Final project

There are two options for the final project. You need to choose one option and submit a project proposal by June 18.

Final project submission: July 18.

Option 1 - Reconstruction from Internet photos (Section 7.4.4)

The most widely used application of structure from motion is in the reconstruction of 3D objects and scenes from video sequences and collections of images. The latest innovation in this space has been the application of structure from motion and multi-view stereo techniques to thousands of images taken from the Internet, where very little is known about the cameras taking the photographs.

An elegant solution has been proposed here:
http://phototour.cs.washington.edu/

The relevant papers are (pdf files are included):

1. Noah Snavely, Steven M. Seitz, Richard Szeliski, "Photo tourism: Exploring photo collections in 3D," SIGGRAPH 2006.
2. Noah Snavely, Steven M. Seitz, Richard Szeliski, "Modeling the world from Internet photo collections," International Journal of Computer Vision (2008).

In this project you will create software that can reconstruct the camera poses and sparse 3D scene geometry. This corresponds to Sections 4.1, 4.2 and 4.4 in the paper. Do no implement the visualization tools in Sections 5, 6. You can skip also Section 4.3. The components of the system are:

A. Key-point detection and matching
B. Structure from motion

What you need to do:

- Part 1
  - Implement components A+B as proposed in the paper. It is o.k. to use available software (SIFT, RANSAC, ANN, SfM).
  - Download two sets of 20 images each of famous landmarks and test on them. The visualization of your results should display the 3D reconstruction as well as the camera locations.

- Part 2
  In this part of the project you are expected to add a new component to the system, preferably based on your own idea, but it is O.K. to be inspired by other papers. Here are some suggestions:

- Use a different key-point detector and descriptor. Compare the performance to the original implementation.
- Modify the SfM algorithm. Compare the performance to the original implementation.
- Augmented reality. Add a 3D object into the scene and render it in all the input images.
- Improve the rendering of the 3D structure by using blending or graph-cuts.
- Virtual tour. Create a video of a virtual flight through the scene.

Final submission

1. Project summary

Your project summary should include the following:

- **Analysis 1:** One paragraph summarizing what you've learned from the implementation of part 1. What are the strengths and weaknesses of the system you've constructed?
- **Analysis 2:** When will the proposed solution fail?
- **Experiments 1**: Your results for part 1.
- **Abstract 2:** A short summary of the ideas you followed in part 2.
- **Experiments 2:** Your results for part 2.
- **Analysis 2:** What are the strengths and weaknesses of your idea?
- **Creativity 1**: Suggest a solution for improving one or several of the weaknesses. . Test your suggestion.
- **Creativity 2**: Suggest future directions for research.

2. Code+data

Your submission should include:

- A "help" description for each function.
- Comments explaining non-trivial steps in the code.
- runme.m function that will be called and the code will run
- Data required for testing the code.

Option 2 – Study a state-of-the-art topic

You can do this by either implementing a recent paper, or by coming up with your own idea of a cool application. A good way to collect ideas is by going over papers published in one of the leading computer vision conferences (ICCV, CVPR or ECCV). Here is a link to all the papers of recent years:
http://www.cvpapers.com/index.html

Alternatively, a list of project ideas can be found here:
http://www.cs.cornell.edu/courses/cs6670/2011sp/projects/p4/index.html

Final submission

1. Project summary

Your project summary should include the following:

- **Paper details**: Title, author names, where was the paper published.
- **Abstract**: a short summary of the problem you solved.
- **Background**: why is this problem relevant and interesting?
- **Approach**: the solution direction you adopted.
- **Experiments**: what experiments you did and on what data. Include a clear visualization of your results.
- **References**: list of related papers.
- **Analysis 1**: What are the strengths and weaknesses of the paper?
- **Analysis 2:** When will the proposed solution fail?
- **Creativity 1**: Suggest a solution for improving one or several of the weaknesses. Test your suggestion.
- **Creativity 2**: Suggest future directions for research.

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