

Visualization Syllabus

Objectives: To provide a broad overview of visualization for multidimensional data sets; to survey current hot research topics; to explore and evaluate visualization techniques and applications; to apply course concepts to the visualization of a complex problem.

Outcomes: Students upon completion of the course should be able to:

- understand the design and perception issues for creating effective visualizations;
- understand information and scientific visualization techniques;
- read, evaluate, and present technical papers;
- apply effective visualization techniques to a real-world visualization problem and associated dataset.

CS576 Additional Objective: To provide an introduction to and application of visual analytics; to apply visual analytics to the analysis and visualization of a complex problem.

CS576 Additional Outcomes: Students upon completion of the course should be able to:

- research, analyze, and evaluate visualization research topics and write survey papers on such topics.
- apply visual analytics to a real-world visualization problem and associated dataset.

Required Textbook: Information Visualization: Perception for Design, Colin Ware, 3rd Edition, 2013: Reading assignments are shown in the schedule. Technical papers will be available through the class portal. Additional (optional) references will be listed in the class portal.

Content: Course content will include: 1) theory and foundations of perception for understanding visualization, 2) visualization from frameworks to analytics, and 3) practical hands-on experimentation (not shown on schedule, but will normally be a part of most classes). The schedule may be modified on the course calendar.

Date	Textbook Topic	Ch.	Add. Topics
1-12	Foundations of Data Visualizations	1	Introduction
1-19			<i>Academic holiday</i>
1-26	The Environment, Optics, Resolution, and the Display	2	Evaluation
2-2	Lightness, Brightness, Contrast, and Constancy <i>(exp 1)</i>	3	Vis. Cycle & User Studies
2-9	Color	4	Color
2-16	Visual Saliency and Finding Information	5	Scientific
2-23	Static and Moving Patterns <i>(exp. 2)</i>	6	Graphs
3-2	Space Perception <i>(project proposal)</i>	7	Visual Analytics
3-9	(proctored) Chapters 1-7		1 st Exam
3-16			Spring Break
3-23	Visual Objects and Data Objects	8	Lab lecture
3-30	Images, Narrative, and Gestures for Explanation	9	1-ND
4-6	Interacting with Visualizations & Visual Thinking Processes <i>(draft paper for peer review)</i>	10 & 11	Interaction
4-13	Project Discussion <i>(peer review)</i>		Exam Review
4-20	Comprehensive		2 nd Exam
4-27	Project Presentations & Demos <i>(project report)</i>		Projects
~ 5-4	Project Pres. & Demos (date/time TBD – finals period)		Projects

Student interests will drive selection of other topics and emphasis. Assignments will be submitted and returned via the class portal. Note: red italics indicate a due date for, e.g., *exploratory 2 (exp. 2)* is due on February 23rd. Note assigned reading above.

Projects: Projects (exploratory (2) and final projects) provide the opportunity to develop and exhibit visualization skills. All work and files are subject to inspection and demonstration. Projects and student evaluations are to be submitted electronically within the course portal. For group projects, all members will receive grades based on the work submitted by the group. All files must include documentation to specify group member contributions, with the exception of papers prepared for publication. A separate file must be included to specify contributions for such papers. Individual grades may be adjusted based on the individual student's contribution as determined by instructor observation, as well as group member evaluations. For each group project, group members will draw up, sign and turn in a contract for member responsibilities, which will be used in disputes and grading for member contributions. Contracts should be resubmitted at least one week before project completion, if substantial revisions are needed. Contracts are due at the beginning of the class following distribution of project assignments. Each group member must actively participate in design, development, and integration for each group assignment. Each student in every group must fairly grade (score 0-100) and evaluate the contribution of all students in their group (including him/herself) based on the group contract and the student performance. Each group (including every member) will present the results of their final project in class. Group projects will be evaluated in terms of group and individual performance. Late projects will not be accepted.

Topical Papers and Presentations: These will reinforce lecture concepts and demonstrate application of critical thinking skills to visualization topics. Students are to research the topical area and prepare a short presentation on each topic (3-5 slides; 15 minutes). Topical survey papers (CSE 576 only) must be done independently and written in your own words. Topical papers must include

references and will be posted in the class portal to guide others interested in the topic. Late assignments will not be accepted.

