CS148 Summer 2025 - Lecture 16

08/14/2025

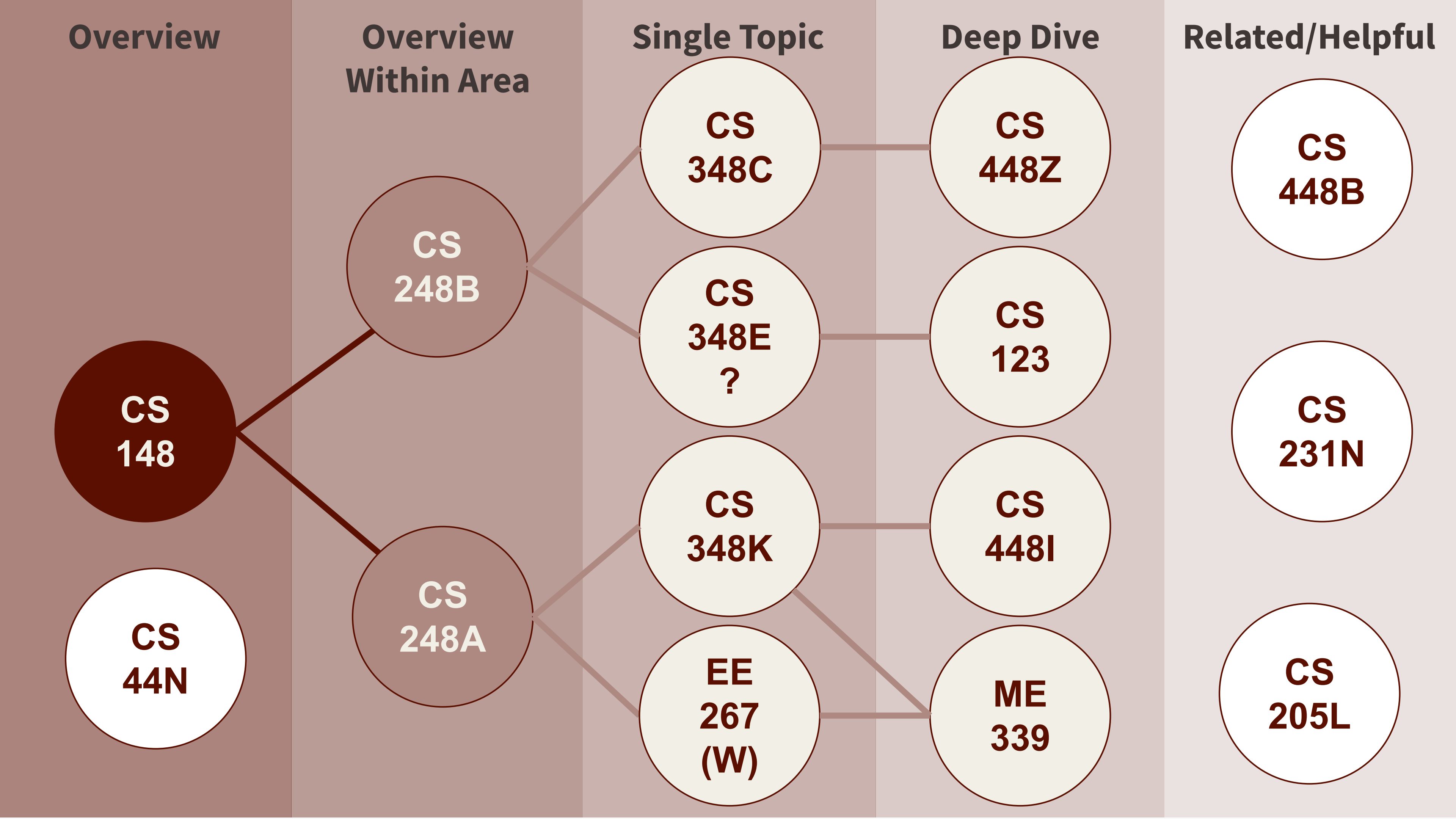
What's Next in Graphics

cs148.stanford.edu

Logistics

- Course Reviews
    - in Canvas, students will see a pop-up notification on their Canvas dashboard page any time they log into Canvas during the evaluation period.
    - direct link: http://course-evaluations.stanford.edu.
    - in Axess > My Academics > Course and Section Evaluations > Link to the evaluation system near the top of the page
- Final Showcase
    - Saturday (Aug. 16) from 8:30-11:00AM
    - BE ON TIME
    - There will be various awards presented
    - Remember to prepare a ONE MINUTE presentation!
    - Let us know IN ADVANCE if you will not be present (and record your 1 minute!)
- Final Project Rendering
    - Render now

Upcoming Classes


Overview
Overview Within Area
Single Topic
Deep Dive
Related/Helpful
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CS 44N
CS 248B
CS 248A
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CS 348E ?
CS 348K
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CS 448Z
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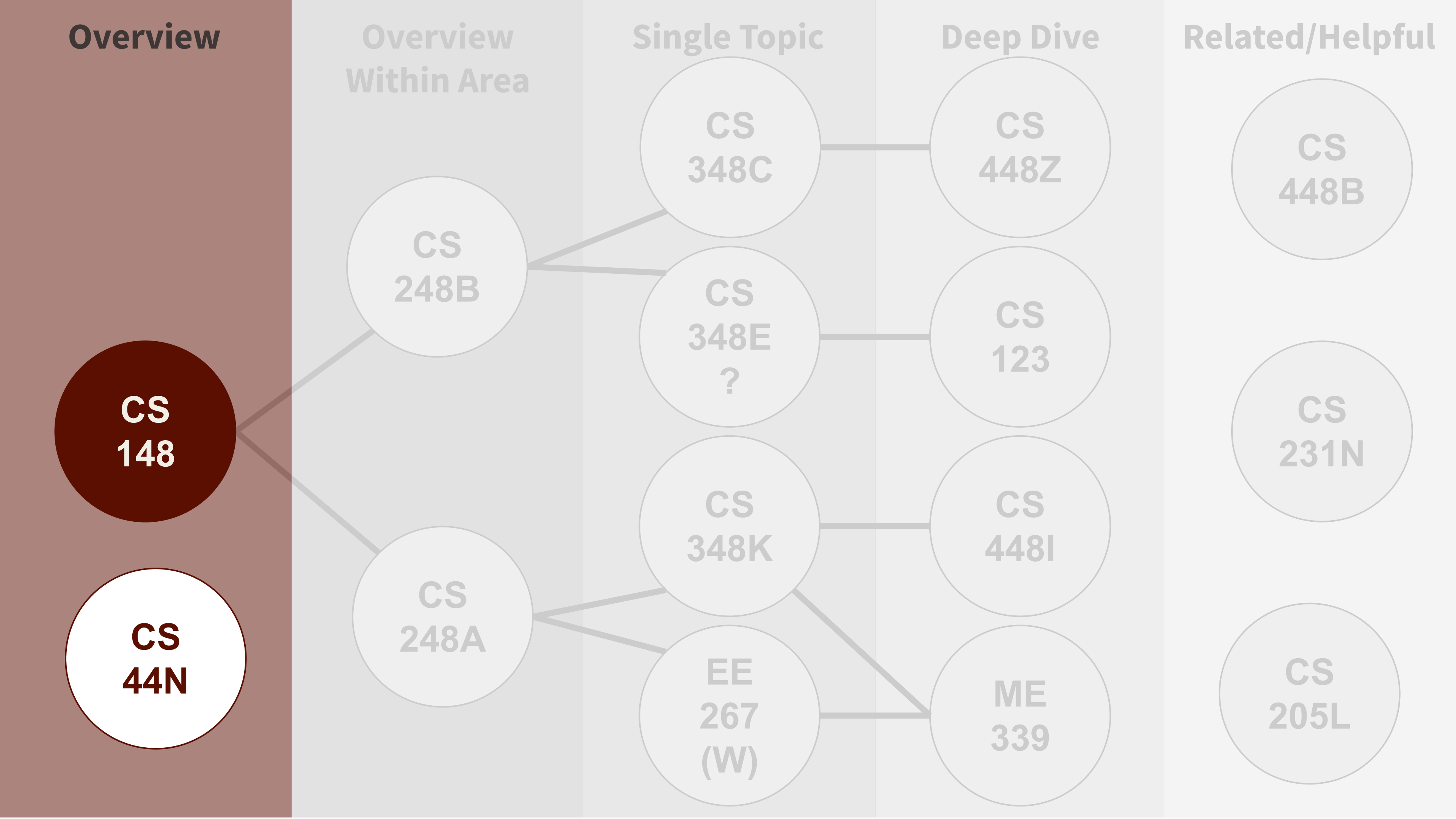
CS 448I
ME 339
CS 448B
CS 231N
CS 205L



