CS 523: Multimedia Systems

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creativecoding.evl.uic.edu/courses/cs523

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

CS + New Media Arts

- Generative Systems

Simple rules that create complex, emergent systems

- Cellular automata
- Flocking systems / Swarm behavior
- Genetic Algorithms

- Generative Machine Learning Models

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

- GANs, RNNs
- Deep Dream / Inceptionism
- Style Transfer

CS + New Media Arts

Course is project-based, governed by the idea that you will spend some energy determining interesting, creative, meaningful projects, and then learn what you need in order to create those projects

Instead of (or alongside of) learning specific material and then choosing projects solely as examples to show that you understand particular concepts

Creative Computational Intelligence

How can creative, multimedia applications amplify our intelligence?

Last week looked at projects by Dennis Hlynsky, Memo Atken, CSAIL projects that involved experiments with manipulating time and the juxtaposition of images

Creative Computational Intelligence

We also talked about different notions of intelligence, and how that could (potentially) be encoded in computational systems.

Homework from last week?

- Magnified Videos

ML advances in:

- Realtime Speech Translation
- Identifying Location of a Photograph
- Self-Driving Cars
- Predictive Keyboards
- Gesture Recognition
- Lip Reading
- Product Recommendation
- Tumor Detection
- Speech Synthesis
- Image Processing

ML projects

Overarching idea:

- Complex systems have too many rules, or rules that are difficult to quantify.

- Rather than try to come up with all of the rules, create a system that can learn the meaningful rules automatically, through examining lots of data where examples of the rules are expressed.

- Train your system on examples where you know the right answer, and then test to see if it works on new examples.

Discriminative vs Generative

Discriminative: Detecting events, Finding patterns, Classifying objects, Recognizing elements

Generative: Synthesizing data, Inferring examples, Interacting with models

Discriminative vs Generative

Inverses of each other:

If I have the knowledge of what features determine whether or not a specific sample belongs or doesn't belong to a particular category or class,

Then I can also use those features to create new samples that are examples of a particular category or class

Online classifier for handdrawn objects (Google's A.I. Experiments)

https://aiexperiments.withgoogle.com/quick-draw

Deep Dream

"neural networks that were trained to discriminate between different kinds of images have quite a bit of the information needed to generate images too"

https://youtu.be/DgPaCWJL7XI

https://research.googleblog.com/2015/06/inceptionism-going-deeper-into-neural.html

