

CSCI 561 - Foundation for Artificial Intelligence

DISCUSSION SECTION (WEEK 1)

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OUTLINE

Introduction of myself

Overview of Course Discussion

History (Success) of Artificial Intelligence

Agents and Environments

Evaluation Criteria of AI

Applications of AI

What You Should Know This Week

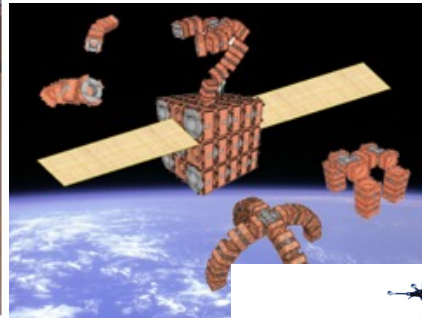
USC POLYMORPHIC ROBOTICS LAB

[HTTP://WWW.ISI.EDU/ROBOTS](http://www.isi.edu/robots)

Transformer Robots: Self-Reconfigurable & Modular



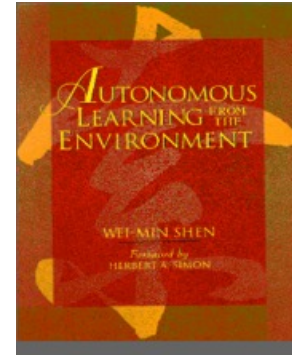
Welcome



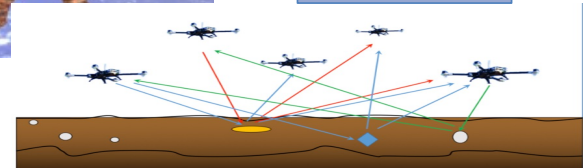
Projects

We conduct research in **adaptive, self-reconfigurable, autonomous robots and systems**, including **StarCell**, modular, multifunctional and self-reconfigurable **SuperBot**, Hormone-

Surprise-Based Learning



Teaching
CS561 (AI)
CS360 (AI)
INF552
INF553



SURPRISE-BASED LEARNING

Herbert A. Simon (1916-2001)

- Nobel Price Winner (AI, Machine Discovery)

Wei-Min Shen (1983 – now)

- Autonomous Learning from the Environment

Nadeesha Ranasinghe (2005 – now)

- Learn and predict unexpected changes

Thomas J. Collins (2013 – now)

- Discovery of hidden/latent structures



Forecasting the Future or Shaping it?
October 19, 2000

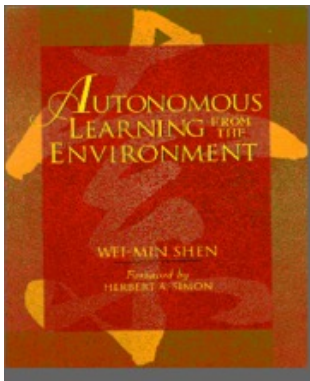
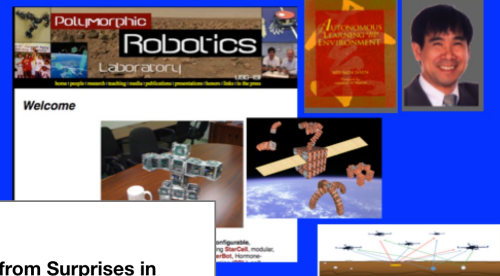
Our task is not to *predict* the future; our task is to *design* a future for a sustainable and acceptable world, and then to devote our efforts to bringing that future about.

Professor Herbert A. Simon
Nobel Price Laureate
A Founder of Artificial Intelligence

Prof Wei-Min Shen <http://www.isi.edu/robots>

Self-Reconfigurable Modular Robots
(System of Systems)

Surprise-Based Learning



Surprise-Based Learning

by
Nadeesha Oliver Ranasinghe

PhD. Dissertation Proposal Guidance Committee:
Dr. Yu-Han Chang
Dr. Laurent Itti
Dr. Ramakant Nevatia
Dr. Michael Safonov
Dr. Wei-Min Shen (Chair)

Active State Learning from Surprises in
Stochastic and Partially-observable Environments

Thomas Joseph Collins

Defense Committee:
Prof. Wei-Min Shen (Chair)
Prof. Paul Rosenbloom
Prof. John Carlsson (Outside member)

CS561: ARTIFICIAL INTELLIGENCE

Course overview: foundations of symbolic intelligent systems. Agents, search, problem solving, logic, representation, reasoning, symbolic programming, and robotics.

Prerequisites: Good programming and algorithm analysis skills. Basic probability theory desirable.

