

COMP SCI M268 MACHINE PERCEPTION

Homework II

Due: 10/29/2015

The goal of this problem is to familiarize yourself with the useful tools and algorithms discussed in class. You will do this by implementing automatic feature selection and automatic image stitching to produce an image mosaic. A mosaic is *one* image, obtained by composing domain-deformed versions of the given images. Fig. 1 shows a set of images taken from a skiing scene. They will be the input of your system, and the output will be the mosaic stitched from transformed images of the input. In your submission, you need to provide a technical report with descriptions, codes and results. The technical report should cover the details of each major component in your system. You may discuss with your classmates and implement the system together, but each of you have to submit a separate report.

Here is a guideline for how this can be done step by step. They are purposefully vague so that you are free to design your system and to play with various parameters/choices in the learning process.

1. **Correspondence.** Use a library that provides feature extraction and description, such as VLFeat or OpenCV, to implement code to automatically find putative correspondences between points in each pair of images. (Note: You may have to play with the parameters to generate a reasonably good set of matches.)
2. **Model Estimation.** Given matches between two images, you are able to estimate the geometric relation between these two images. Choose a model discussed in the lecture/tutorial and implement the algorithm to get the solution from initial matches. To verify that your implementation is correct, you can manually select correspondences (instead of doing it automatically as described in 1.), and then run your model estimation code. This should give you a “perfect” mosaic after you stitch all images together.
3. **Robust Model Selection.** Using all of the putative matches and attempting to construct a mosaic from your images should turn out badly because of the outliers in the putative matches. Therefore, you need a mechanism to reject those outliers and use only inliers (correct matches) to estimate the model. The idea will be using only a subset of matches to estimate your model and then checking each putative matches against your estimated model to decide which are inliers and which are not. Repeat this “proposal and verification” step a large number of times and select the “best model”.
4. **Stitching.** Now that you have “transformations” between pairs of images, you can start stitching them together by choosing one of the image as the reference, warping all others into the same reference frame and overlaying all of them to produce the mosaic.

Important: *You are allowed to use open libraries for feature detection/description and image warping. But for the model estimation and robust model selection/outlier rejection, you have to implement them yourself as much as possible.*

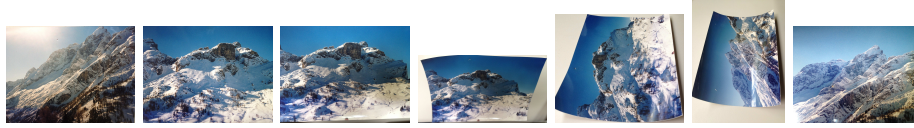


Figure 1: Sample images. The original images are downloadable from the course website.