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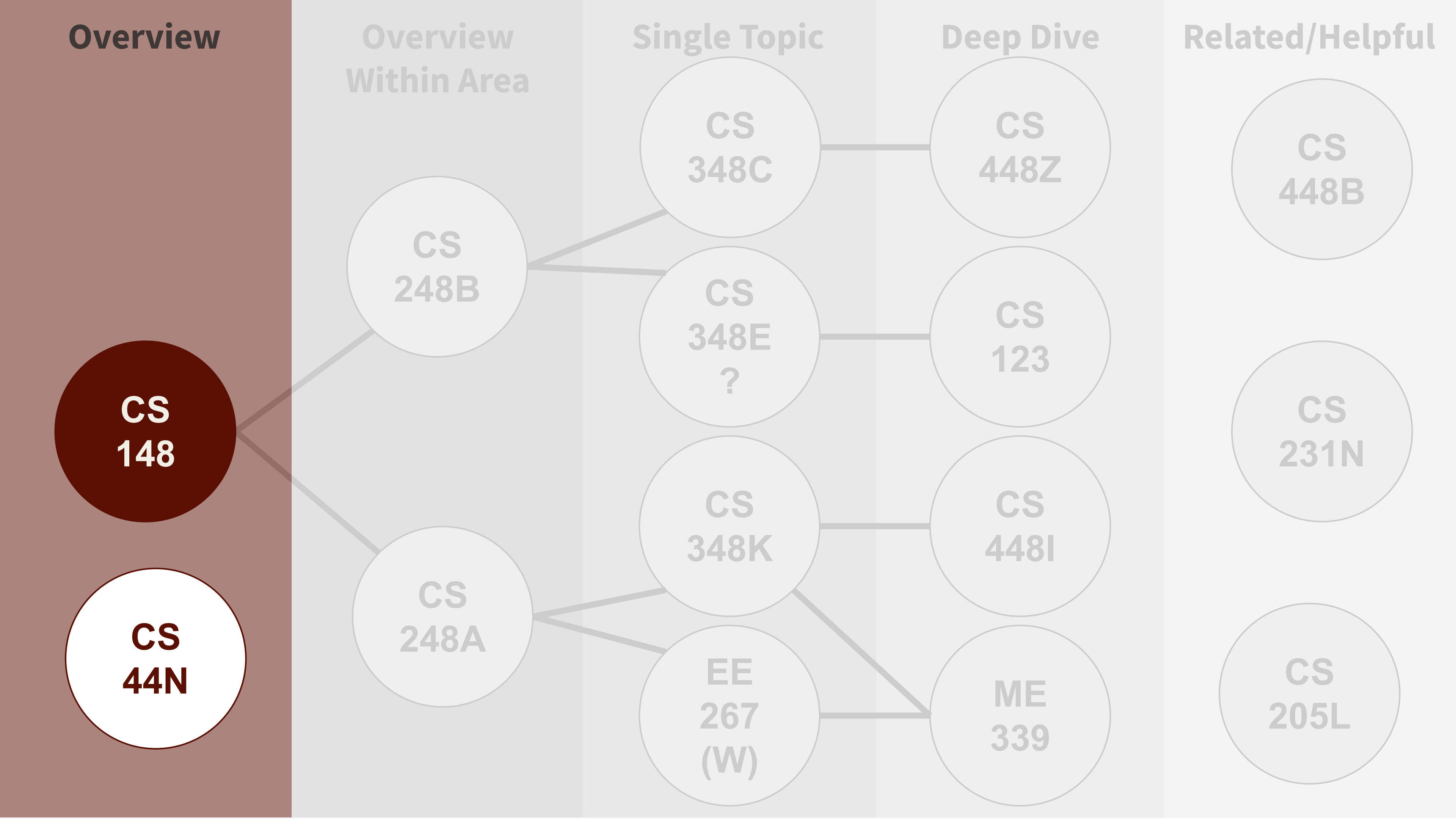
Fall Quarter

CS 44N: Great Ideas in Computer Graphics

A hands-on interactive and fun exploration of great ideas from computer graphics. Motivated by graphics concepts, mathematical foundations and computer algorithms, students will explore an eccentric selection of "great ideas" through short weekly programming projects. Project topics will be selected from a diverse array of computer graphics concepts and historical elements.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CS 448I
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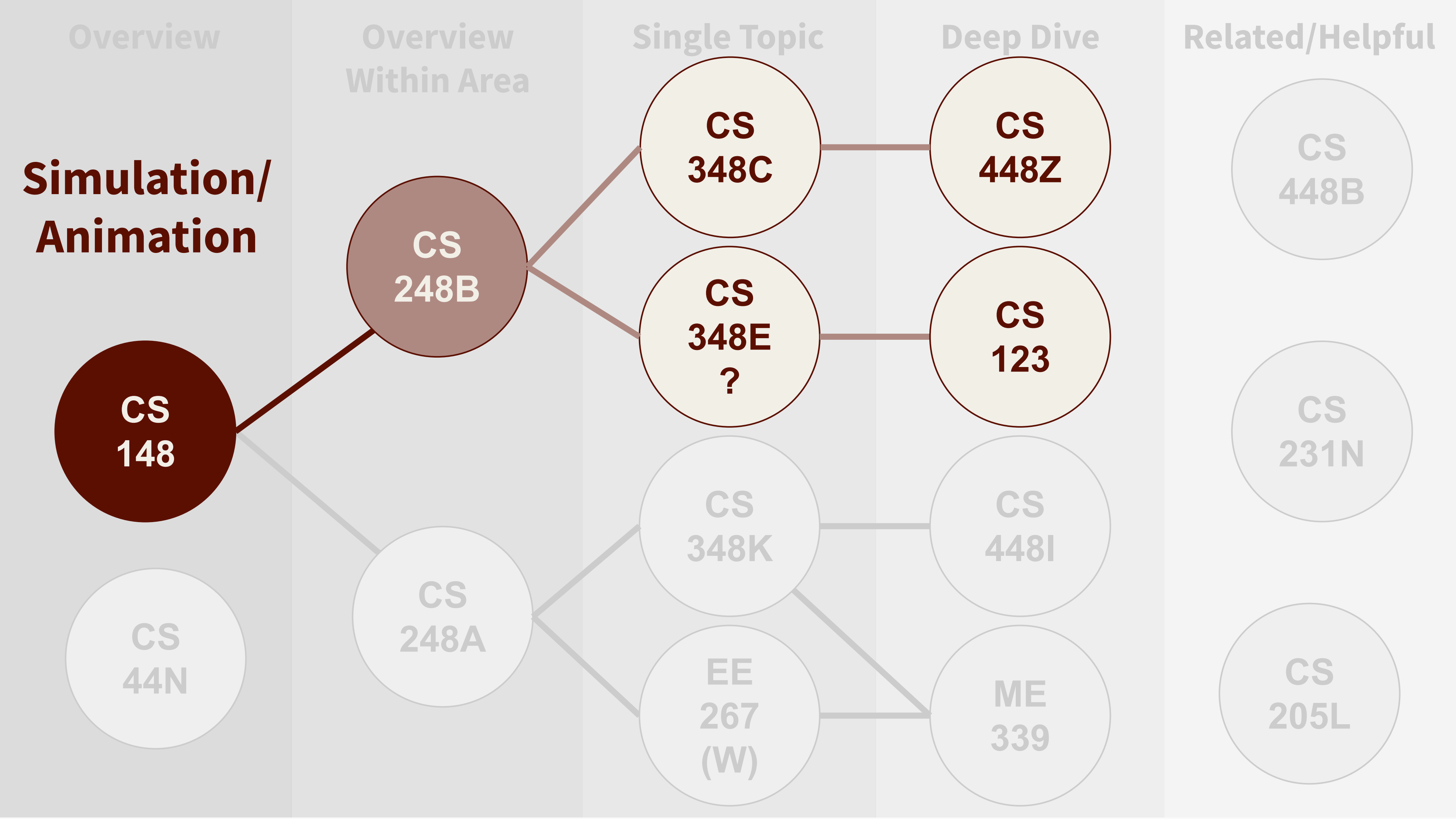
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CS 448I
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CS 248B: Fundamentals of Computer Graphics: Animation and Simulation

- Learn more about simulation and motion
- Focus on sound and motion
- Rigid body and soft body interactions
- Particle systems
- IK bones (rigging)

Fall Quarter

CS 248B: Fundamentals of Computer Graphics: Animation and Simulation

- Learn more about simulation and motion
- Focus on sound and motion
- Rigid body and soft body interactions
- Particle systems
- IK bones (rigging)

CS 348C: Computer Graphics: Animation and Simulation

- Simulation and Animation, but focused on particle systems
- Taught in Houdini
- Particle systems, procedural geometry, dynamics, and sound
- Final project

Winter Quarter

CS 348C: Computer Graphics: Animation and Simulation

- Simulation and Animation, but focused on particle systems
- Taught in Houdini
- Particle systems, procedural geometry, dynamics, and sound
- Final Project

Spring Quarter

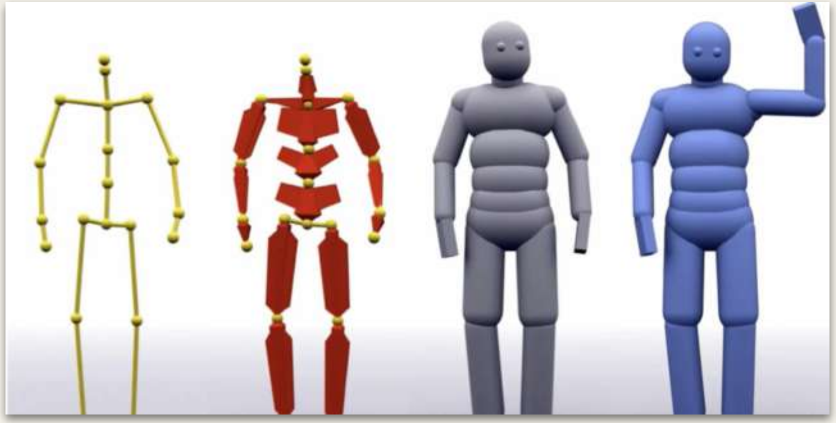
CS 448Z: Physically Based Animation and Sound

- Modeling sound waves and radiation
- Sound propagation and acoustic transfer
- Fracture
- Fire
- Cloth

Spring Quarter
(NOT THIS YEAR)

