Your Instructor Team

- Hank Childs
  - Associate Professor of Computer and Information Science
  - Research interests include visualization, high-performance computing, computer graphics

- Brent Lessley
  - 5th year PhD student
  - Research interests include visualization and high-performance computing
Looking for notetaker

Hi Everyone,

The AEC is looking for a notetaker for this course. See below.

Thanks!
-Hank

The Accessible Education Center is requesting a peer notetaker for this course. You can earn $25 per credit hour for uploading the notes that you're already taking. If you take clear and comprehensive notes, please go to aec.uoregon.edu to sign up to be a notetaker. You may also enter the CRNs of other classes you are taking to see if there are additional notetaking opportunities.
Outline

• Class Overview (Syllabus)
• Overview of Visualization: Scientific Visualization versus Information Visualization
• Project 1 Overview
Outline

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• Project 1 Overview
Syllabus is Online

• http://ix.cs.uoregon.edu/~hank/410

CIS 410/510, INTRODUCTION TO SCIENTIFIC VISUALIZATION

Time: Mon/Weds/Fri 11:00am-11:50am
Location: 220 Chapman Hall
Instructor: Hank Childs
Office Hours: TBD
Teaching Assistant: Brent Lessley
Office Hours Location: 301 Deschutes Hall

Expectations

This is a projects-driven class. The projects will help you learn the theory behind scientific visualization, but they will also help you become better programmers, and provide you with experiences, anecdotes, and images that will impress potential employers.

The grading is designed to make sure you are keeping up with the assignments. Staying on top of the projects will be critical to succeeding in this class.

The projects in this class will be hard work for those who have not done significant programming previously. It is difficult to quote exactly how much time, since there is variation in background and programming skill. I expect those who have less developed programming skills will find this class to be a considerable effort, but also that they will have significant improvement by the end of the course.

The only prerequisite for the class is CIS 330, but this will be waived for anyone who has good knowledge of C++. The first eight projects will be in C++, and you will start from a common code base that is implemented in C++. For the advanced project, you may use any language you wish. Computer graphics is not a prerequisite for the course and we will cover whatever graphics we need to know as we go.

Course Materials

• The textbook is The Visualization ToolKit. The textbook is helpful, but most students find they do not need it to be successful at the class.

Grading

• Introductory Projects (410): 45 points
  o Project 1 (assigned January 8, due January 12): Install and run example program (2 points)
  o Project 2: Field Interpolation (7 points)
  o Project 3: Coloring (6 points)
  o Project 4: Advection and streamlines, part 1 (7 points)
  o Project 6A: Isolines (7 points)
  o Project 6B (ALL STUDENTS): Isosurfaces (5 points)
• Cheat sheet on SVN
  o Project 7A: visualization toolkit usage #1 (11 points)
Prerequisites For This Course

• CIS 330 is the only prerequisite
  – Waived for anyone who has good C++ knowledge
• CIS 441 is not a prerequisite
Enrolling In This Class

• Spots available.
Grading (410)

• Introductory Projects: 45 points
• Advanced Project: 35 points
• Quizzes: 20 points
• Extra credit through:
  – Community participation
• Grades: 90%: A-, 80%: B-, etc.
Grading (510)

• Introductory Projects: 45 + 10 points
• Advanced Project: 35 + 35 points
• Quizzes: 30 points
• Presentation: 10 points
• Extra credit through:
  – Community participation
• Grades: 90%: A-, 80%: B-, etc.
Introductory Projects

- Introductory Projects (410): 45 points
  - Project 1 (assigned January 8, due January 12): Install and run example program (2 points)
  - Project 2: Field interpolation (7 points)
  - Project 3: Coloring (6 points)
  - Project 4: Advection and streamlines, part 1 (7 points)
  - Project 6A: Isolines (7 points)
  - Project 6B (ALL STUDENTS): Isosurfaces (5 points)
    - Cheat sheet on SVN
  - Project 7A: visualization toolkit usage #1 (11 points)
- Introductory Projects (510): 55 points
  - All 410 projects
  - Project 5: Advection and streamlines, part 2 (6 points)
  - Project 7B: visualization toolkit usage #2 (4 points)
Advanced Projects