Neural Photo Editor

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

Neural Style Transfer

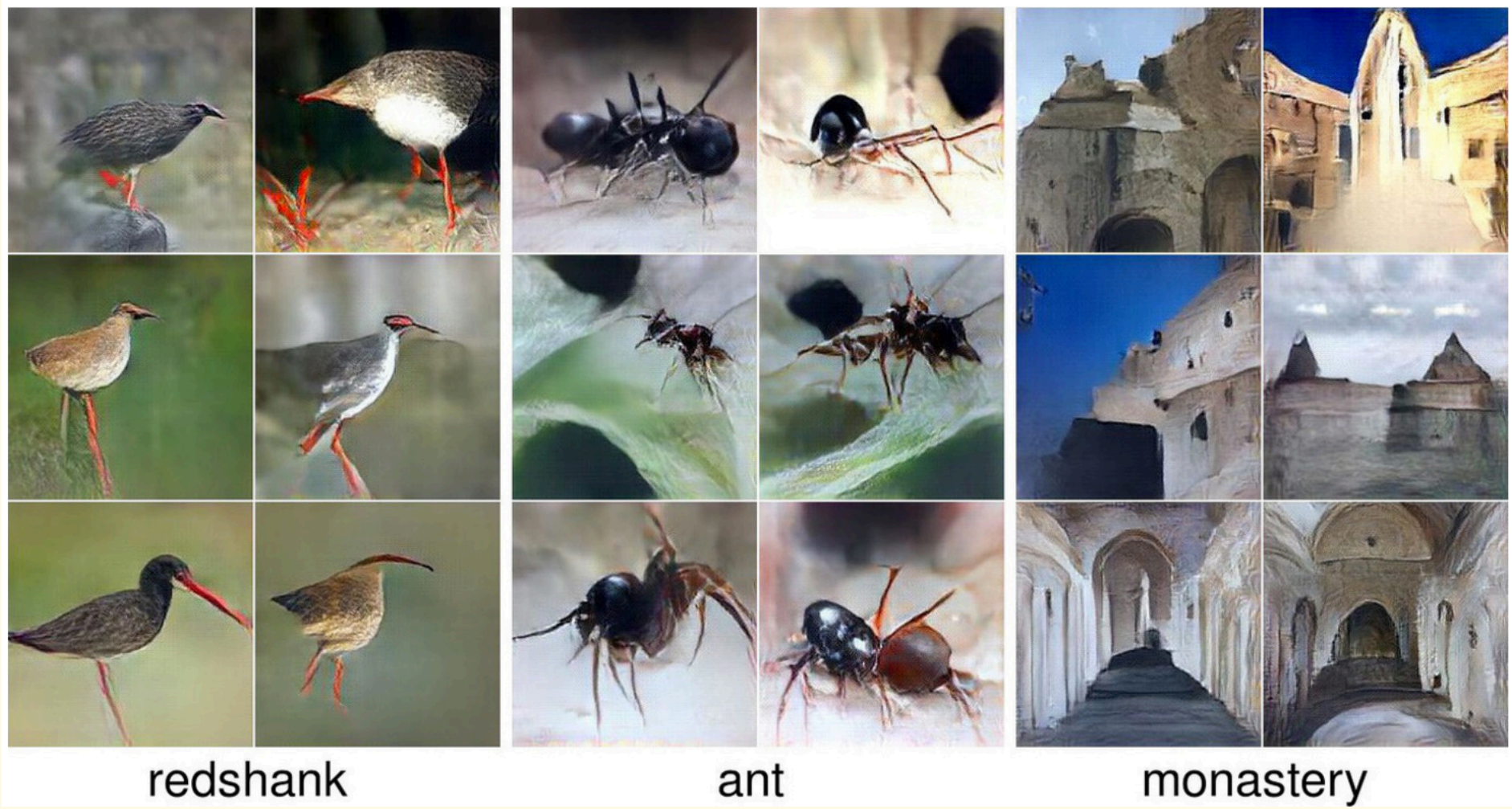
Generative Visual Manipulation on the Natural Image Manifold