CS 348E: Character Animation: Modeling, Simulation, and Control of Human Motion

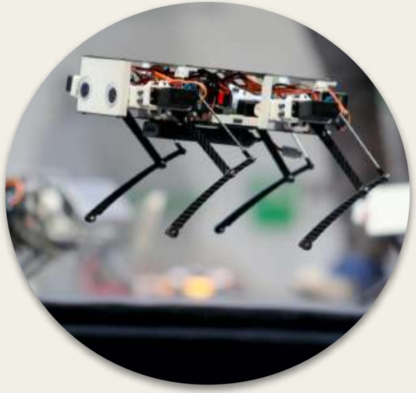
- Simulation and Animation, but focused on the human body
- Forward and Inverse Kinematics
- Study of hands
- Using motion to predict future actions

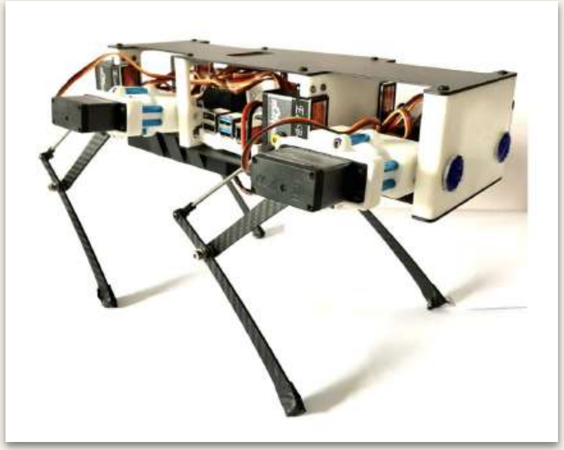


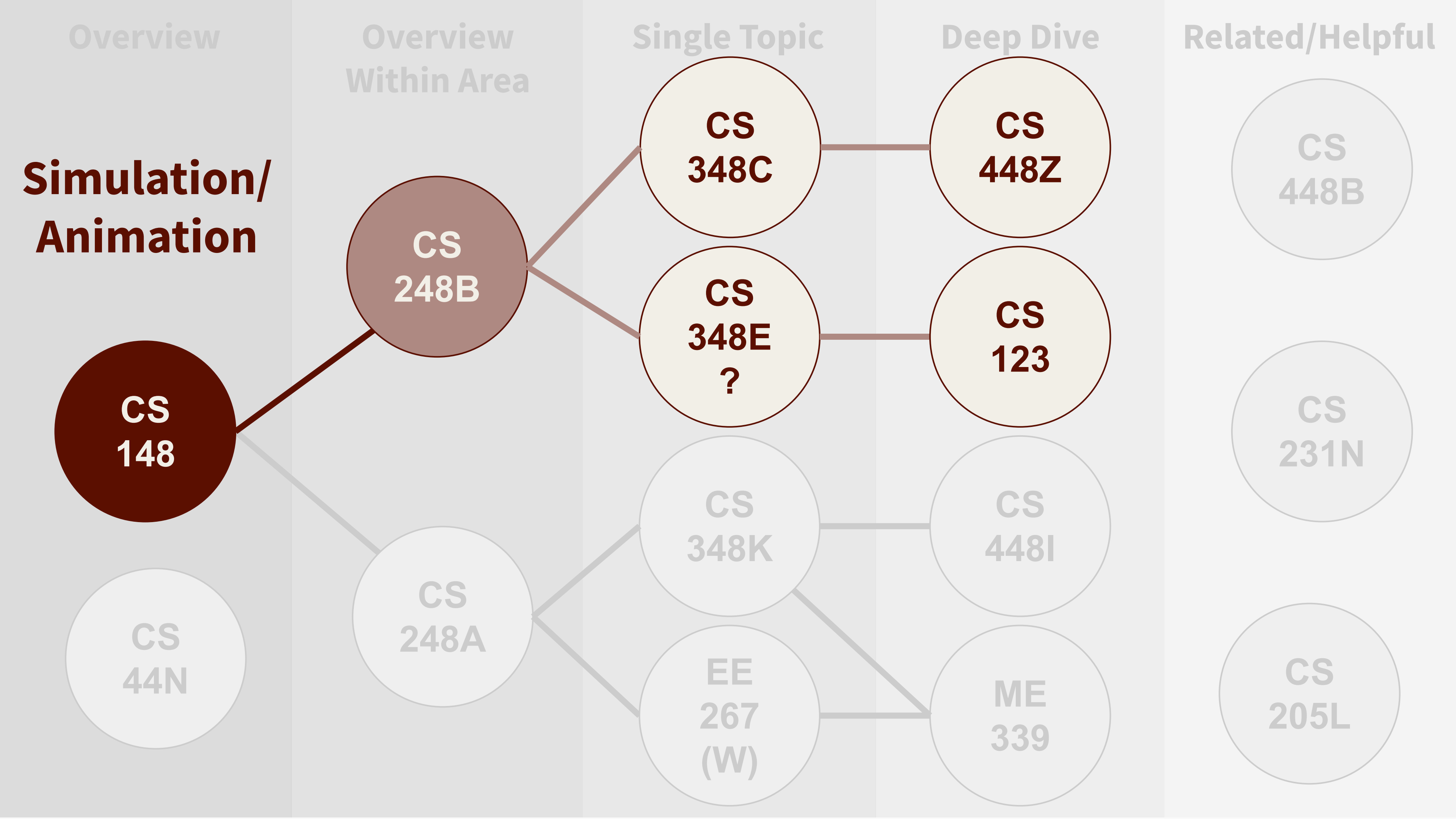
Fall and Spring Quarter

CS 123: A Hands-On Introduction to Building AI-Enabled Robots

- Build your own quadruped robot
- Program the Robot
- Requires only basic linear algebra and python
- Only 20 slots



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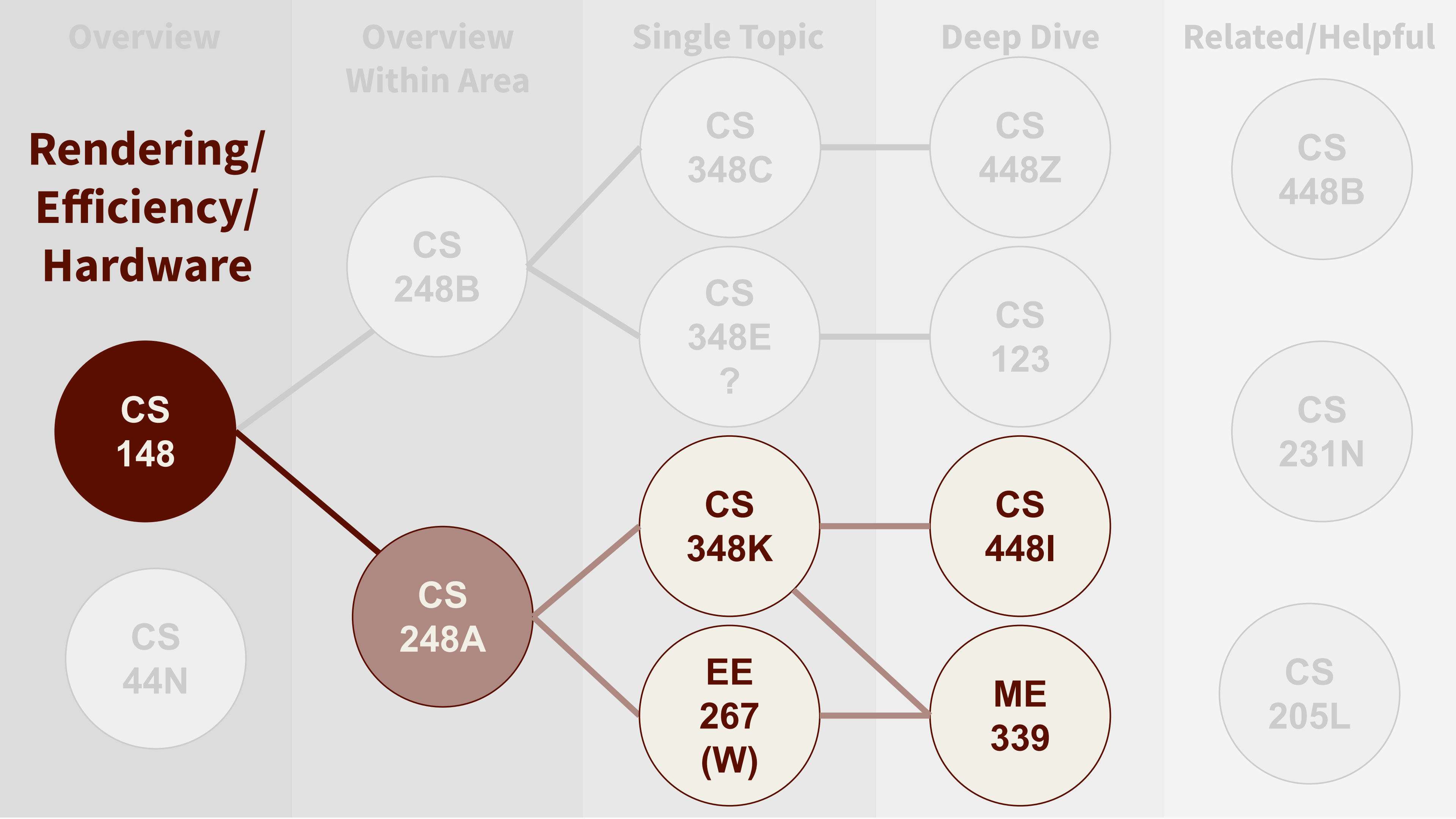
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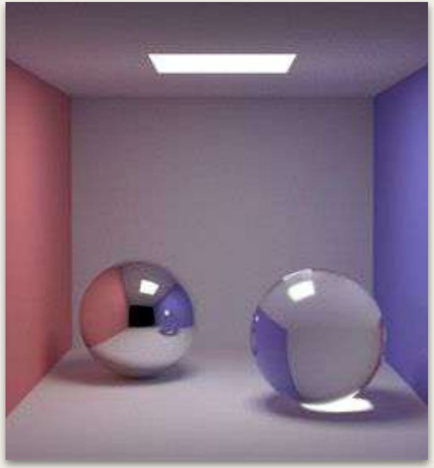
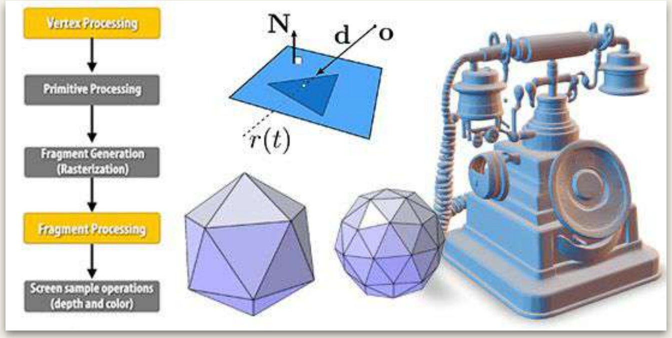
Winter Quarter