• Two tracks:
  – Custom project
  – Pre-defined project

• 410: you choose

• 510: do both
Pre-defined Project

- Ray-casted volume rendering
- 35% of grade
- There will be a grading rubric that outlines different levels of complexity
Custom Project

• You design and implement a project involving visualization

• Milestones:
  – Proposal: ~February 20th (3% of grade)
  – Implementation: March 23rd @ 10:15am (27% of grade)
  – Presentation: March 23rd @ 10:15am (5% of grade)
Custom Project Presentations

• All students attend project presentations for custom projects
  – (even if you do pre-defined project)
• -4% of grade if missed
• Have a good excuse for missing?
  – Tell me by Friday.
  – Otherwise you will lose 4%.
    • (unless extenuating circumstances)
Language Used For This Class

• The introductory projects will be implemented in C++.
  – Each project will start with a skeleton
• The advanced project can be implemented in whatever language you like.
Quizzes

• Quiz #1 on advection: 10 pts (410) / 15 (510)
• Quiz #2 on isosurfacing: 10 pts (410) / 15 (510)
Expectations

• This is a projects-driven class.
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Expectations

• The projects in this class will be hard work for those who have not done significant programming before.

• It is difficult to quote exactly how much time, since there is variation in background and programming skill.

  — I expect those who have less developed programming skills will find this class to be a considerable effort, but also that they will have significant improvement by the end of the course.
Norms for this class

• Please ask questions
• Please ask me to slow down
• Please give feedback
• Feel free to call me Hank

• Please always bring paper and pencil/pen … we will do exercises during class
This Class In a Nutshell...

- 1^{st} Half: Learn the basics behind scientific visualization
- 2^{nd} Half: Advanced project

Most of the learning will happen with projects. The lectures are designed to help you do the projects.
Course Materials

• Textbook: The Visualization ToolKit.

• PowerPoint lectures will be posted online.

• Some lectures may be complemented with chalkboard exercises.
What is VTK?

- VTK: Visualization ToolKit
- Most popular visualization library in the world
- We will use this for our introductory projects
- Cross-platform, so you can use whatever development platform you please.
Office Hours

• Show of hands…
Academic Misconduct (1 of 2)

• The programming projects are individual efforts
  – You may discuss the projects with your classmates.
  – Do not let someone look at your code on your screen.
  – Absolutely, positively do not email code.
  – Do not search the internet for previous implementations.
Academic Misconduct (2 of 2)

• If I detect collusion, all individuals involved will receive an F in the course immediately
  – I choose to not enumerate cases that involve collusion. Having a conversation without showing code is as far as you should go. Whiteboard conversations are fine. If you feel you are in a gray area, then you should email me.
  – Please note that if you are the one providing too much help, then you will also get an F

• I will be looking at your source code
Piazza

• I have set up a forum on Piazza.
  – I will monitor (and respond) to the forum and encourage you all to do the same.
  – I may award extra credit to students who are particularly helpful on Piazza.
  – The amount of credit will vary based on involvement, with a maximum of 3%.
Evaluation Criteria

• I will describe evaluation criteria on a project-by-project basis.

• For the most part,
  – I give you:
    • the right answer
    • a differencing program
  – And ask that you send me:
    • a screenshot of the differencing program showing you have no differences with the right answer
    • your source code
Evaluation Criteria, pt 2

• If you hand in something that produces the wrong answer, then assume you will get <50% on it.
  – I would rather you turn in something that works correctly late than on time and incorrect
Late Passes

• You have 2 "late passes."

• Late passes allow you to turn in your project after the due date for full credit.
  – One late pass gives you an extra two days.
  – Example: due Friday, use a late pass, now due Sunday
  – Can combine two late passes

• If you run out of late passes, then you may continue to earn half credit on any project.

