EE 368 – Project Proposal – Puzzle Solver

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Introduction

Most jigsaw puzzles that are available today consist of several 100 pieces of a single image, and can take several hours to solve. This project proposes to solve the puzzle simply by using a picture of all of the pieces, and an image of the final solution.

The proposed solution will first label all the individual pieces in the given image with a number, and then rearrange them into a single image. However, the final image will not appear seamless, and will have pieces which will be outlined and labeled with their original number, so that the user will know where it originated from when compared to the first image containing all the pieces.

High-level Solution

Let's say that the image consisting of all the pieces is P, and the seamless image of the solution is S. Our first step will be to mark out and label all the pieces in P. Once this is done, we will then use Scale Invariant Feature Transform [1] or Maximally Stable Extremal Regions [2] to find the presence of these pieces and then label and mark them out in S. Either of these methods should be helpful in dealing with any orientation, skew, scaling, issues that can occur in image P. After every piece has been determined, we will output our modified S image.

The project will be implemented in the following stages, and could involve some more improvements or added constraints based on the time needed.

1. Use a "perfect" image created by simply segmenting a known image into square / rectangular shapes where there are very few pieces involved (starting with two, then more), and the lighting and orientations of all the pieces are ideal for assembling.

2. Slowly add more pieces to image P, this time using real images of a sliced picture, and implement the segmentation and labeling portion of the algorithm.

3. Change the orientation and skew of the pieces to verify if these changes could affect the algorithm, and make any changes if necessary.

4. Use more abstract shapes that are more common to jigsaw puzzles, making changes if needed.

5. A more ambitious goal would be to perform reassembly using only the image P, and without the aid of a finished S image. This could be a final step that might be implemented based on time constraints. Since this step will not include image S as an input, an image-stitching [3] technique will be required.

This project will not be using a Droid phone for its implementation.

References

[1] D. G. Lowe, “Object recognition from local scale invariant features,” in *IEEE ICCV*, 1999, vol. 2, p. 1150.

[2] J. Matas, O. Chum, M. Urban, and T. Pajdla. “Robust wide baseline stereo from maximally stable extremal regions.” Proc. of British Machine Vision Conference, pages 384-396, 2002.

[3] Ward, Greg (2006). "Hiding seams in high dynamic range panoramas". Proceedings of the 3rd symposium on Applied perception in graphics and visualization. ACM International Conference Proceeding Series.