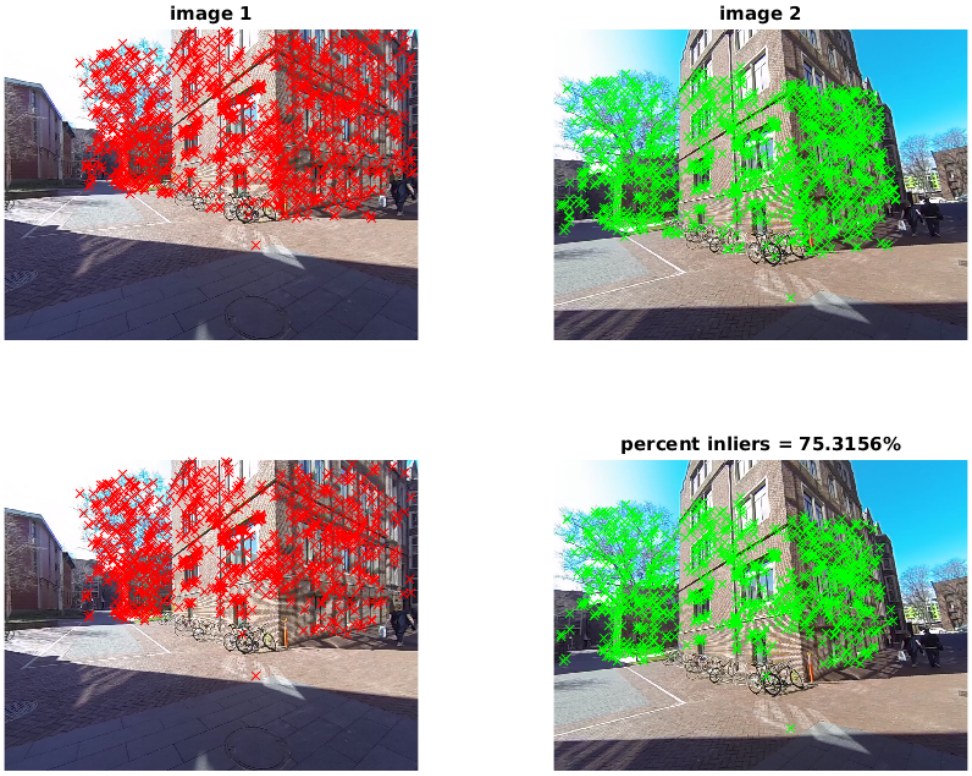

Figure 1: The original matches are shown in the top row of images. The inliers determined by RANSAC are int he bottom row.

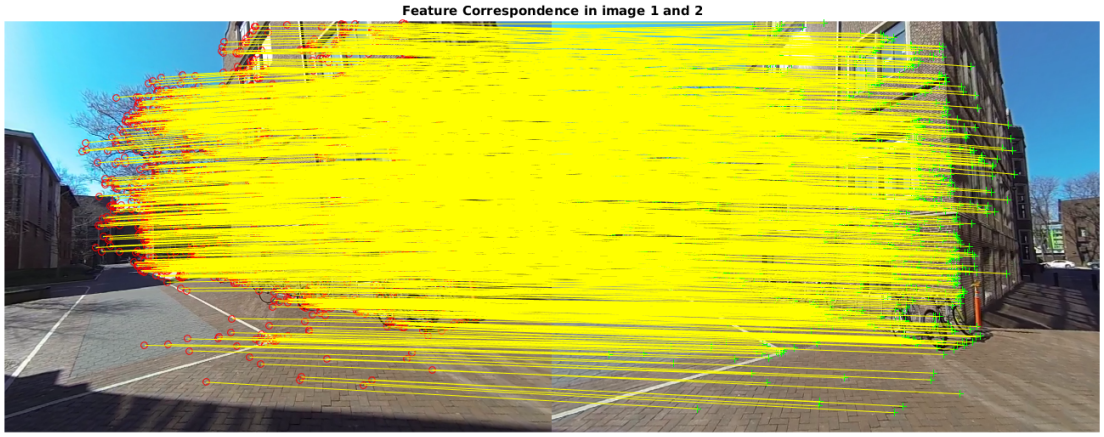

Figure 2: Matches shown with their exact correspondence in the second image.

Triangulation

I have implemented the linear triangulation between two images and disambiguated the camera pose. The result is a 3D point cloud that looks like a building. I have not been able to get non-linear triangulation working, but believe it will improve the point cloud.