• Every unused late pass is worth 0% extra credit.
Class Summary

• This class will teach you the theory and techniques behind scientific visualization
• This class will improve your programming skills
• This class may help you land a job
• This class will require a lot of work
  – (but not as much as 330 or 441)
Grading for 410
(repeat of previous slide)

• Introductory Projects: 45%
• Advanced Project: 35%
• Quizzes: 20%
• Extra credit through:
  — Community participation
Lecture hiccups

- Unfortunate: travel week of Feb 4th
- Plan: to be determined
  - Brent will likely do one lecture
  - Possibly one YouTube and one class cancelation
Lecture Plan

• First six weeks are mapped out.
• Last four weeks can be adaptive based on your project plans.
Outline

• Class Overview (Syllabus)
• Overview of Visualization: Scientific Visualization versus Information Visualization
• The Very Basics of Computer Graphics
• Project 1 Overview
Scientific Visualization

• An interdisciplinary branch of science
  – primarily concerned with the visualization of three-dimensional phenomena (architectural, meteorological, medical, biological, etc.)
  – the emphasis is on realistic renderings of volumes, surfaces, illumination sources, and so forth, perhaps with a dynamic (time) component.
• It is also considered a branch of computer science that is a subset of computer graphics.
• The purpose of scientific visualization is to graphically illustrate scientific data to enable scientists to understand, illustrate, and glean insight from their data.

Source: wikipedia
Information Visualization

• The study of (interactive) visual representations of abstract data to reinforce human cognition.
  
  – The abstract data include both numerical and non-numerical data, such as text and geographic information.
SciVis vs InfoVis

• “it’s infovis when the spatial representation is chosen, and it’s scivis when the spatial representation is given”
What sorts of data?

Of course, lots of other data too...
What Is Visualization Used For?

• 3 Main Use Cases:
  – Communication
  – Confirmation
  – Exploration
How Visualization Works

• Many visual metaphors for representing data
  – How to choose the right tool from the toolbox?
• This course:
  – Describe the tools
  – Describe the systems that support the tools
This Class

• Focus is on SciVis
• We can add some InfoVis in the second half to fit advanced projects.
Outline

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Project #1

- Goal: write a specific image
- Due: “Friday Jan 12th” → “6am Saturday Jan 13th”
- % of grade: 2%
- Goal: get multi-platform issues shaken out ASAP.
- Experience last year was pretty good.

Worth 2% of your grade

Assignment:
1) Download, build, and install VTK.
2) Download and install CMake. Use version 3.X
3) Download the file called data.vtk
4) Make directory called “project1”
5) Download file project1.cxx and CMakelists.txt from class website and copy them into directory project1
6) Update the VTK_DIR variable in CMakelists.txt to point to the path of the VTK you just installed.
7) Run CMake. This will create build files.
8) Compile the program. For Unix/Mac, this means “make”
9) Run the program. (How to run is platform dependent … on Linux and Mac, a binary gets generated and you invoke it.)
10) Submit a screenshot of the working program via Canvas
What is **CMake**?

- Cmake is a cross-platform, open-source build system.
- CMake is a family of tools designed to build, test and package software.
- CMake is used to control the software compilation process using simple platform and compiler independent configuration files.
- CMake generates native makefiles and workspaces that can be used in the compiler environment of your choice.
How do you install CMake?

• Go to www.cmake.org & follow the directions
What is the **Visualization Toolkit (VTK)**?

- The Visualization Toolkit (VTK) is an open-source, freely available software system for 3D computer graphics, image processing and visualization.
- VTK consists of a C++ class library and several interpreted interface layers including Tcl/Tk, Java, and Python.
- VTK is cross-platform and runs on Linux, Windows, Mac and Unix platforms.
How do you install VTK?

• Go to [www.vtk.org](http://www.vtk.org), go to Resources->Download and follow the directions
How do you install VTK, part 2?

• See if your favorite package manager has a version already.

• Note: consult project 1 prompt for version of VTK to use
What do I do again?

• Install CMake & VTK.
• Download
  – “project1.cxx” from class website
  – “CMakeLists.txt” from class website
  – “data.vtk” from class website
• Run CMake
• Compile project1.cxx
• Run program
• Upload a screenshot of the result to Canvas by 6am Sat. morning.
What should you do if you run into trouble?

1) Start with Piazza
2) Ask questions at Weds, Fri class
3) Attend OH (times will be announced)
Don’t forget

• This lecture is available online
  – [http://ix.cs.uoregon.edu/~hank/410](http://ix.cs.uoregon.edu/~hank/410)

• All project prompts are available online