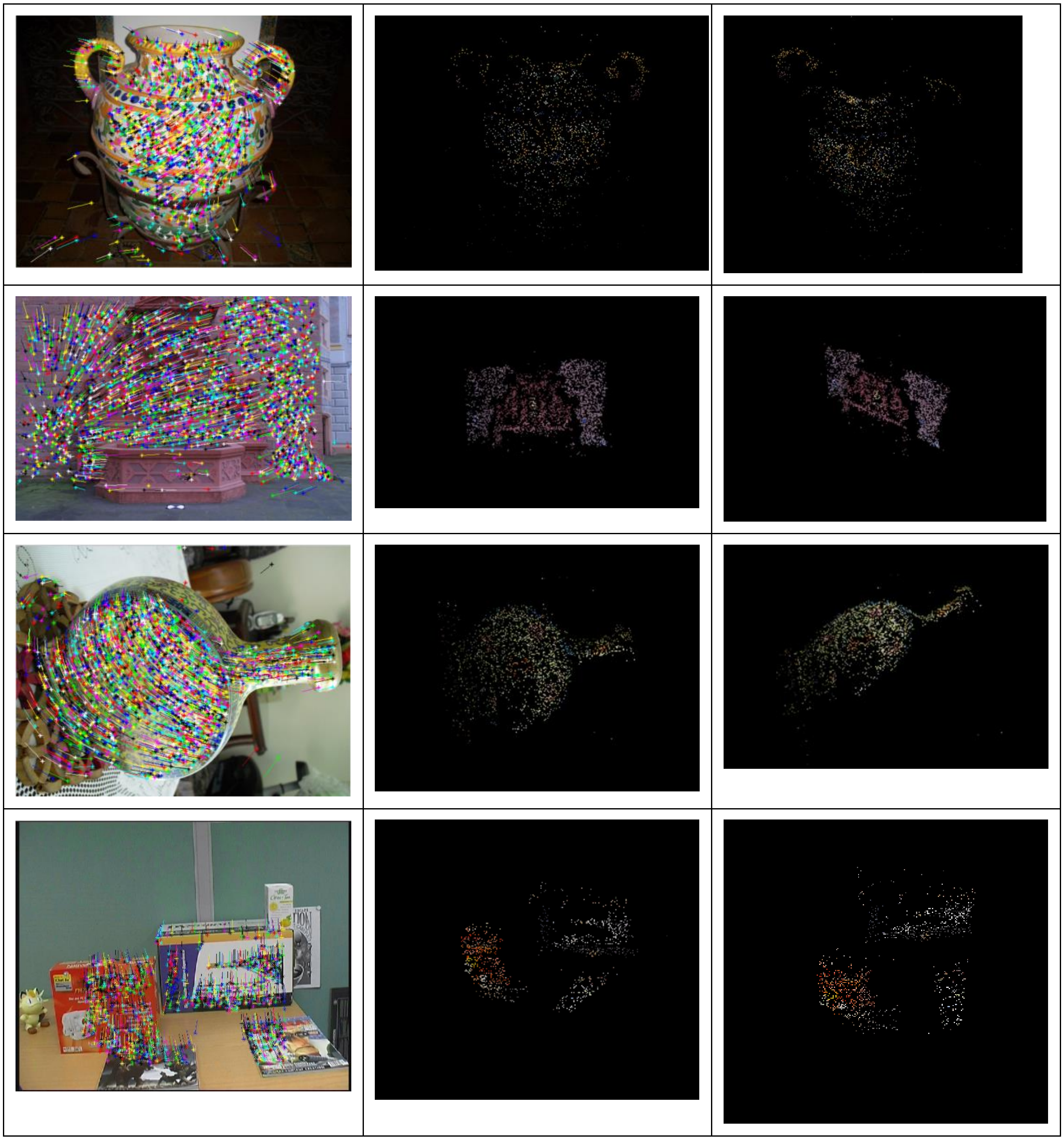
Homework Assignment #5

DUE: (Electronic turnin required)



You are to implement a 2-view, sparse 3D reconstruction algorithm. Your program takes two photos taken by the same camera, with the camera executing a general motion. With a general camera movement, epipolar lines most likely will not correspond to the image scan lines.

Furthermore, you will not be able to recover the absolute scale of the 3D scene. A rough estimate of the camera's intrinsic parameters will be provided with the test data sets. So you can attempt a similarity 3D reconstruction.

Sample test images can be found in http://www.cs.ucsb.edu/~cs181b/testimages/prog5/ (or follow the local image archive link from the class web page). Make sure that your programs work on images in that directory. Again, you are welcome to use your own photos, but do heed the instruction discussed in class for taking pictures, e.g., the baseline should not be too large nor too small, the camera's aim shouldn't rotate too much, environmental lighting must be good, and the object of interest must be heavily textured.

Your code should accept two image filenames, and output the 3D point cloud to a file in this format:

x y z r g b

That is, each line should correspond to a recovered 3D point, with coordinates (x,y,z) and color (r,g,b). (x,y,z) should be in the floating-point format and (r, g, b) should be integers, ranging from 0 to 255. You can use the pixel color from either input image.

You should add the following header to your point-cloud file and rename your point-cloud file with a "ply" extension.

```
ply
format ascii 1.0
element vertex 1336
property float x
property float y
property float z
property uchar red
property uchar green
property uchar blue
end_header
```

The last number in the 3rd line beginning with "element vertex" should correspond to the number of 3D points in your point-cloud file (in the above example, there are 1,336 3D points recovered). Your point-cloud file is now in the ply format that can be viewed by most 3D visualization software (e.g., Meshlab).

BONUS: You need to implement only a sparse, feature-based 3D reconstruction algorithm. It is also possible to perform dense reconstruction if you rectify the image pairs into a standard stereo configuration or recover the epipolar relations mathematically. Be warned that dense reconstruction based on un-calibrated and un-rectified image pairs is considered a tough problem. Featureless regions are hard to match and, without camera calibration, it may not be possible to recover accurate epipolar geometry. Again, turn in your images with your program if you are attempting something extra that the reader should take a look at.