CS 453/553
Scientific Visualization

Credits: This course combines approximately 120 hours of instruction, and outside programming work for 4 credits.

Prerequisites
Prior experience with C programming and the Linux or Windows operating systems.

Catalog Description: This course applies 3D computer graphics methods to visually understand scientific and engineering data. Methods include hyperbolic projections; mapping scalar values to color spaces; data visualization using range sliders; scalar visualization (point clouds, cutting planes, contour plots, isosurfaces); vector visualization (arrow clouds, particle advection, streamlines); terrain visualization; Delauney triangulation; and volume visualization.

Terms Offered: Spring

Structure: Three 50-minute lectures per week.

Instructor: Mike Bailey

Course Content
- OpenGL, GLUT, and GLUI graphics APIs
- Hyperbolic geometry
- Mapping scalar values to a variety of color spaces
- Color gamuts
- Data visualization using range sliders
- Scalar visualization
- Vector visualization
- Delauney triangulation
- Volume visualization
- Terrain Mapping

Course-Specific Measurable Student Learning Outcomes:
On completion of the course, students will be able to:
1. Demonstrate a proficiency with 3D interactive OpenGL programming, including a user interface.
2. Articulate how data is characterized in terms of spatial and data dimension.
3. Demonstrate how to geometrize scalar data using a variety of approaches such as range sliders, point clouds, colored cutting planes, contoured cutting planes, and isosurfaces.
4. Demonstrate how to geometrize vector data using a variety of approaches such as vector clouds, streamlines, multi-streamlines, ribbon traces, and blob traces.
5. Articulate what makes each method appropriate or not appropriate for what one is trying to accomplish.
6. Demonstrate how to perform interactive terrain visualization.
7. Demonstrate how to perform volume visualization
8. Evaluate ethical situations in the use of visualization.
9. Articulate the theory and practice of resampling scattered data.
10. Evaluate the effectiveness of existing visualizations.

In addition, those taking this course as CS 553 will also have demonstrated the ability to:
11. Read a scientific-visualization-related research paper and write a 5-page analysis paper of it. (I will make some of these available for you, or you can propose your own. It has to be a real research paper, though, and I need to pre-approve it.)

**Evaluation of Student Performance**
CS 453/553 will be graded on a total-point basis. There will be several projects, two tests, and weekly quizzes.

Your final grade will be based on your overall class point total. Based on an available point total of 1020, grade cutoffs will be no higher than:

<table>
<thead>
<tr>
<th>Points</th>
<th>Grade</th>
</tr>
</thead>
<tbody>
<tr>
<td>995</td>
<td>A</td>
</tr>
<tr>
<td>935</td>
<td>B+</td>
</tr>
<tr>
<td>885</td>
<td>B</td>
</tr>
<tr>
<td>835</td>
<td>C+</td>
</tr>
<tr>
<td>785</td>
<td>C</td>
</tr>
<tr>
<td>735</td>
<td>D+</td>
</tr>
<tr>
<td>685</td>
<td>D</td>
</tr>
</tbody>
</table>

**Learning Resources**
There is no required textbook for this class. We will use my own notes, augmented with web sites, and videos.

**Students with Disabilities:**
Accommodations for students with disabilities are determined and approved by Disability Access Services (DAS). If you, as a student, believe you are eligible for accommodations but have not obtained approval please contact DAS immediately at 541-737-4098 or at [http://ds.oregonstate.edu](http://ds.oregonstate.edu). DAS notifies students and faculty members of approved academic accommodations and coordinates implementation of those accommodations. While not required, students and faculty members are encouraged to discuss details of the implementation of individual accommodations.

**Link to Statement of Expectations for Student Conduct**, i.e., cheating policies [http://studentlife.oregonstate.edu/studentconduct/offenses-0](http://studentlife.oregonstate.edu/studentconduct/offenses-0)