CS 248A: Computer Graphics: Rendering, Geometry, and Image Manipulation

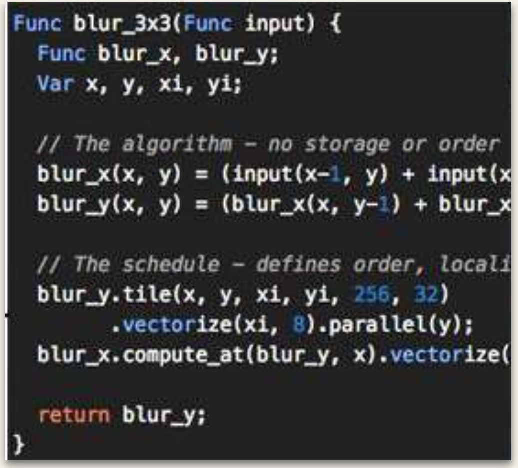
- What is an image and how does it get shown on the screen?
- GPU pipeline
- Transformations
- A bit of interaction
- Final Project





CS 348K: Visual Computing Systems

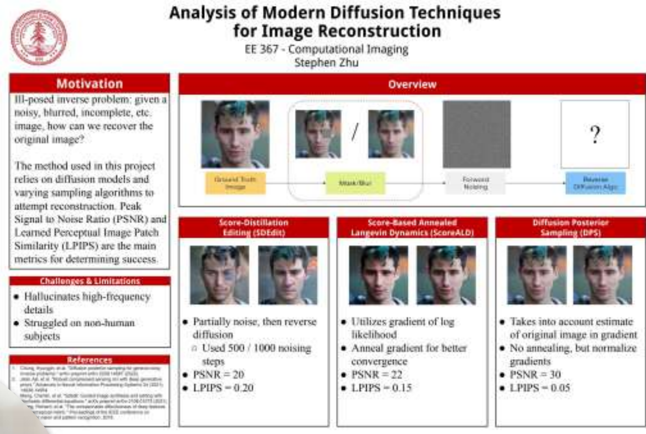
- Digital camera processing
- Neural network hardware
- Video compression
- NERFS
- GPU accelerated ray tracing

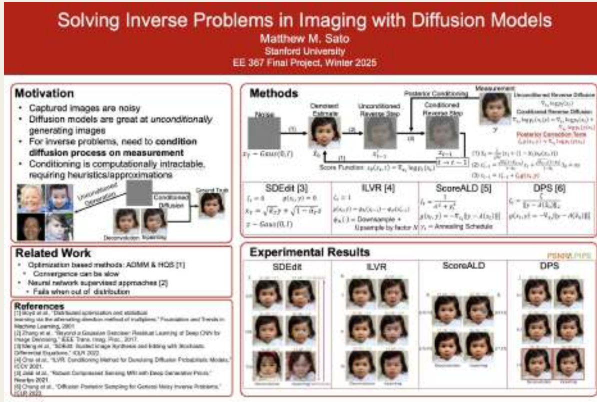


Spring Quarter

CS 448I: Computational Imaging

- Human Perception and Digital Cameras
- Using ML to solve inverse problems (denoising, etc.)
- Light field imaging
- Wave optics

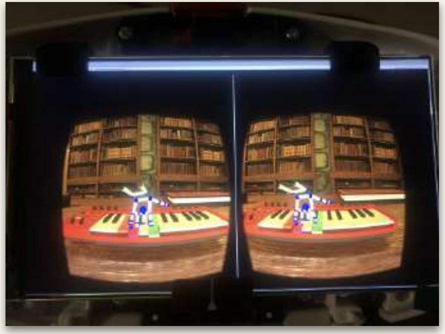


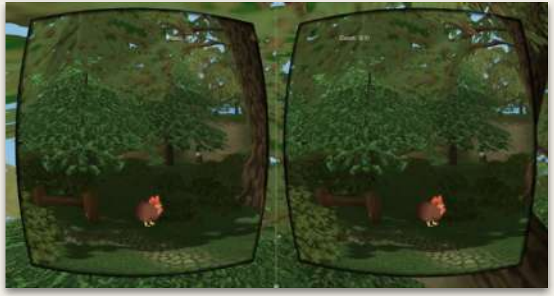


Spring Quarter

EE 267: Virtual Reality

- Hands on electrical engineering class
- Hardware systems used for virtual reality
- Write code and explore software for VR
- Project based class