Textbook:

Russell & Norvig, *Artificial Intelligence: A Modern Approach 3rd Edition*

Wei-Min Shen, *Autonomous Learning from the Environment, (selected readings)*.

CS561: ARTIFICIAL INTELLIGENCE

Discussion Sections

- Provide more details, discussion and new material to augment lectures
- Run algorithms on more complex examples than during lectures
- Relate lecture concepts to latest research topics
- Showcase cool demos of recent A.I. achievements

NOTE:

- You will be responsible for material presented in lecture *and* discussion sections

AI SUCCESS: DEEP BLUE

In 1997 Deep Blue became the first machine to win a match against a reigning world chess champion (by 3.5-2.5)



DEEP BLUE COMBINED

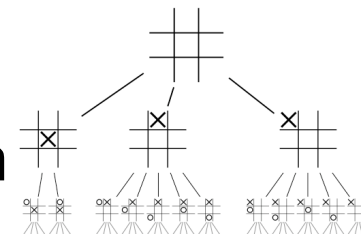
Parallel and special purpose hardware

- A 30-node IBM RS/6000, enhanced with 480 special purpose VLSI chess chips



A heuristic game-tree search algorithm

- Capable of searching 200M positions/sec
- Searched 6-12 moves deep on average, sometimes to 40



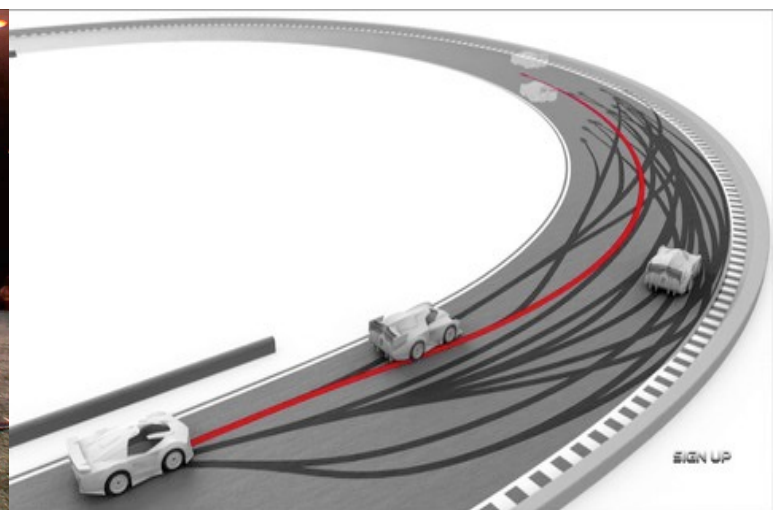
Chess knowledge

- An opening book of 4K positions and 700K GM games
- An endgame database for when only 5-6 pieces left
- A positional evaluation function with 8K parts and many parameters that were tuned by learning over thousands of Master games

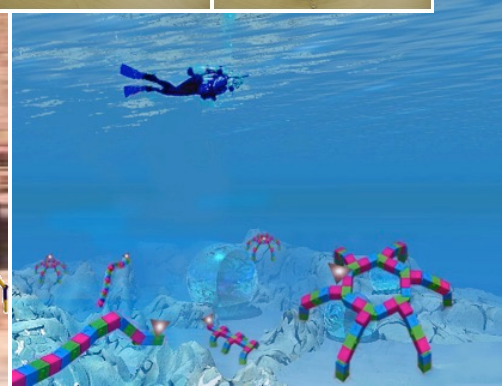
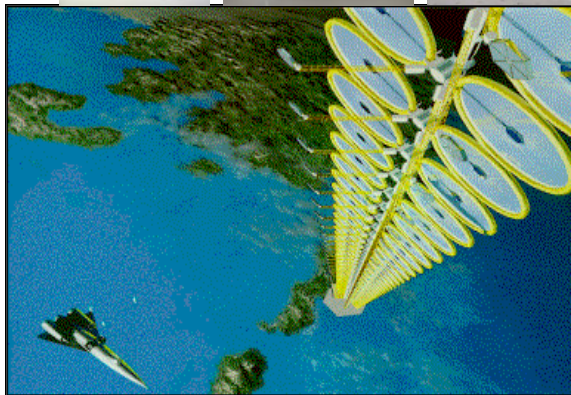
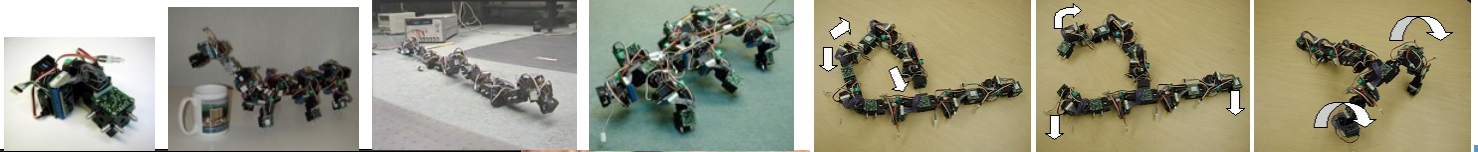
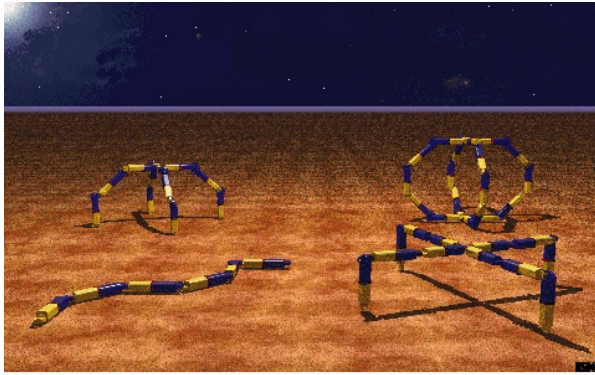
DARPA URBAN CHALLENGE (2007)