Quizzes and Participation: Pop quizzes and class discussions will be used to reinforce and explore concepts and/or check student comprehension. Pop quizzes will often cover reading material, but may cover previously covered content. Participation will be based on both small group and full class participation. Missed quiz and participation points *cannot* be made up.

Examinations: Examinations may consist of any mix of multiple choice, short answer, and short essay questions. Your goal is to demonstrate knowledge and understanding of course concepts. Exams may cover any material presented in class, covered in assigned reading, and/or related to research projects. Exams are closed book. No makeup exams will be given. An excused absence for one exam will result in additional weight on the other exam. Documentation for an excused absence must be submitted immediately upon return.

Grades: The tentative percentage of points allocated to the major graded components is shown below. Student grades will be determined based on a straight scale (≥ 80 B- < 83%, $\geq 83\%$ B < 86%; $\geq 86\%$ B+ < 90%, other grades follow this pattern, except ≥ 93 A ≤ 100 ; and $0 < F < 63\%$)

- Quizzes and Class Participation: 10%
- Assignments (In class & homework): 10%
- 1st Exam: 10%
- 2nd Exam: 10%
- Topical Papers and Presentations: 10%
- Exploratory Projects: 10%
- Final Project: 40%

Course Descriptions

CSE/IT 476, Visualization, 3 cr, 3 cl hrs

Prerequisite: IT 222 or consent of instructor

This course presents application of graphical visualization to current problems, with a focus on extracting and representing information in multidimensional data sets using 2D and 3D graphics. Topics include visualization tools and techniques, human vision and perception, color mapping, sound, data representation for insight extraction, time visualization, visual analytics, volume rendering, surface extraction and rendering. Students will develop visualizations of real world problems.

CSE 576, Advanced Visualization, 3 cr, 3 cl hrs

Prerequisite: consent of instructor

This course presents application of graphical visualization to large problems and complex systems, with a focus on extracting and representing information in multidimensional data sets using 2D and 3D graphics. Topics include visualization tools and techniques, human vision and perception, color mapping, sound, data representation for insight extraction, time visualization, visual analytics, volume rendering, surface extraction and rendering. Students will perform visual analytics research for large problems and/ or complex systems.

Class and University Policies

Instructor Discretion: The instructor reserves the right to modify syllabus and policies to improve the course. Any modifications will be posted on the "Syllabus" page of the course portal.

Attendance and Participation: Attendance and participation is mandatory. Auditors must also submit the two exploratory projects, but are not required to submit quizzes, topical papers, major projects, or exams.

Academic Honesty Policy: Students are required to adhere to all NMT academic policies. All exams must be individual efforts unless explicitly group work. You may not collaborate or use work from others not enrolled in this course, without prior instructor approval. Students are encouraged to discuss topical research and projects with each other. However, everything that is turned in for each assignment and/or project must be your own (or your group's) work. It is not acceptable to: copy in part or in totality another person's assignment and submit it as your own work; get someone else to do all or a part of the work for you; submit the work of a group as your own individual work. These acts are academic dishonesty and will not be tolerated in this course. If such actions are proven, you may receive an F for the course. If you are in doubt, ask the instructor and always give credit where it is due. Academic dishonesty is a serious offense, which, in addition to a failing grade for the course, may bring you before the Disciplinary Board. See the NMT Catalog (graduate or undergraduate as appropriate) for full policy: <http://www.nmt.edu/university-catalogs>.

Counseling and Disabilities: New Mexico Tech is committed to protecting the rights of individuals with disabilities. Qualified individuals who require reasonable accommodations are invited to make their needs known to the Office of Counseling and Disability Services (OCDS) as soon as possible. In addition, New Mexico Tech offers mental health and substance abuse counseling through the Office of Counseling and Disability Services. The confidential services are provided free of charge by licensed professionals. To schedule an appointment, please call 835-6619.

Additional NMT Student Policies: See the New Mexico Tech Catalog (<http://www.nmt.edu/university-catalogs>) and Student Policies at <http://www.nmt.edu/nmt-policies-and-procedures> for a full listing discussion of policies.