

**CS 532: Homework Assignment 6**  
**Due: December 2, 6:00pm**

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**Collaboration Policy.** Homeworks will be done individually: each student must hand in their own answers. It is acceptable for students to collaborate in understanding the material but not in solving the problems. Use of the Internet is allowed, but should not include searching for previous solutions or answers to the specific questions of the assignment. I will assume that, as participants in a graduate course, you will be taking the responsibility of making sure that you personally understand the solution to any work arising from collaboration.

**Late Policy.** No late submissions will be allowed without consent from the instructor. If urgent or unusual circumstances prohibit you from submitting a homework assignment in time, please e-mail me explaining the situation.

**Submission Format.** Electronic submission on Canvas is mandatory. Submit in a zip file:

- the source code separately as well as in a pdf file with brief of explanations of what was done.
- a text file listing the vertex coordinates and estimated normals for `gargoyle.ply`. **The vertices must appear in EXACTLY the same order as in the input.** This part will be graded automatically.
- a ply file for Problem 2.

**Problem 1. (60 points)** Download the *gargoyle* data from the course web page. The zip file contains a model of a gargoyle in ASCII ply format. The header of the file is as follows:

```
ply
format ascii 1.0
comment
element vertex 10002
property float32 x
property float32 y
property float32 z
property float confidence
```

```
property float intensity
element face 20000
property list uchar int vertex_indices
end_header
```

The goal is to estimate the surface normal at each vertex of the mesh as the average of the surface normals of all faces that are incident to it. The surface normal of a triangular face can be computed as the cross-product of two of its sides.

### Hints.

- There is no need to generate the winged edge or half edge representation of the mesh.
- Make sure that the normals you are averaging are unit vectors and that they are properly oriented. Make sure that the final normals are unit vectors.
- Vertex indices in face specifications in the ply format start from 0.

**Problem 2. (40 points)** Generate a mesh for one of the disparity maps you computed in Homework Assignment 4. You may choose how to connect the 3D points using their image coordinates to find nearest neighbors. No triangles should contain vertices with 0 disparity values, but unused vertices in the vertex list will not be penalized. Each vertex should have an RGB color, which can be taken from the corresponding image. You should specify vertices as follows:

```
element vertex N
property float32 x
property float32 y
property float32 z
property uchar red
property uchar green
property uchar blue
```

If you were not able to estimate disparity maps for Homework Assignment 4, you have two options: do it now for extra credit, or use the ground truth.