CS 523: Multimedia Systems

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What is this class about?

Multimedia Systems has been used as a special topics / projects course for human-centered research

Interaction Design and Children – Tom Moher

Museum Installations – Leilah Lyons

HCI projects – various professors

Focus on design process, practical application of new technology to traditional domains

What is this class about?

Multimedia

- Somewhat outdated, catch-all term, can have a bit of a pejorative connotation, was used in the era of Flash, animated web graphics, CD-ROM projects, etc.

- ACM MM conference largely focused on video codecs, compression, but also creative applications

- Implies computational research at the intersection of more than one media, and by extension interdisciplinary research

What is this class about?

1. Generative Systems / Algorithm Simulations using multimedia data

- Simple rules that create complex, emergent systems
- Cellular automata
- Flocking systems / Swarm behavior
- Genetic algorithms
- NPC behavior
- Simulating biological, ecological, sociological processes

What is this class about?

2. Generative Machine Learning Models

Models that can be used to create and simulate, rather than classify or categorize

- GANs
- RNNs
- Deep Dream
- HMMs
- LDA / topic modeling

CS + New media arts

Creative and critical thinking leads to better applications and more meaningful research

- what hasn't been done before, who is left out of what is being done, what perspectives are ignored, what are the ramifications of the tech?

Understanding technology and the underlying computational science leads to more relevant - and topical creative works

- how does it actually work, not just a subjective interpretation of how it works

CS + New media arts

Sentiment analysis – remarkable technology, but brackets all sentiment into a small number of categories... What is left out? If you could answer that, perhaps could develop a better data mining algorithm to find patterns of sentiment...

Surveillance Art – important and timely subject, often explored in media arts, but wouldn't the artwork be more powerful if the projects showed a deep understanding of networking, cybersecurity, etc?

Generative Systems

Set of discrete rules that lead to complex systems with emergent, unexpected properties

Cellular Automata – 1970, John Conway, Martin Gardener

Generative Systems

The birth of computer science is interlaced with speculations about the novelty and importance of generative systems.

- Ada Lovelace, 1843, Notes to the translation on a description of Charles Babbage's "Analytical Engine." Contains the first computer program.

Machine Learning

"[The Analytical engine] might act upon other things besides *number* [...] Supposing, for instance, that the fundamental relations of pitched sounds in the science of harmony and of musical composition were susceptible of such expression and adaptations, the engine might compose elaborate and scientific pieces of music of any degree of complexity or extent."

– Ada Lovelace, 1843

Machine Learning

"This science constitutes the language through which alone we can adequately express the great facts of the natural world, and those unceasing changes of mutual relationship which, visibly or invisibly, consciously or unconsciously to our immediate physical perceptions, are interminably going on in the agencies of the creation we live amidst. ... the Analytical Engine *weaves algebraical patterns* just as the Jacquard-loom weaves flowers and leaves ... the Analytical Engine is equally capable of analysis or of synthesis."

– Ada Lovelace, 1843

Generative Systems

CA video

https://www.youtube.com/watch?v=R0k73uJUzbs

Smooth Life video

https://www.youtube.com/watch?v=KJe9H6qS82I

Order from Chaos video

https://vimeo.com/196269431

Creative Computational Intelligence

How can creative, multimedia applications amplify our intelligence?

Dennis Hlynsky – video traces

https://vimeo.com/87207954

https://vimeo.com/163248494

Creative Computational Intelligence

Eulerian Video Magnification

https://www.youtube.com/watch?v=3rWycBEHn3s

https://www.youtube.com/watch?v=sVlC_-e-4yg

Visual Microphone

https://www.youtube.com/watch?v=FKXOucXB4a8&feature=youtu.be

Creative Computational Intelligence

Memo Atken / Quayola – Forms

https://vimeo.com/38017188

https://vimeo.com/38421611

Creative Computational Intelligence

Amplification of senses, by:

- experimenting with time, juxtaposition of images

- seeing more than one things at once

- focusing on pertinent elements and ignoring others, deciding what's important/

AI in popular culture

Skynet / Matrix – computers become sentient, take over world, enslave humans

Person of Interest – invisible distributed intelligence

BSG – cylons, religious robots

Westworld – robots that become sentient

2001 – spaceship that becomes sentient

X-men – instrumentation that lets people read minds

- Others?

Introduction / Project ideas

- What projects you've work on related to generative systems, data mining, machine learning, media arts, complex systems?
- Given infinite resources, what application or project would you like to create that utilizes or generates multimedia data? What would you require to build it?

AI / ML today

- What does AI / ML / DL do for us today?
- How is learning / intelligence quantified?

AI / ML today

Detecting events,

Finding patterns,

Classifying objects,

Recognizing elements

Amazing... but also a reductive notion of intelligence...

Generative intelligence?

poetic intelligence?

visual intelligence?

musical intelligence?

mathematical intelligence?

personality, emotion, character, narrative...

https://www.youtube.com/watch?v=zkv-_LqTeQA

THE TYPES OF INTELLIGENCE

by Mark Vital

spatial
visualizing the world in 3D

naturalist
understanding living things and reading nature

musical
discerning sounds, their pitch, tone, rhythm, and timbre

intra-personal
understanding yourself, what you feel, and what you want

quantifying things, making hypotheses and proving them
logical-mathematical

finding the right words to express what you mean
linguistic

tackling the questions of why we live, and why we die
existential

coordinating your mind with your body
bodily-kinesthetic

sensing people's feelings and motives
interpersonal

Assignments & Quizzes

Read tutorials and articles + study contemporary programming techniques for machine learning

Participation

Learn from and teach each other; make sure you understand the material; find ways to make the material meaningful to you

Projects

Three in total, first will be introduced next week

Homework for next week

- Think about intelligence.
- Download and set up TensorFlow.
- Implement the Eulerian Video Magnification code and create a video that accentuates a color or motion, be prepared to explain what new understanding of the scene you have after doing so.