Welcome and Introduction to the Course

MSE 2400 EaLiCaRA
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WELCOME TO EALICARA

EaLiCaRA

Evolution and Learning in Computational and Robotic Agents

or simply

Evolution & Learning

Intro to the Course

- About me
- Syllabus
- Web site
- Class meetings (lectures & labs)
- Laptop
- Participation
- About the subject matter

EaLiCaRA

- Evolution
- Learning
- Computational Agents
- Robotic Agents

Evolution

- Biology - Change in the genetic composition of a population during successive generations, as a result of natural selection acting on the genetic variation among individuals, and resulting in the development of new species.

Evolution

- General - A gradual process in which something changes into a different and usually more complex or better form.

Evolution?

- Where else do we see evolution in action?

Learning

- Knowledge or skill acquired by instruction or study.
- Modification of a behavioral tendency by experience or exposure to conditioning.

Learning?

- Where else do we see learning in action?

Computational Agent

- An autonomous, computerized entity which observes and acts upon an environment and directs its activity towards achieving goals.
- A computer program designed to behave in some life-like manner.

Computational Agent?

- What is a computational agent that you have used?

Robotic Agent

- A mechanical device that sometimes resembles a human and is capable of performing a variety of often complex human tasks on command or by being programmed in advance.
- A machine, device or computer program that simulates a machine or device, that operates automatically or by remote control.

Robotic Agent

- What is a robotic agent that you have used or seen being used?

First Lab

- Evolution – Game of Life
- Learning – Ants
- Computational Agent - ELIZA
- Robotic Agent – Ants

Does Technology Evolve?

- Living systems evolve
- Does the same definition of “evolve” apply to technology?
- If so, how does technology evolve?
- Kevin Kelly: How technology evolves

TED Ideas worth spreading

Things We Will Explore

- Existing software that exhibits evolution and learning
- Machine Learning
- Artificial Intelligence
- Software-based Robots
- Modifying computer programs
- Actual Robots
- The Four Paradigms of Science

The Four Science Paradigms

1. Empirical Science – past 3,000 years
2. Theoretical Science – past 300 years
3. Computational Science – past 60 years
4. Data-Intensive Science – past 10 years

1. Empirical Science

- The first paradigm, which has lasted over the last few thousand years, was empirical science.
- Empirical Science describes natural phenomena.
- That which can be observed.
- What are examples?

2. Theoretical Science

- Over the last few hundred years, the second paradigm of theoretical science has been used.
- Theoretical Science uses models and generalizations to make discoveries.
- Theories that can be tested.
- What are examples?

3. Computational Science

- Within the last 50 to 70 years, the third paradigm of Computational science has developed.
- Computational Science is used to simulate complex phenomena to make discoveries.
- Ideas that can be imagined.

4. Data-Intensive Science

- “Big Data”
- Scientific breakthroughs powered by advanced computing capabilities that help researchers manipulate and explore massive datasets.
- Uncovering the heretofore unknown.
- What are examples?

Assignment

- Homework 1 – The Fourth Paradigm
- See class “Schedule” web page