SELF-DRIVING CAR



USC SELF-RECONFIGURABLE SUPERBOT



SUPERBOT VISION FOR SPACE

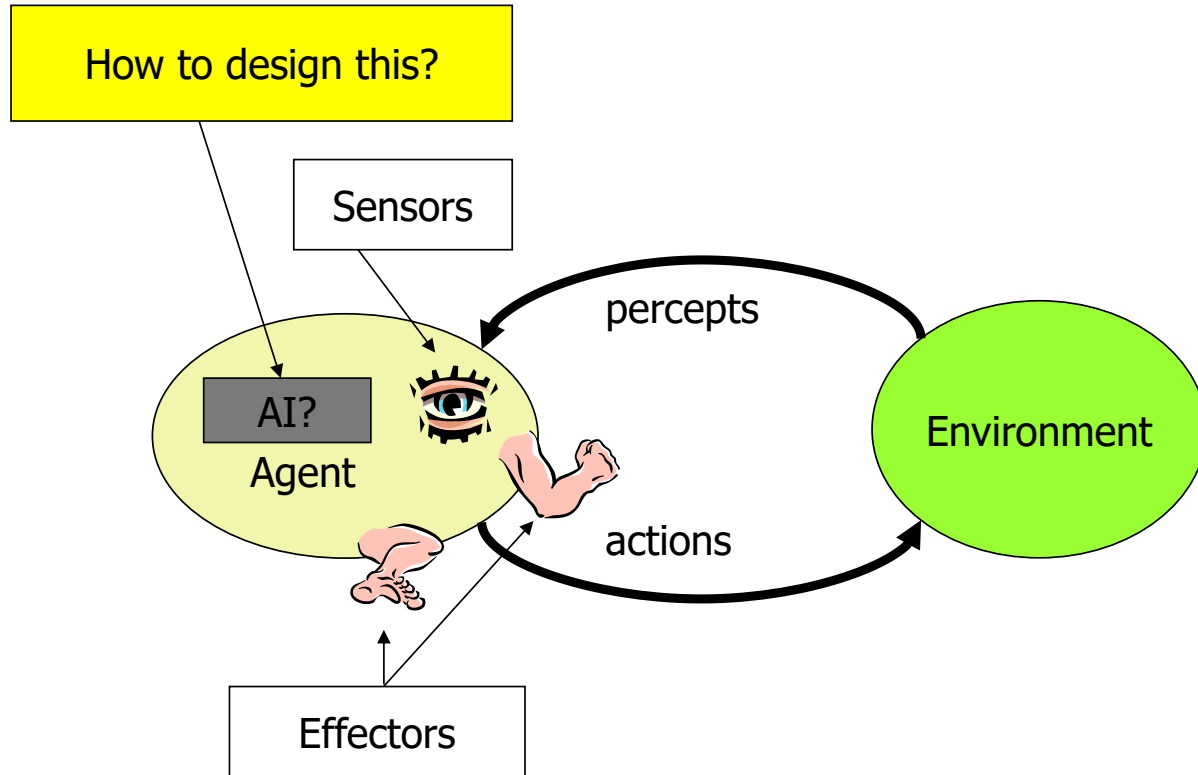
MODULAR, MULTIFUNCTION, SELF-RECONFIGURATION



USC SELF-RECONFIGURABLE “SUPERBOT”



AGENT ENVIRONMENT INTERACTIONS



2.7b

PLEASE CONSIDER

How to test if a system is “intelligent” or not?

