CSC 570R: 3D Data acquisition and Enhancement
Syllabus

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Schedule: T-Th 4:10-6pm
Location: Building 2, room 203

General: This course will expose you to the latest research in computer graphics. In particular the course is focused on 3D models (acquisition, representation, enhancement, etc.) **This course requires substantial math and programming skills.** In particular it will be helpful if students are familiar with linear algebra and writing 3D computer graphics programs in OpenGL.

Assignments:
- One in class presentation about a current research paper from an instructor provided list of papers
- One larger final programming project of the student’s choice approved by the instructor.
- 1-2 intermediate programming assignments
- Participation in seminar discussions!
- Weekly quizzes or homework assignments related to the lecture material and papers.

Text: We will be primarily reading research and survey papers published in computer graphics related journals and conferences. See next page for the list of papers.
The following is a tentative schedule for seminar topics and assignments

<table>
<thead>
<tr>
<th>Week</th>
<th>Date</th>
<th>Topic</th>
<th>Notes</th>
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</thead>
<tbody>
<tr>
<td>1</td>
<td>1/3/06</td>
<td>Orientation</td>
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<td></td>
<td>1/5/06</td>
<td>Introduction to representations</td>
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<td>2</td>
<td>1/10/06</td>
<td><em>Surface reconstruction</em></td>
<td>Quiz 1</td>
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<td></td>
<td>1/12/06</td>
<td><em>Model acquisition</em></td>
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<tr>
<td>3</td>
<td>1/17/06</td>
<td><em>Model acquisition</em></td>
<td>Quiz2</td>
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<td></td>
<td>1/20/06</td>
<td>Linear algebra review</td>
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<tr>
<td>4</td>
<td>1/24/06</td>
<td>Least squares</td>
<td>Program 1 (least squares)</td>
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<td></td>
<td>1/27/06</td>
<td>Enhancement:simplification</td>
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<td>5</td>
<td>1/31/06</td>
<td>Enhancement:simplification</td>
<td>Quiz 3</td>
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<td></td>
<td>2/2/06</td>
<td><em>Representation: IBR</em></td>
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<td>6</td>
<td>2/7/06</td>
<td><em>Representation: IBR</em></td>
<td>Quiz4</td>
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<td></td>
<td>2/9/06</td>
<td>Parameterization</td>
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<td>7</td>
<td>2/14/06</td>
<td>Parameterization</td>
<td>Program 2 (Parameterization)</td>
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<td>2/16/06</td>
<td>Parameterization</td>
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<td>8</td>
<td>2/21/06</td>
<td><em>Representation: smooth</em></td>
<td>Final project check-in demo</td>
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<td></td>
<td>2/23/06</td>
<td><em>Representation: normal</em></td>
<td>Quiz 5</td>
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<tr>
<td>9</td>
<td>2/28/06</td>
<td><em>Representation: GIM</em></td>
<td>Final project check-in demo</td>
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<td></td>
<td>3/2/06</td>
<td><em>Representation: normal+geom</em></td>
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<td>10</td>
<td>3/7/06</td>
<td>Recent trends:lighting</td>
<td>Final project check-in demo</td>
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<td>3/9/06</td>
<td><em>James Davis – UCSC Invited speaker</em></td>
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<td><strong>Final</strong></td>
<td>3/14/06</td>
<td><strong>7:10-10pm (subject to change)</strong></td>
<td>Final Projects demo</td>
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The following are a tentative list of reference papers:

*Implicit Surfaces* by Jules Bloomenthal p 1-18 *(surface representation intro.)*

*Marching Cubes: A High Resolution 3D Surface Construction Algorithm,*
William E. Lorenzen and Harvey E. Cline; SIGGRAPH ’87 *(representation volume)*

*Surface reconstruction from Unorganized Points,* Hugues Hoppe, PhD Thesis, Ch. 1 *(surface reconstruction intro.)*

*Recent progress in coded structured light as a technique to solve the correspondence problem: a survey* Batlle et al, Pattern Recognition 1998 *(acquisition of range images)*

*A Volumetric Method for Building Complex Models from Range Images,* Curless & Levoy; Siggraph 1996 *(acquisition)*

*Real-Time 3D Model Acquisition,* Szymon Rusinkiewicz, Olaf Hall-Holt and Marc Levoy, , SIGGRAPH 2002 *(acquisition)*
Surface reconstruction from Unorganized Points, Hugues Hoppe, PhD Thesis, Ch. 2  
(Representation points/surface)
Progressive Meshes, Hugues Hoppe, Siggraph 1996  
(surface representation/enhancement:simplification)

Surface Simplification using Quadric Error Metrics, M. Garland and P. Heckbert,  
SIGGRAPH 1997 (enhancement:simplification)
Dual Contouring of Hermite Data, Ju, Losasso, Schaefer & Warren; SIGGRAPH 2002  
(volume representation/enhancement:simplification)

Modeling and Rendering Architecture from Photographs: A Hybrid Geometry- and  
Image-Based Approach, Debevec. P., Taylor, Malik, Siggraph 1996 (acquisition &  
representation:IBR)  
(Also sketches from sig 05 + new IBR paper? Modeling Hair from multiple perspectives sig 05)

Parameterization and smooth approximation of surface triangulations, Michael Floater,  
Computer Aided Geometric Design 1997 (enhancement:tool)

Fitting Smooth Surfaces to Dense Polygon Meshes, Krishnamurthy and Levoy,  
SIGGRAPH 1996 (representation/enhanacement)  
Appearance-Preserving Simplification, Cohen, Jonathan, Marc Olano, and Dinesh  
Manocha.. SIGGRAPH 98 (representation/enhanacement)
Texture mapping progressive meshes, P. Sander, J. Snyder, S. Gortler, H. Hoppe.  
ACM SIGGRAPH 2001(representation/enhanacement)
Geometry images, X. Gu, S. Gortler, H. Hoppe, SIGGRAPH 2002  
(representation/enhanacement)

Efficiently Combining Positions and Normals for Precise 3D eometry, D. Nehab, S.  
Rusinkiewicz, J. davis, R. ramamoorthi, Siggraph 06 (representation/enhanacement)

Precomputed Radiance Transfer for Real-Time Rendering in Dynamic, Low-Frequency  
Lighting Environments, Peter-Pike Sloan, Jan Kautz, and John Snyder, SIGGRAPH  
2002 (recent advances: lighting)
Precomputed Local Radiance Transfer for Real-Time Lighting Design  
Anders Wang Kristensen, Tomas Akenine-Möller, and Henrik Wann Jensen, SIGGRAPH  
2005 (recent advances: lighting)

Others?  
A New Voronoi-Based Surface Reconstruction Algorithm, Amenta, Bern & Karnvysselis;  
Siggraph 1998 (representation points/surface)