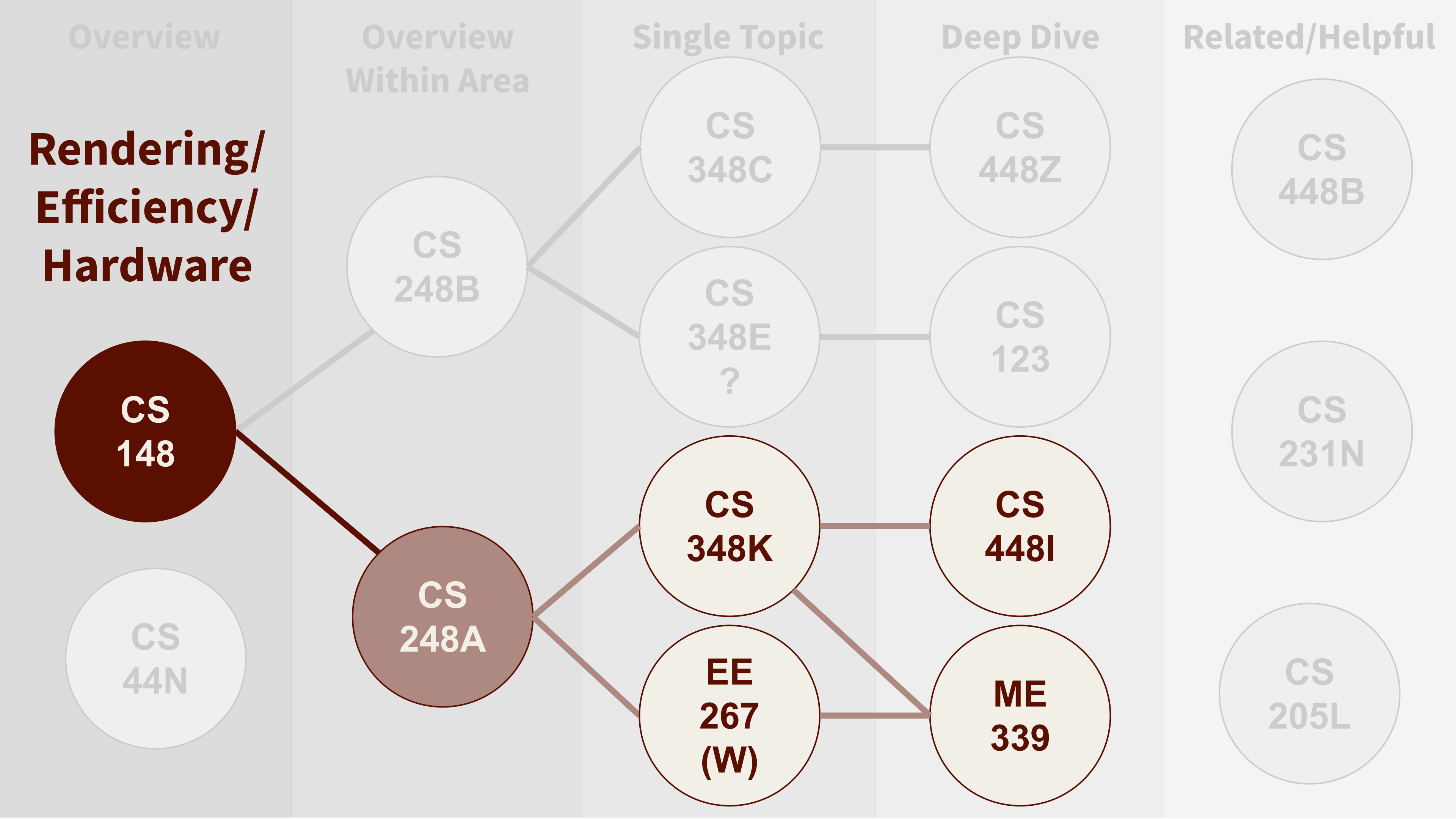




Spring Quarter

ME 339: Introduction to Parallel Computing Using MPI, OpenMP and CUDA

- Programming multicore processors, GPUs, and parallel computers
- Multi-threaded programs
- Machine learning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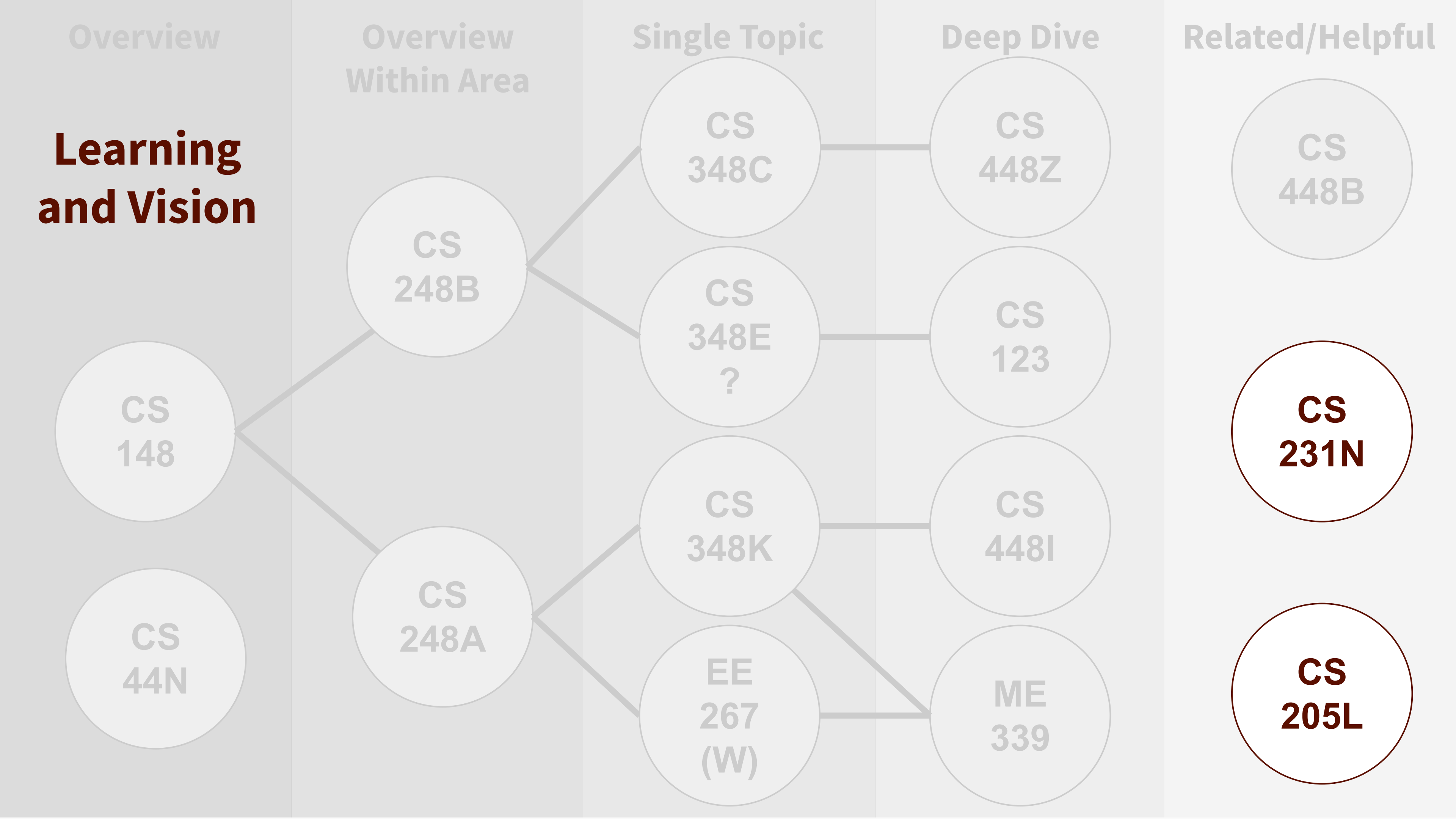
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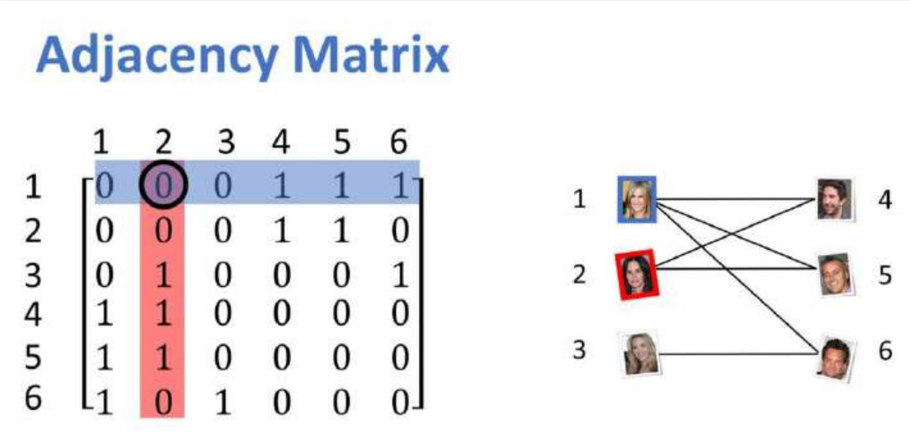
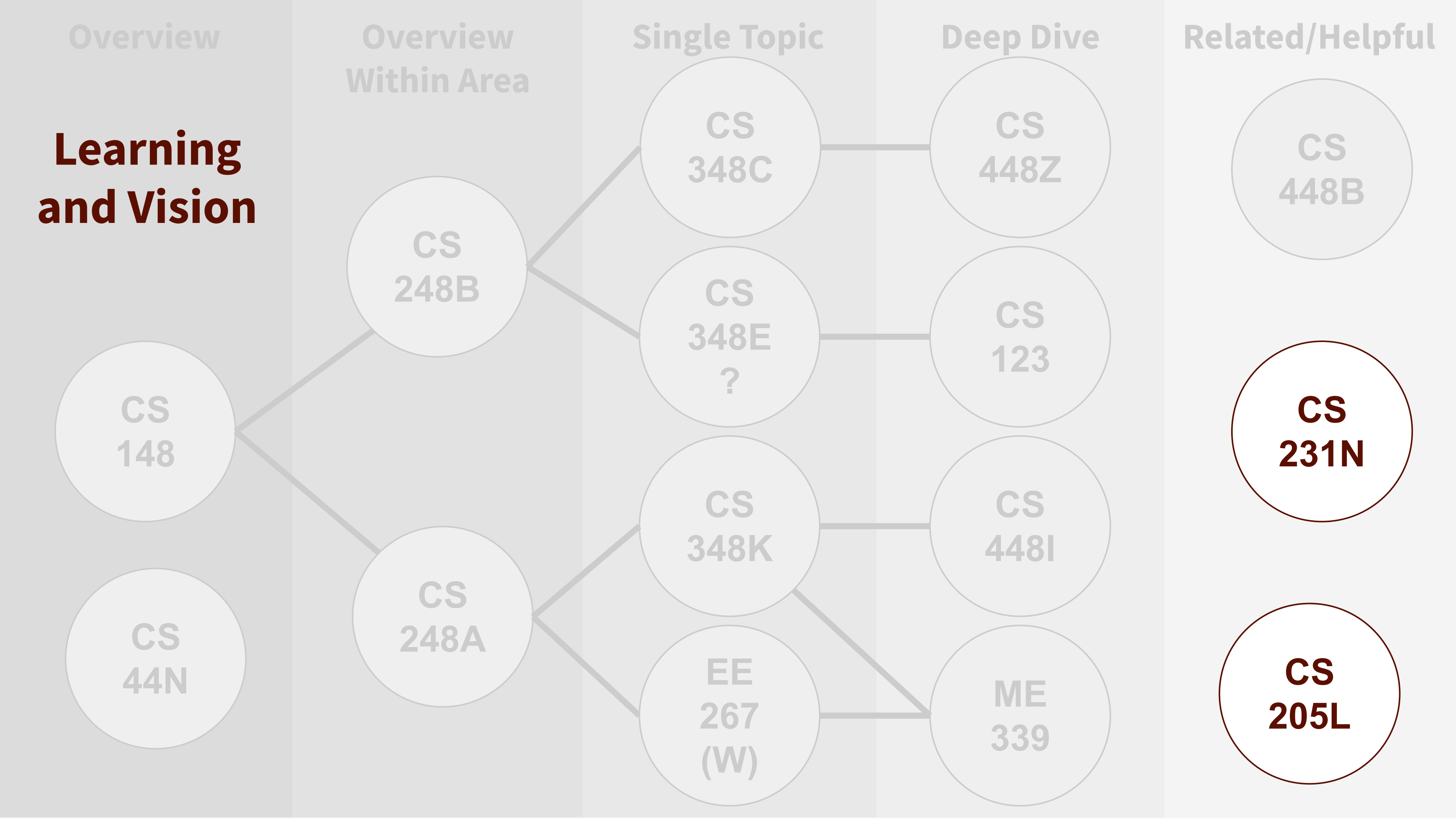
Winter Quarter

CS 205L: Continuous Mathematical Methods with an Emphasis on Machine Learning

- Learn about the mathematical foundation of Machine Learning
- Basis in Linear Algebra
- Programming and paper assignments

