Sample syllabus - students receive the detailed syllabus at the beginning of the term they are enrolled in the class.

CS 519 Scientific Visualization

Course Description

Welcome to CS 519: Scientific Visualization! In this course, you will be introduced to techniques and tools to effectively visualize, investigate, and understand scientific data. In addition to gaining a working knowledge of existing visualization tools, you will come to understand a set of core visualization algorithms at a deep level and be introduced to current research in visualization.

The course will require programming using Python and JavaScript...but mostly Python. If you are unfamiliar with these, you might want to get a head start and work through the following:

- **A very basic Python tutorial offered by Microsoft**
- **Or...alternatively...a set of videos introducing Python programming.**
- **A tutorial on the Python scientific computing package Numpy**
- **Mozilla tutorials on HTML and JavaScript programming.**

Course Goals and Objectives

Upon successful completion of this course, you will be able to:

- Make more effective visualizations for data.
- Be able to choose the most appropriate visualization method for a given type of data and task.
- Understand how fundamental principles of design and human cognition inform effective visualizations.
- Utilize the popular scientific visualization application ParaView.
- Work with Python and PyVista to visualize scientific data.
- Create visualizations using interactive web graphics programming with JavaScript and VTK.js.
- Understand current research directions and open problems in scientific visualization.

Prerequisites

The official prerequisites for the course are one of CS 418 Interactive Computer Graphics or CS 498DV Data visualization or consent of the instructor. More generally, the course material should be accessible to anyone with some familiarity with calculus, some prior coding experience, and the drive to learn the material.

Textbook and Readings

There is no textbook required for this course. All necessary content will be available in the lectures. The Scientific Visualization Resources page has information on data visualization books and software available to students that wish to investigate certain topics at a deeper level.

Course Outline

This course consists of material from two Coursera MOOCs as well as additional assignments, a project, and two exams. Office hours will be offered each week by the instructor and the TA's to help with these additional assessments.

Module	Topics	Grade
Week 1	Introduction to Scientific Visualization	5%
Week 2	Mathematical Visualization	5%
Week 3	Data Science for People in a Hurry	10%
Week 4	Domain Modeling and Terrain Visualization	5%
Week 5	Contouring	5%
Week 6	Volume Visualization	5%
Week 7	Midterm Exam	15%
Week 8	Segmentation and Classification	5%
Week 9	Vector Field Visualization	10%
Week 10	Advanced Flow Visualization	5%
Week 11	Tensor Field Visualization	5%
Week 12	Bioinformatics Visualization	5%
Week 13	Visualization at Scale	5%
Week 14	Fall Break	0%
Week 15	Current Research in Visualization	10%
Week 16	Final Exam	15%

Elements of This Course

The course is comprised of the following elements:

- **Lecture Videos.** In each week, the concepts you need to know will be presented through a collection of short video lectures. You may stream these videos for playback within the browser by clicking on their titles or you may download the videos. You may also download the slides that go along with the videos. **There are 1-2 hours each week of short video lessons with condensed, fast-paced, densely-packed material.** You generally should spend at least the same amount of time reviewing and digesting the content in these videos. The actual amount of time

needed to comprehend and retain the content will vary based on your background. It may be helpful to create your own notes on the videos. The videos are organized by "week#-lesson#-video#" to make it easier to reference in your notes and discussions.

- **Office Hours.** Office hours will be offered by the Instructor and the TA's throughout each week.
- **Weekly Quizzes.** There is a quiz on the material at the end of each week. These quizzes must be completed by the end of the course and are graded pass/fail with 80% or greater indicating a passing grade. These quizzes are designed to be repeated as a formative learning and studying activity, and your highest score will be retained for the final grade.
- **Weekly Assignments.** There will be one or more assignments each week. These assignments will be completed online and will generally be short. The course is divided into weekly modules, with each week running from Monday to Sunday, and each assignment should be completed no later than one week from the Sunday at the end of the week it was assigned.
- **Programming Assignments.** The course requires completion of 2 larger programming assignments. The first of these is will be a simple 2D mathematical visualization to get you acquainted with Python. This will be due at the end of Week 3. The second project will be a volume visualization app using VTK.js, due at the end of week 9. Both of these assignments are to be done individually. These assignments are staff graded and will require time from the TA's to complete their grading. **These deadlines are strict and programs handed in after their deadline will be penalized at the rate of 10% per day with a limit of 7 days.** ***Unfortunately, there are no extensions to these deadlines.***
- **Final Project.** The final project will be building a visualization application of your choice. This can be done as a team project, in which each team consists of up to 3 people. You will submit a project proposal in Week 10. The technology you use for the project will be up to you, subject to approval of the instructor based on our ability to to grade the work. The final project will be due at the end of Week 15. **Projects handed in after their deadline will be penalized at the rate of 10% per day with a limit of 7 days.** ***Unfortunately, there are no extensions to these project deadlines.***
- **Midterm and Final Exams.** The midterm and final exams will be offered in Week 7 and Week 16 respectively. They will be online and synchronous exams. You may use any references you wish; the exams are open-web. You are expected to complete the exam individually and failure to do so will be considered an academic integrity violation as outlined in the following section.

Academic Integrity

- These assessments are carefully designed to not only measure the knowledge and skills acquired in this course, but to also help you acquire the knowledge and skills needed to complete them.
- You can discuss course material with classmates, but your work on all assessments must be solely your original work, and must not contain any portion that can be attributed to anyone other than yourself.
- Any publicly-available code segments unrelated to the assigned work can be used but must be credited.

- In addition to the Student Code, we will follow the procedures and hold the expectations of the CS Honor Code. Cheating on any assignment can lead to a zero on the assignment, and for multiple instances, can lead to failure of the course and possibly eventual dismissal from the University of Illinois.

Academic Calendar

- The Graduate College at the University of Illinois maintains a Graduate College calendar. The calendar includes important dates such as final exam dates, course registration and cancellation, and holidays.
- There is also a campus-wide calendar available.
- The CS Department also sends reminders about upcoming deadlines. You will also receive the Graduate College newsletter in your Exchange email account.

Course Withdrawal and Refund

For course withdrawal-related questions, please refer to the Academic Calendars. Be sure to select the current term on that page.

For course refund information, please refer to the Office of the Registrar refunds website and select the current term. You can also refer to this website for the pro-rate refund schedule if you plan to withdraw from the course after the first day of classes for any given semester.