https://www.youtube.com/watch?v=9c4z6YsBGQ0

Neural Doodle

https://www.youtube.com/watch?v=fu2fzx4w3ml

PPGANs

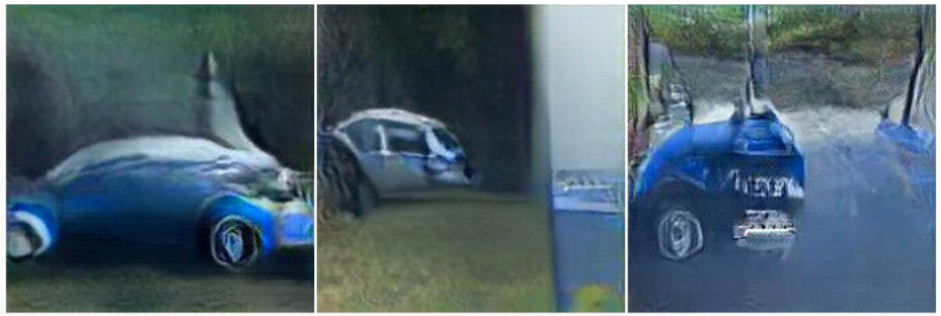


PPGANs

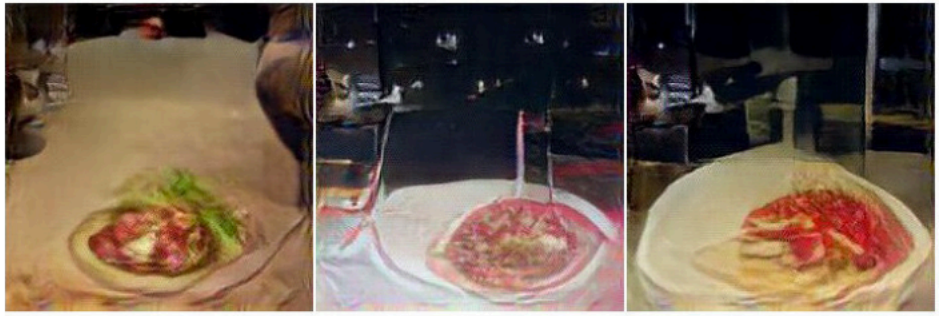
volcano

PPGANs

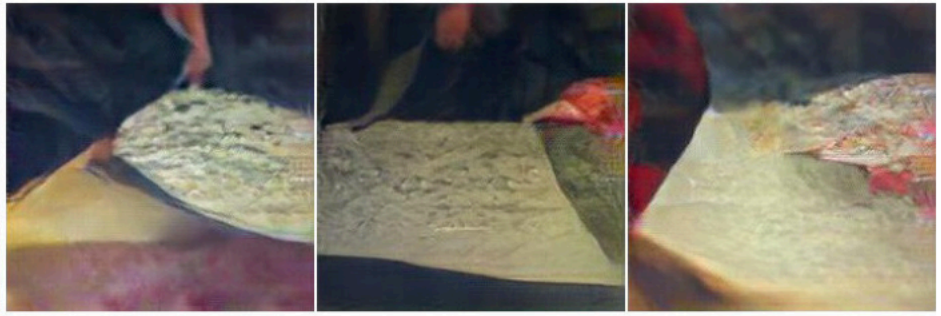
a red car parked on the side of a road



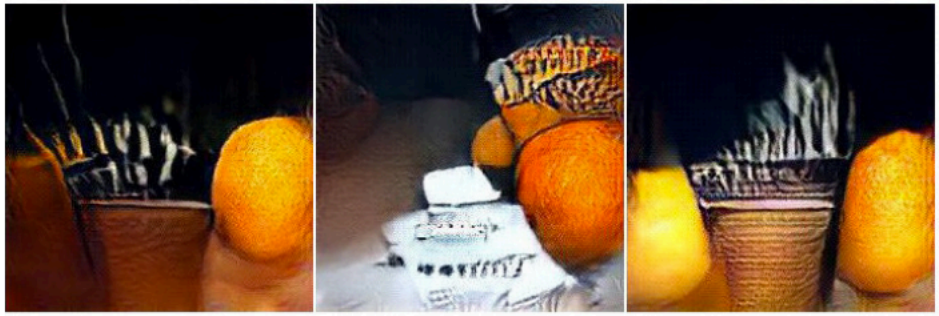
a blue car parked on the side of a road



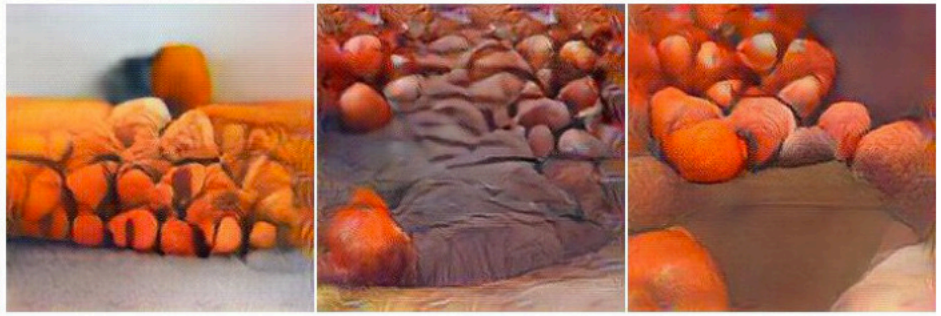
a pizza on a plate at a restaurant



someone is just about to cut the pizza



oranges on a table next to a liquor bottle



a pile of oranges sitting in a wooden crate

One-shot generalization

https://www.youtube.com/watch?v=6S6Tx_OtvnA

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

DeepMind's Deep Q-learning

https://www.youtube.com/watch?v=V1eYniJ0Rnk

Probabilistic Future Frame Synthesis

https://www.youtube.com/watch?v=zidaYS85mCY

Generative Design (Dreamcatcher)

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

a crumb of friction milks god

https://vimeo.com/187931421

Face2Face

http://www.graphics.stanford.edu/~niessner/thies2016face.html

Tensor Flow

Software library that makes it easier to conceive of numerical computing on big data using "data flow graphs," which can represent different kinds neural network configurations, or other ML operations.

- New data types to work with data commonly used in Machine Learning (tensors, or multi-dimensional matrices)

- Workflow: 1. Configure a graph, 2. Create a session to run the graph, 3. Examine results

Tensor Flow

- Large community of users, supported by Google, lots of tutorials, examples
- Runs on Linux, OSX, and Windows
- Supports CPU or GPU
- Incorporates Keras, a high-level NN library

Homework for next week

A. Download and set up TensorFlow, go through MNIST tutorial.

B. Two (short) assignments – see PDF on website:

1. 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.

2. Choose an interesting project from CuratedAI.net and present it in class.

C. Two readings (see website)