ETH Zürich
Computer Science Department

Computer Vision - Exercise 7
Shape from Silhouettes

Objective:

In this assignment you will reconstruct a 3D object from multiple calibrated images by implementing a naive silhouette extraction algorithm. Code skeleton, images and camera calibrations are provided. You will be modifying the Matlab script *exercise8.m*. Feel free to make any modifications and improvements that you like.

7.1 Silhouette extraction (10%)

Extract silhouettes from the provided images, using a simple thresholding technique. Adjust the *silhoutteThreshold* so that the silhouettes of the statue are clearly extracted.

7.2 Volume of interest (10%)

Define the volume of interest. At first you will want to use a larger bounding box than necessary, just to make sure you have included the statue. Once you have completed all the steps, you can come back and make the bounding box tight to get better resolution. Similarly, you can start with a coarse grid, say $10 \times 10 \times 20$, and then once everything is working, try a larger grid, at least $64 \times 64 \times 128$.

7.3 Visual hull (60%)

Write the code to compute the occupancy score at each voxel. For each voxel, transform the point from volume to world coordinates using the transformation provided. Then project the points into the image. If a projected point falls within the silhouette, add 1 to the score.

The provided code extracts an iso-surface from the volume based on a threshold. Feel free to adjust this threshold although you shouldn't have to.

7.4 Improvements (20%)

For the report, write a short description of how the method works and describe simple ideas you can think of as to how you could improve this system. As a starting point, here are two questions to think about: what is the main drawback of the shape from silhouettes approach? Is there additional information in the images that could be used?

7.5 Hand in:

Make sure to submit the following material:

- A short report including the following:

  - The parameters you chose, including silhouette threshold, bounding box and volume resolution;

  - Exemplar silhouette images you extracted;

  - Screenshots of the 3D model;

  - Your brief description of the method and simple ideas you can think of for improving it.

- Your source code

- The 3D model saved as a *.fig file

Compress the above in a *zip* file and send it to `mentzerf@vision.ee.ethz.ch`. Please do not include the data in the zip file.