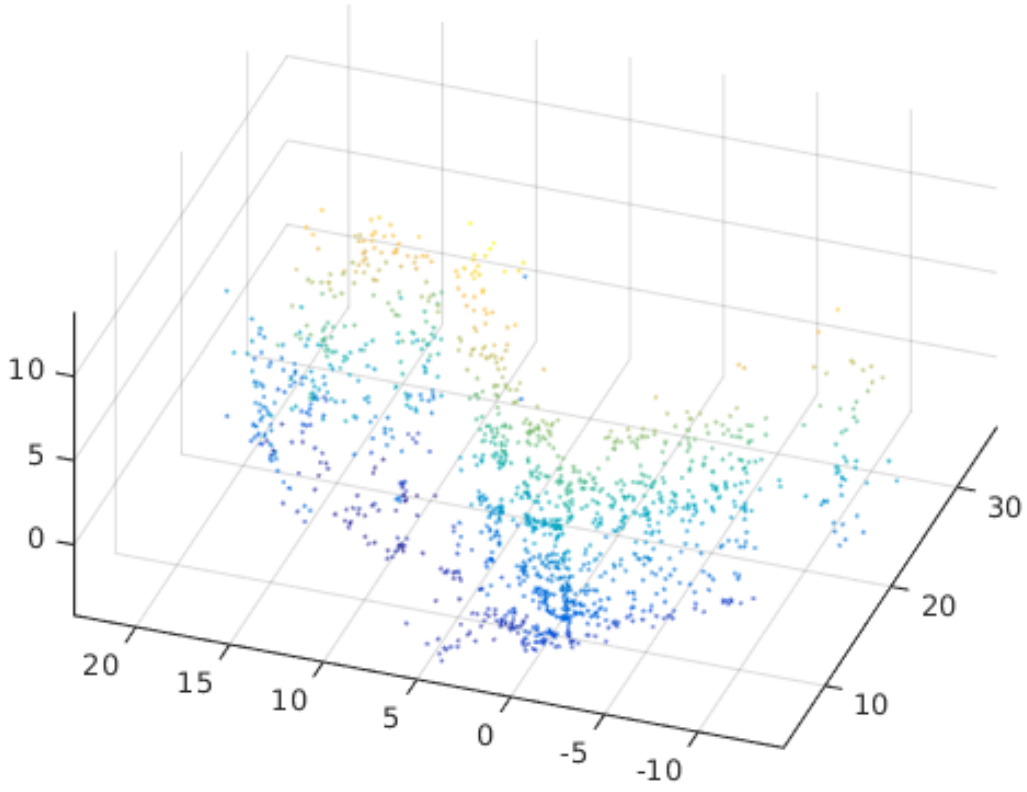

Figure 3: View of the point cloud generated by linear triangulation from above the camera position

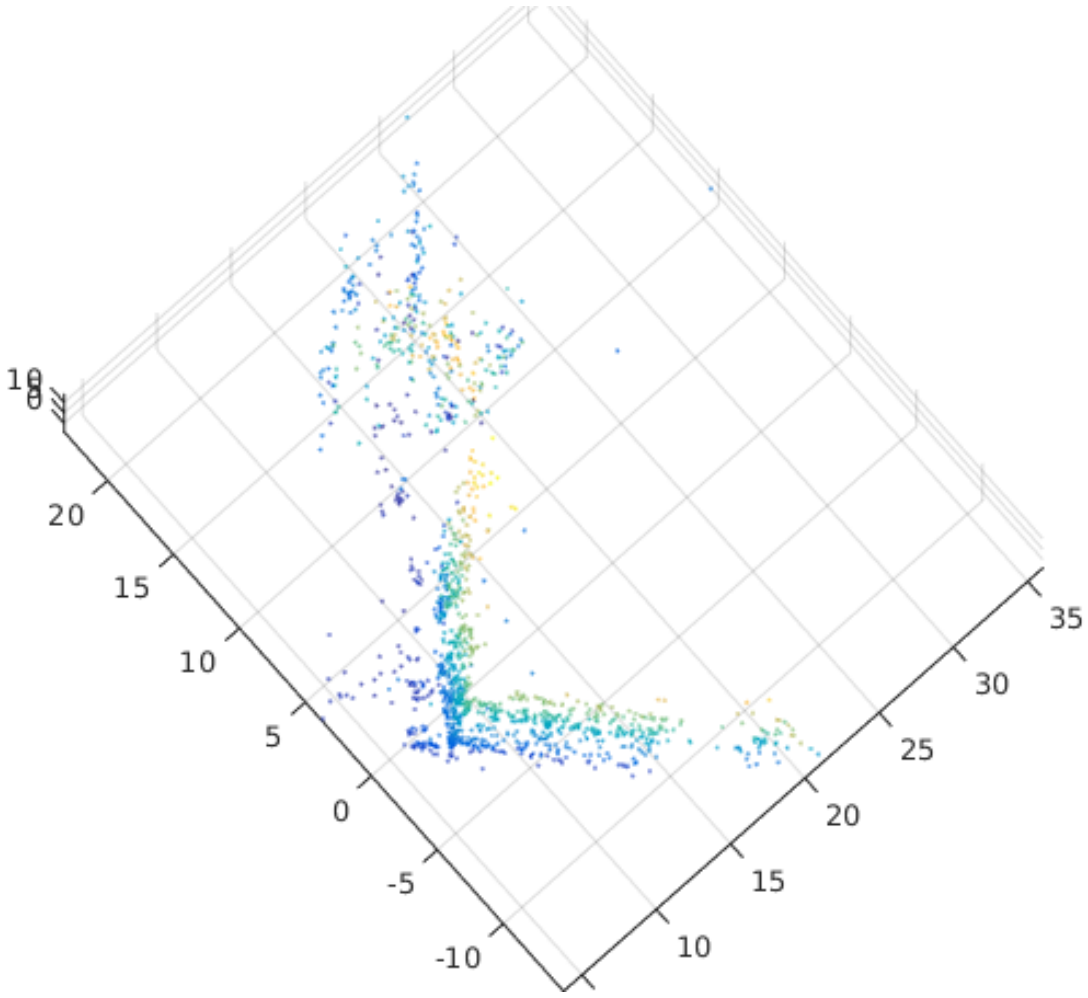

Figure 4: View of the point cloud generated by linear triangulation from a bird's eye view