Introduction

This topic concerns a panorama-stitching algorithm, and more precisely, one that can be run in real-time and one that scales with the hardware it is run on, in terms of resolution and quality.

The algorithm studied will enable, for example, a mobile camera unit to be used as a traditional scanner, simply by moving the camera across the image to be scanned. I.e., the algorithm will implement a method for autonomous real-world perception, a general notion that is very interesting in any field where cameras are used to scan or monitor the real world, robots and A.I. vision, not to mention the least.

Problem statement

While this general idea is most interesting with multiple cameras scanning the same motifs, thus constructing a 3D model of the reality they perceive, this paper will be limited to the special case of a single camera scanning a flat surface in 3D space.

Previous research made in fully automatic panorama stitching [1] as well as calculating a camera's ego-motion from the images it registers will make up the foundations of the study.

The problem here is whether this can be made scalable and executable in real-time and if so, if the resulting quality is sufficient for any practical applications.

Approach

I will begin with studying and attempting to thoroughly understand some state of the art technology in this area, namely the work done by Newcomb and Davison [2]. Their results closely resemble what I wish to achieve in the long run. Although beyond the scope of this essay, studying their work will provide me with a roadmap to better guide me in my study of the Autostitch algorithm, upon which I plan to build, to make a scalable algorithm for fully automatic panorama stitching that allows real-time execution.

To further focus my efforts on the development of an algorithm, I will only be using a Matlab environment for development. Granted, an actual mobile application will remain a theoretical one but with proven scalability, implementing the algorithm on a mobile device will be little but an exercise in software engineering.
References

Brown, Lowe
Department of Computer Science, University of British Columbia, Vancouver, Canada.

[2] Live Dense Reconstruction with a Single Moving Camera
Newcombe, Davison
Department of Computing, Imperial College London, London, UK

Time plan

To better track my progress I’ve defined my time plan using milestones and then set dates for commencing and completing these milestones.

Milestones

[Theory1: read] Read reference papers.
[Theory2: understood] Understood the theory in reference papers.
[Theory5: 2D-stitch] Constrained Autostitch to stitching frames from a pan across a flat surface.
[Theory6: RT-stitch] Modified Autostitch to have it scale with set performance parameters.

[Report2: draft] First draft complete with partial or preliminary results.

Schedule

Theory and proof skill

Feb 12 Start [Theory1]
Feb 14 Start [Report1]
Feb 15 Completed [Theory1, Report1]
Feb 17 Start [Theory3, Theory4, Theory5, Theory6]
Feb 25 Completed [Theory3]

Development


Report writing

April 4 Completed [Theory6]
April 12 Completed [Report3]

A scalable real-time panorama-stitching algorithm