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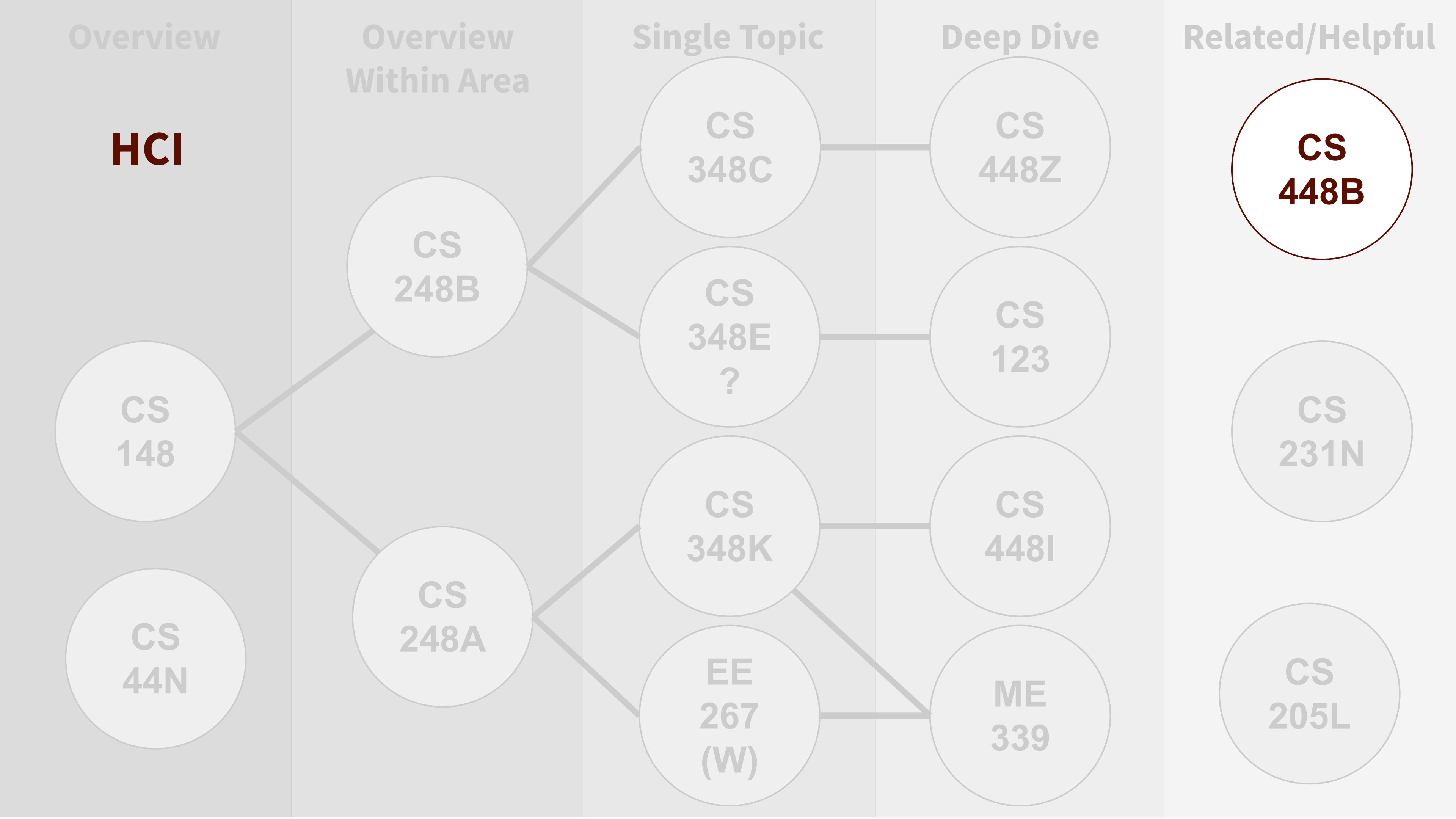
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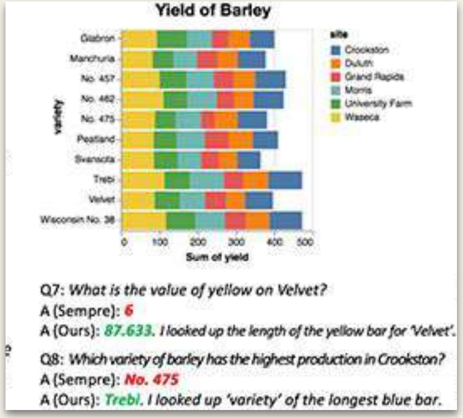
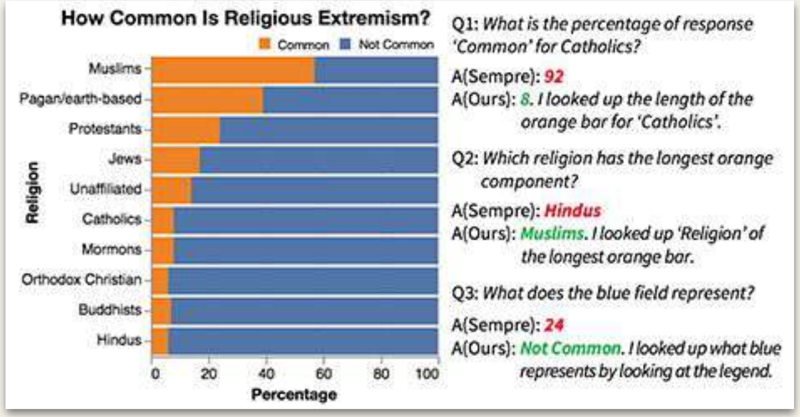
CS 448B: Data Visualization

- Think about Computer Graphics from a comprehension perspective
- Learn how to use and optimize visualization tools
- Discuss data visualization theory





MI 260: Creative Visualization Studio

BIOE 281: Biomechanics of Movement (ME 281)

ARTSTUDI 167M: Animated By Origins: Africa and The Americas (AFRICAAM 167)

BIOE 485: Modeling and Simulation of Human Movement (ME 485)

AMSTUD 129: Animation and the Animated Film (FILMEDIA 129, 329, 429)

PSYCH 230: Computational Models of Human Creative Expression

Questions?

If You're Interested in Industry

- Make a demo reel
- Meet people in the field
    - Volunteer for SIGGRAPH!
    - Look for and go to events
- Take project based classes
- Save your work!

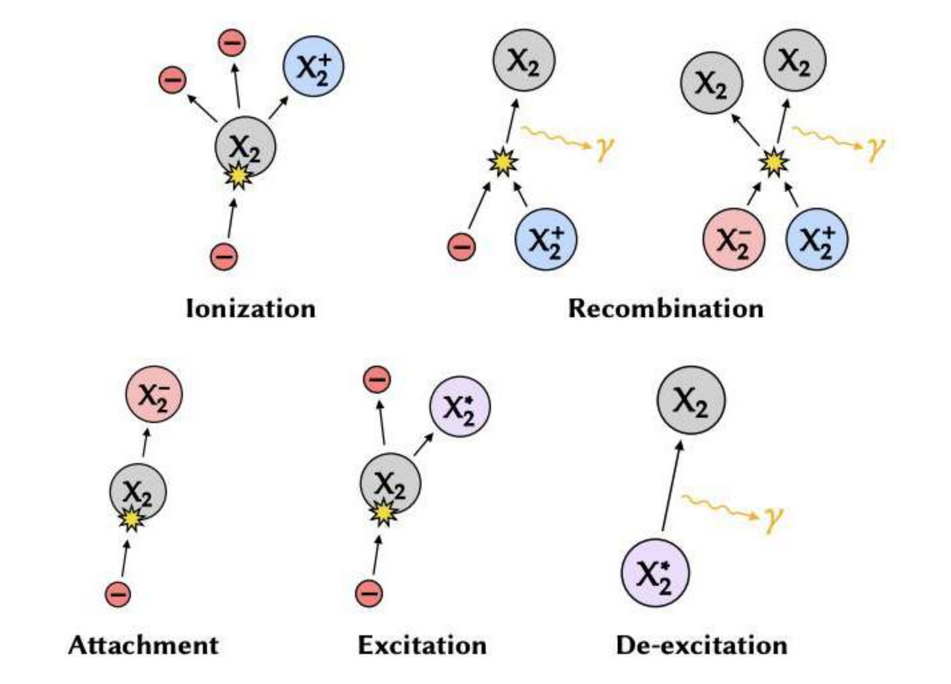
Cutting Edge Graphics


SIGGRAPH 2025
Vancouver+ 10-14 August
The Premier Conference & Exhibition on
Computer Graphics & Interactive Techniques
Technical Papers Trailer

