EE368 Project Proposal
Image Stitching with POV Translation

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1 Description

Image stitching is a fairly well researched problem that has largely been solved under certain constraints in the last several years. The most popular form of such stitching are mosaics[2] and panoramas[6], which usually combine multiple images taken from the same point in space and (roughly) time into a larger composite of the environment at that location/time. One area of stitching that has largely been overlooked, both due to complexity issues and lesser applicability, is the problem of stitching together multiple images that have been taken of an environment as the camera is moving. This translation breaks many of the assumptions made in simpler stitching algorithms, making many of those techniques imperfect for this task[3][5]. The main application of such a technology is in mapping, whether it be the mapping of a residential street, or the mapping of the interior of a retail store. In these situations, by the nature of wanting to capture a long expanse (i.e. a block of houses or an aisle of products), the camera is moving and capturing images at a constant rate.

My project will focus on implementing an accurate image stitching algorithm to account for camera translation and the variability in images that arise from that translation over time. This problem has indeed been tackled before, namely by [4] and [1], so I will focus on reproducing and extending their work for the particular task of indoor imaging, as opposed to "city block" stitching. The images to be stitched will be frames extracted from a high definition video on a mobile device moving horizontally on a stabilizing apparatus at a relatively constant speed. While a mobile device is involved, the processing will take place on a standard computer so this project is not truly mobile-oriented. The translation of the camera will be only in one direction, and therefore the resulting stitched image should represent a continuous, linear portion of the environment.

As an extension (time permitting), multiple cameras may be stacked vertically to the apparatus, and then the goal would be to not only horizontally

stitch a given camera's images during the translation but also to stitch the multiple cameras' images vertically over time leading to a larger field of view. All these cameras will be in the same plane and facing the same direction, which differentiates this from a 360 degree camera apparatus or other similar setups.

The progression of milestones for this project will be

1. Develop an apparatus to attach a mobile phone to and record as the apparatus translates horizontally- early November
2. Collect sample videos from a few indoor venues, extract the frames, and set up the software environment- mid November
3. Implement the algorithms detailed in [4] and [1]- late November
4. Extend these algorithms, potentially by adding vertical stitching as well- late November
5. Write a report and create a poster/video- early December

References

[1] G. Garg A. Roman and M. Levoy. Interactive design of multi-perspective images for visualizing urban landscapes. In *Visualization*, 2004.

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[3] Y. Linhong and M. Hirakawa. A stitching algorithm of still pictures with camera translation. In *Cyber Worlds, 2002. Proceedings. First International Symposium on*, pages 176–182, 2002.

[4] A. Roman and H. P. A. Lensch. Automatic multiperspective images. In *Eurographics Symposium on Rendering*, 2006.

[5] I. S. Sevcenco, P. J. Hampton, and P. Agathoklis. Seamless stitching of images based on a haar wavelet 2d integration method. In *2011 17th International Conference on Digital Signal Processing (DSP)*, pages 1–6, July 2011.

[6] Y. Xiong and K. Pulli. Fast panorama stitching for high-quality panoramic images on mobile phones. *IEEE Transactions on Consumer Electronics*, 56(2):298–306, May 2010.