

Due: Monday February 14 at 6:00am

## Assignment 2—Projective Texture Mapping

### *In a nutshell*

Implement a basic application that allows a user to register photographs with a geometric proxy of a real world scene, and then allows the user to navigate through the scene.

### *Details*

1. Create a model of a real world 3-D scene comprising at least 12 quadrilaterals.
2. Perform an approximate calibration of your digital camera.
3. Take at least one digital photograph of the scene.
4. Write an application that allows
  - a. Loading an image
  - b. Clicking on image points and 3-D model vertices alternatively to define correspondences between the image and the model
  - c. Saving and loading the correspondences
  - d. Registering the image to the geometric model by finding the camera extrinsics that minimize the correspondence reprojection error
    - i. manual initial guess OK
    - ii. for loop brute force refinement are acceptable
    - iii. allow to save and load camera extrinsics
  - e. Rendering the scene interactively using the photographs for projective texture mapping
    - i. Color should only be projected to the visible surfaces
    - ii. Surfaces not colored should be shown with gray, but with Gouraud shading and diffuse lighting
    - iii. Provide a path making tool: the user should be able to save cameras as they navigate, and then the system should be able to play back the path defined by interpolating in between intermediate saved cameras
    - iv. A GUI flag should allow saving rendered frames as consecutively numbered stills
5. Make a movie showing off your scene rendered by projective texture mapping
  - a. 10 seconds
  - b. 30 frames per second
  - c. 640 x 480 resolution
  - d. Choose a standard format & codec
6. **Extra credit**
  - a. **Precise calibration of camera, including undistortion of images (3%)**

- b. Two overlapping photographs (2%)
- c. Non-linear optimization (e.g. downhill simplex, see Numerical Recipes in C online) (3%)
- d. Audio narration of longer video (e.g. 30s) (2%)

### ***Turn in***

Upload archive on Blackboard containing:

- Your source code
- Your binaries
- Your input image(s)
- Your movie
- A description of your GUI and of the extra credit features attempted in a README.txt file

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