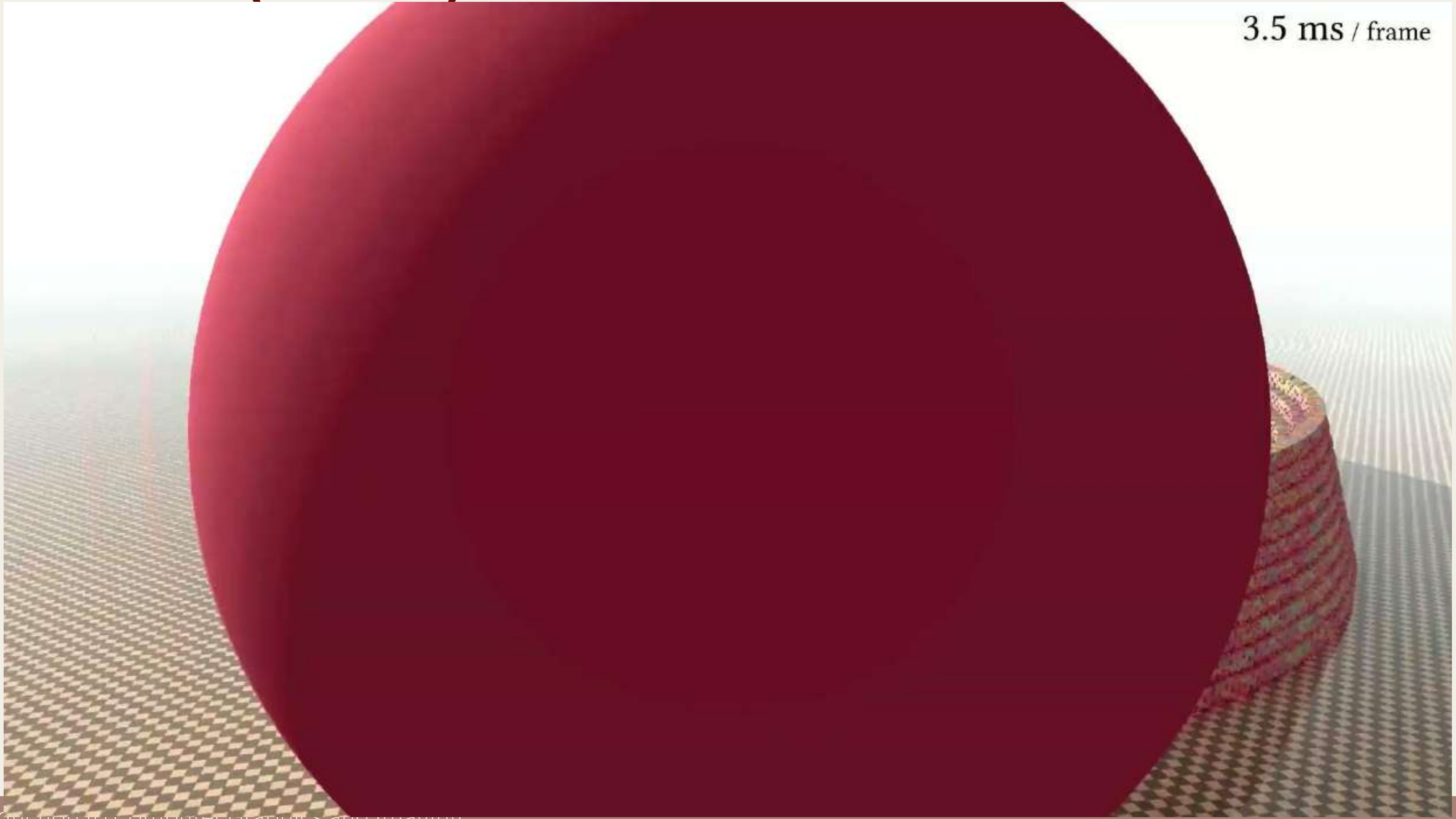
Modeling and Rendering Glow Discharge

Modeling and Rendering Glow Discharge

Symbol(s)	Meaning
$\boldsymbol{x}$	Arbitrary point in space, $\mathbb{R}^3$
$\boldsymbol{\omega}$	Outgoing radiance direction, $\mathbb{S}^2$
$L_o(\boldsymbol{x}, \boldsymbol{\omega})$	Outgoing radiance from $\boldsymbol{x}$ along $\boldsymbol{\omega}$
$L_e(\boldsymbol{\omega}, \boldsymbol{\omega})$	Emission at $\boldsymbol{x}$ along $\boldsymbol{\omega}$
$E, \widetilde{E}$	Electron number density, logarithm
$P, \widetilde{P}$	Positive ion number density, logarithm
$N, \widetilde{N}$	Negative ion number density, logarithm
$\vec{v}_E, \vec{v}_P, \vec{v}_N$	Drift velocity of electrons and ions
$\mathcal{D}$	Diffusion coefficient
α	Ionization coefficient
β	Recombination coefficient
η	Attachment coefficient
ρ	Ion scale coefficient
$\vec{\mu}$	Homogenized drift velocity, $\mathbb{R}^3$
λ	Wavelength of light



Crazy Fast Physics: Augmented Vertex Block Descent (AVBD)



Crazy Fast Physics: Augmented Vertex Block Descent (AVBD)

1. Numerical stability
2. Parallel computing

$$\mathbf{x}^{t+\Delta t} = \underset{\mathbf{x}}{\operatorname{argmin}} \; \frac{1}{2\,\Delta t^2} \|\mathbf{x} - \mathbf{y}\|_M^2 + E(\mathbf{x}) \,,$$

Instance Segmentation of Scene Sketches Using Natural Image Priors

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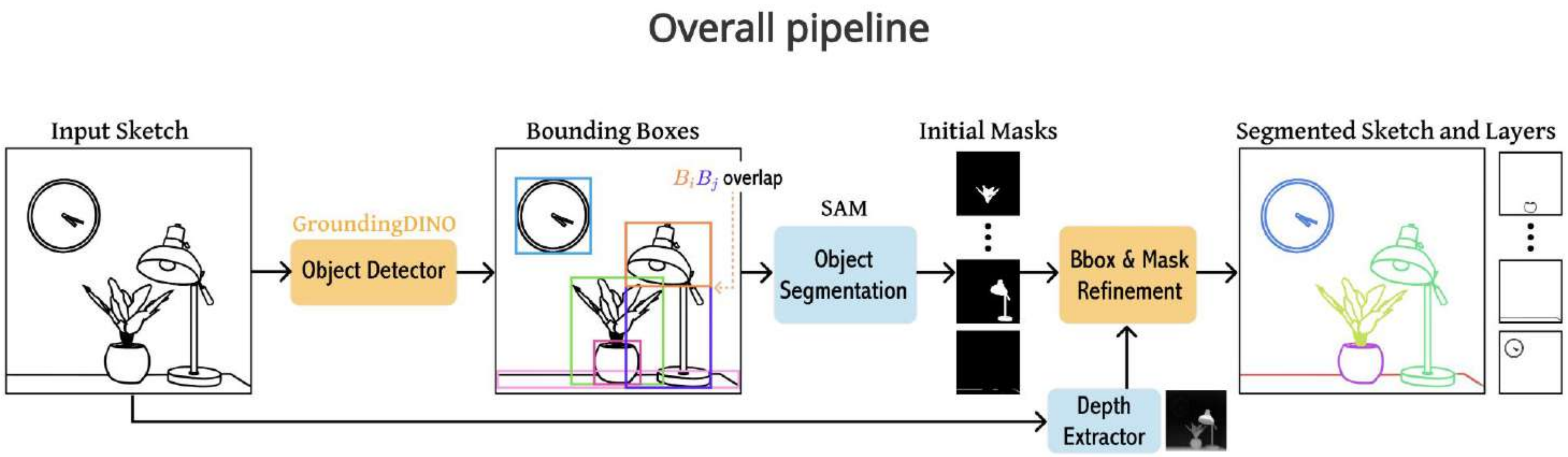
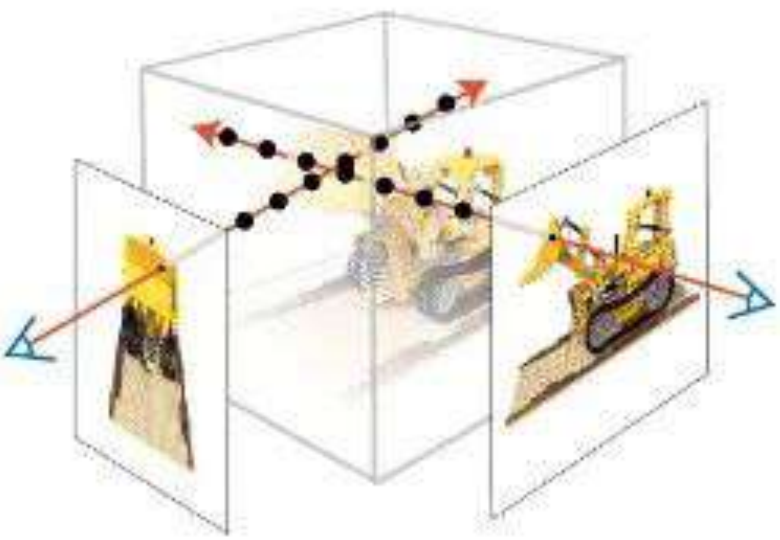


