Introduction

Lecture 1

January 14, 2020
Instructor

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• Associate Prof of Computer Science
• Visualization, Data Analysis, Scientific Computing
• Office: LWSN 3154P
• With Purdue since 2007
Teaching Assistant

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Today

• Introduction
• Syllabus
• Class overview
• Graphics Intro
• Homework
CS530 is NOT a Computer Graphics class
Big Data

- $2.5 \times 10^{18}$ bytes/minute
- 90% of world data created in last 2 years
**Classical Definitions**

“Transformation of the symbolic into the geometric”

[McCormick et al. 1987]
Classical Definitions

“The use of computer-generated, interactive, visual representations of data to amplify cognition.”

[Card, Mackinlay, & Shneiderman 1999]
More Definitions

“Creation of images that convey salient information about underlying data and processes”
[Hansen & Johnson, 2005]

“Communication of information using graphical representations”
[Ward et al., 2010]
More Definitions

"Computer-based visualization systems provide visual representations of datasets designed to help people carry out tasks more effectively."

[Munzner, 2014]
Why Visualize?

To point out interesting things
Why Visualize?
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Why Visualize?
Visualization Objectives

• Record information
• Analyze data to support reasoning
• Confirm hypotheses
• Communicate ideas to others
Syllabus
On Class Web Page

CS530 - Spring 2020
Introduction to Scientific Visualization

Instructor
Prof. Xavier Tricoche
Office: LW3N 315A
Office hours: Tuesday 3-5pm
xmt@purdue.edu

Teaching Assistant
Dana El-Rushaidat
Office: LW3N 315A
Office hours: Monday 10-11am, Wednesday 1-2pm, and by appointment
delrushaidat@purdue.edu

Time and Location
T/R: 1:30-2:45pm
FRNY B-124

Course Summary
Scientific visualization is concerned with the visual representation of numerical datasets obtained through measurements or computational simulations of natural phenomena. Visualization creates interactive graphical interfaces to datasets of ever increasing size and complexity that affords scientists and engineers a powerful and intuitive basis for interpretation, assessment, and decision making.

The course covers the fundamental principles of this discipline and describes the most prominent visualization techniques used in practice. In particular, the course presents both basic and more advanced visualization algorithms for 2D, 3D, and time-dependent datasets corresponding to scalar, vector, and tensor attributes, as well as higher-dimensional and non-spatial data. The lectures emphasize the practical applications of these techniques in science, engineering, and medicine. The material is mostly self-contained and no graphics background is required. The programming assignments explore the use of visualization in the study of real-world datasets.

Learning Outcomes
After completion of the course, you will...
- know basic notions of human vision and color perception that inform the design of effective visual representations.
- be familiar with modern visualization techniques and toolkits used in scientific research.
- be able to critically evaluate scientific visualizations and communicate their insights to a non-specialist audience.

Course Information
Course Numbers: CS53000 (inperson) / CS53000 EPE (online) / CS53000 OXE (online)
CRN: 10607 (FRNY) / 12122 (EPE) / 24495 (OXE)
Credit Hours: 3
Time: T/R 1:30pm - 2:45pm
Location: FRNY B-124 and online
Instructor
Prof. Xavier Tricoche
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Email: xmt@purdue.edu
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Teaching Assistant
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Office: LW3N 315A
Office Hours: by appointment

Course Description
Scientific visualization creates interactive visual representations of numerical datasets obtained through simulation or measure to facilitate their analysis. The course provides an introduction to the principles of this discipline and present the main techniques used in practice. The lectures cover the visualization of 2D, 3D, and time-dependent datasets corresponding to scalar, vector, and tensor attributes, as well as the depiction of non-spatial or high-dimensional data. The presentation emphasizes the practical role of visualization in science and engineering and is mostly self-contained. The evaluation is based on 5 programming assignments, a midterm, and a final project.
Basic Facts

• Lectures: T/Th 1:30 pm - 2:45 pm
• Office hours: T 3:00 pm - 5:00 pm
• Performance evaluation:
  • 5 (programming) assignments (total: 60%)
  • Midterm exam: 20%
  • Final project: 20%
Communication

• Discussions, Q&A’s, and announcements will be on Piazza

piazza.com/purdue/spring2020/cs530

• Sign up!
Lateness Policy

• Assignments due by given deadline
• 5 extension days granted to each student
• 20% penalty for each late day
• No submission accepted past 5th late day
Topics Overview
Computer Graphics Primer

Bare minimum

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CS530 / Spring 2020 : Introduction to Scientific Visualization.  01/14/2020  Introduction
The Visualization Toolkit
Foundations

Visual System and Color Perception
Foundations

Data structures and data processing
Scalar Fields

Color Mapping
Scalar Fields

Isosurfaces / level sets
Scalar Fields

Volume rendering
Vector Fields

Lagrangian methods
Vector Fields

Dense representations
Tensor Fields

Glyphs
Tensor Fields

Hyperstreamlines
Topology
High-Dimensional Data
Applications

Biomedicine
Applications

Fluid dynamics
Applications

Fluid dynamics