CSC 570R: 3D Data acquisition and Enhancement

Syllabus

Professor: Zoë Wood
Office: Building 14, room 209
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Schedule: T-Th 4:10-6pm
Location: Building2, 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

Week 1	1/3/06	Orientation	
	1/5/06	Introduction to representations	
Week 2	1/10/06	*Surface reconstruction*	Quiz 1
	1/12/06	*Model acquisition*	
Week 3	1/17/06	*Model acquisition*	Quiz2
	1/20/06	Linear algebra review	
Week 4	1/24/06	Least squares	Program 1 (least squares)
	1/27/06	*Enhancement:simplification*	
Week 5	1/31/06	*Enhancement:simplification*	Quiz 3
	2/2/06	*Representation: IBR*	
Week 6	2/7/06	*Representation: IBR*	Quiz4
	2/9/06	Parameterization	
Week 7	2/14/06	Parameterization	
	2/16/06	*Parameterization*	Program 2 (Parameterization)
Week 8	2/21/06	*Representation:smooth*	Final project check-in demo
	2/23/06	*Representation:normal*	Quiz 5
Week 9	2/28/06	*Representation:GIM*	Final project check-in demo
	3/2/06	*Representation:normal+geom*	
Week 10	3/7/06	*Recent trends:lighting*	Final project check-in demo
	3/9/06	*James Davis – UCSC Invited speaker*	
Final	3/14/06	**7:10-10pm (subject to change)**	**Final Projects demo**

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. Lorensen 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 Simplfication, 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)**