Instance Segmentation of Scene Sketches Using Natural Image Priors

DreamPrinting: Volumetric Printing Primitives for High-Fidelity 3D Printing



Neural Radiance Field

A 3D Scene is worth 1000 Splats

DreamPrinting: Volumetric Printing Primitives for High-Fidelity 3D Printing

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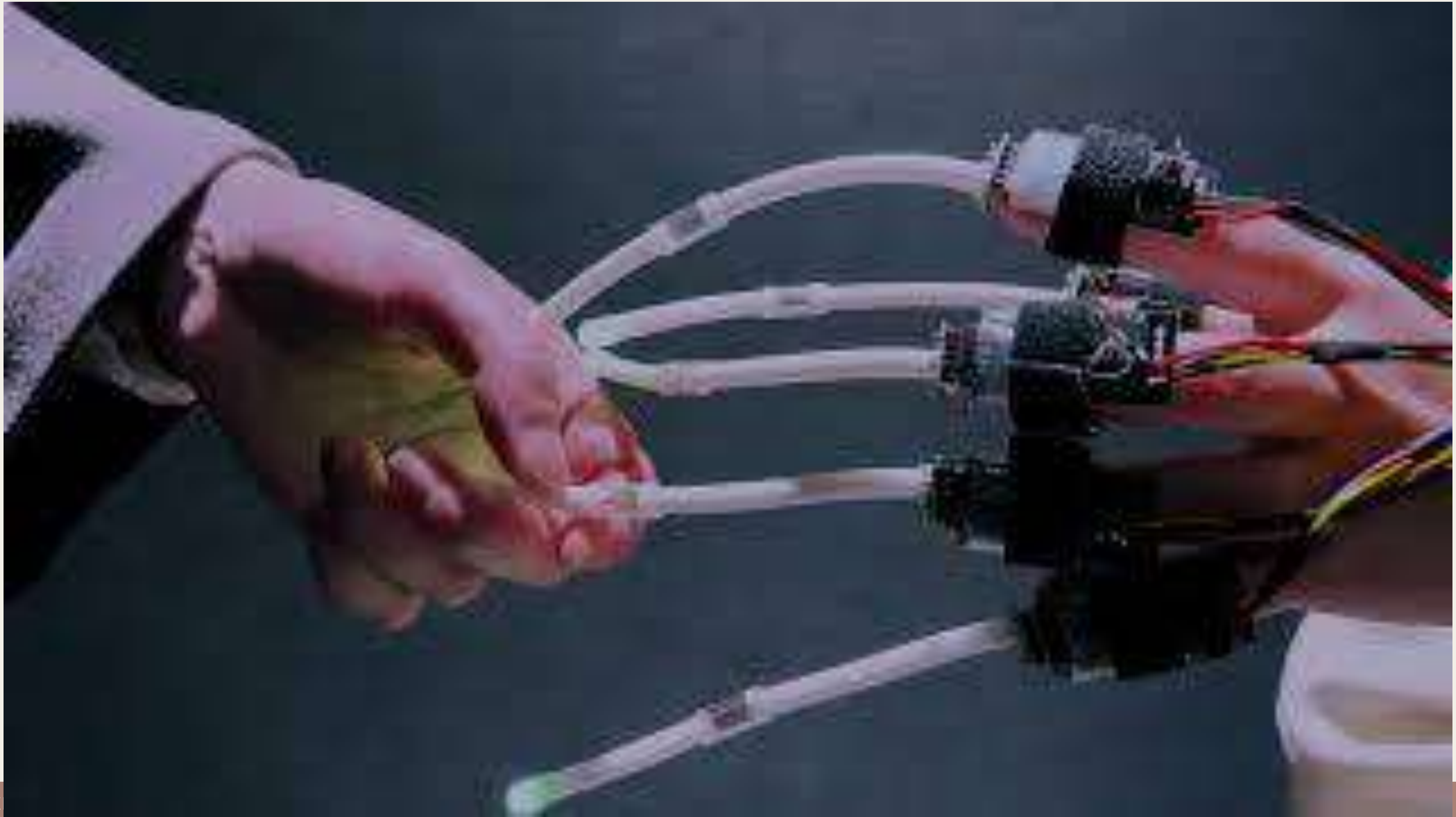
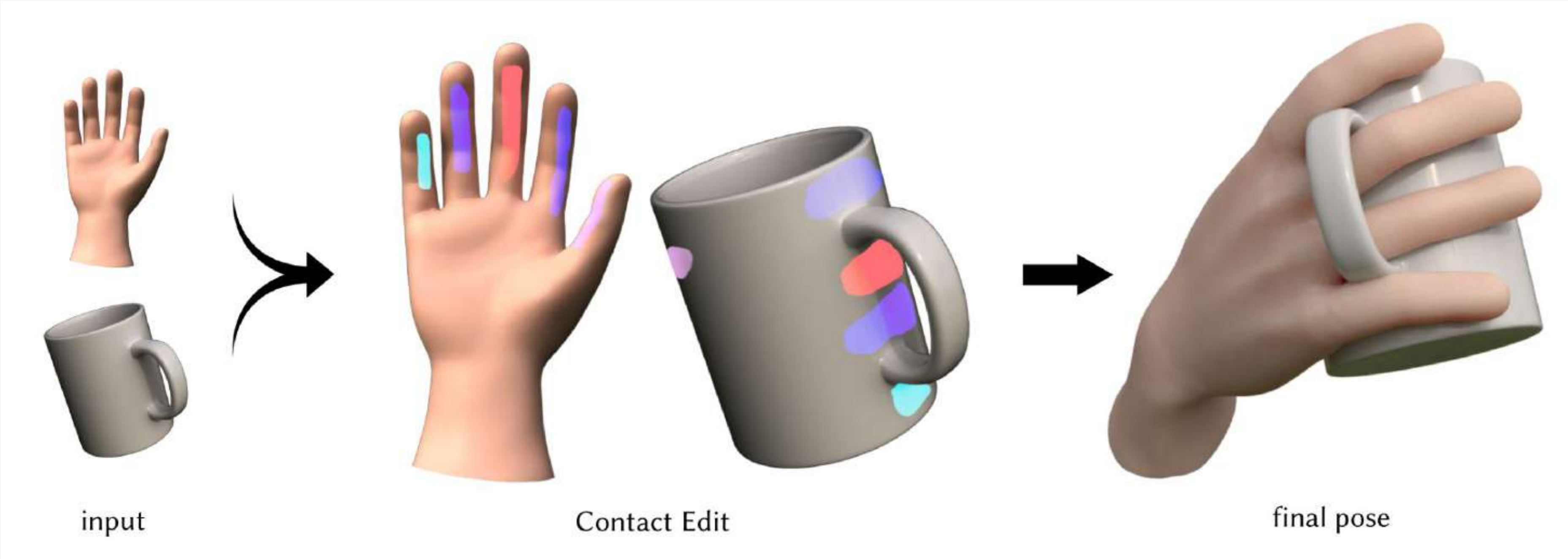
Parasitic Finger



Artist Tools and Human Anatomy

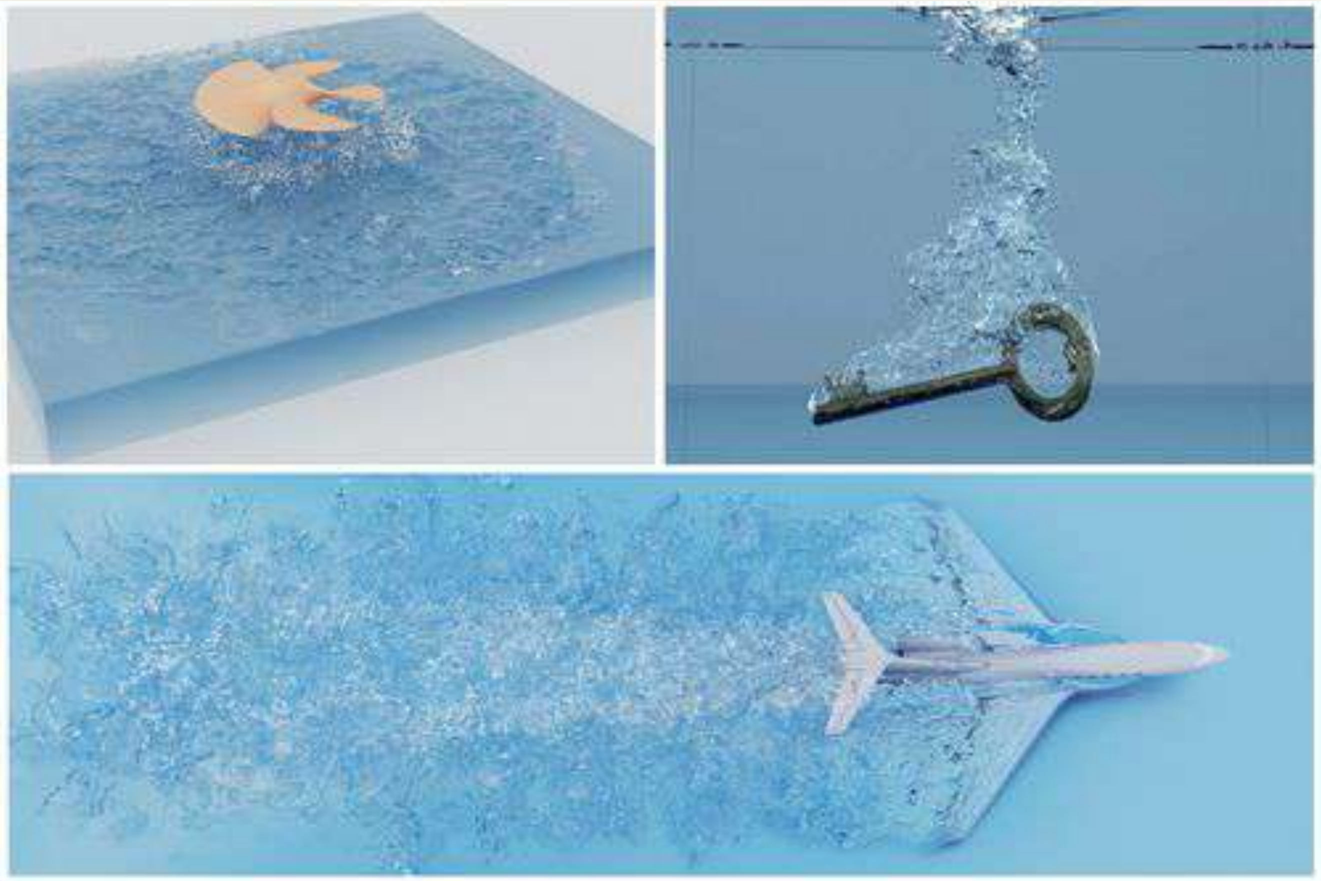


Contact Edit

Specific Use Cases

A Method for Animating Children's Drawings of the Human Figure

Refining Existing Problems



Fluid-solid Coupling in Kinetic Two-phase Flow Simulation

Refining Existing Problems

As-continuous-as-possible Extrusion-based Fabrication of Surface Models

Research in Film and Gaming

Across the Spider-verse

Questions?