What is a (basic) Turing test?

What is a (full) Total Turing test?

What is rational?

What is the most simple environment?

What is the most complex environment?

How many types of Agents?

What is an agent function? (optional 2 views)

WHAT IS AI?

The exciting new effort to make computers think ... machine with minds, in the full and literal sense”
(Haugeland 1985)

“The study of mental faculties through the use of computational models”
(Charniak et al. 1985)

“The art of creating machines that perform functions that require intelligence when performed by people” (Kurzweil, 1990)

A field of study that seeks to explain and emulate intelligent behavior in terms of computational processes”
(Schalkol, 1990)

How to Measure Intelligence?

Systems that think like humans

Systems that act like humans

Systems that think rationally

Systems that act rationally

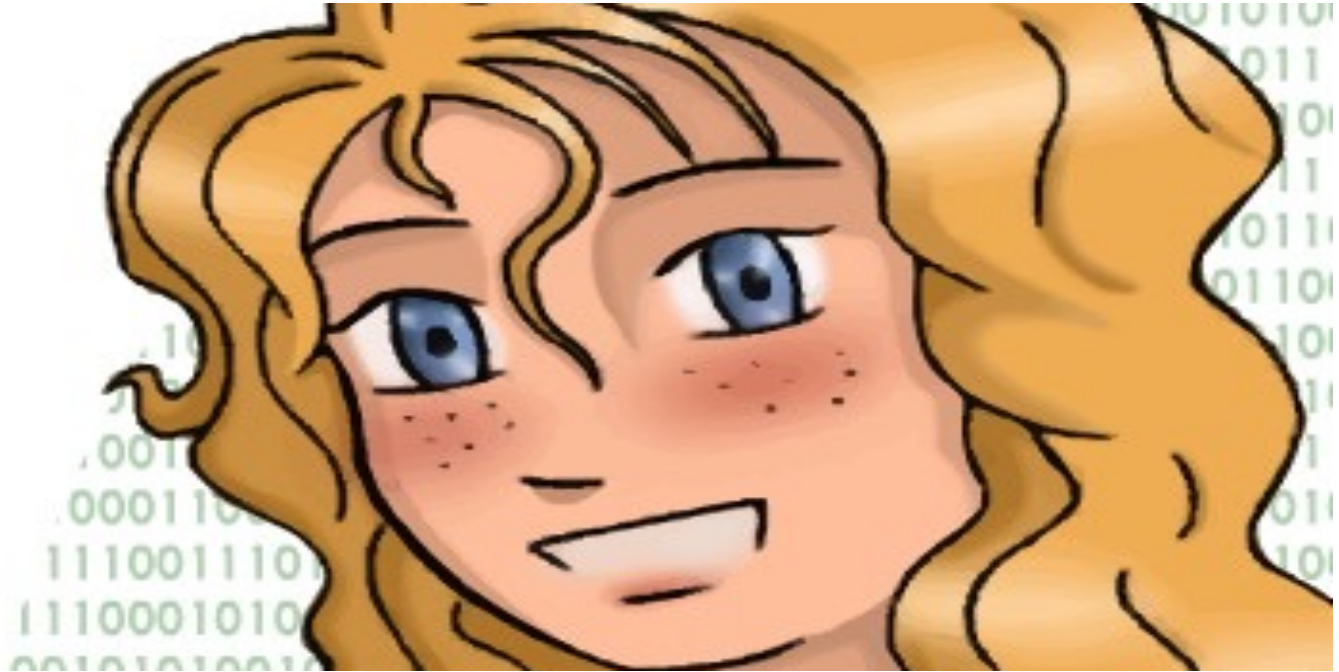
EUGENE GOOSTMAN – TURING TEST 2014

- Interview
- What do you think? Was the test really passed?
- What effect did context, that is, saying that the computer was playing a 13-year-old Ukrainian boy for whom English was a second language, have on the results?
- What does that tell us about the Turing test as a test of artificial intelligence?
- What would be a better test?
- <http://www.princetonai.com/bot/>



EUGENE GOOSTMAN
THE WEIRDEST CREATURE IN THE WORLD

MITSUKE – 2013 LOEBENER WINNER



<http://www.loebner.net/Prizef/loebner-prize.htm>

MAJOR ISSUES FOR AI APPLICATIONS

- **How to represent knowledge about the world?**
- **How to react to new perceived events?**
- **How to integrate new percepts to past experience?**
- **How to understand the user?**
- **How to optimize balance between user goals & environment constraints?**
- **How to use reasoning to decide on the best course of action?**
- **How to communicate back with the user?**
- **How to plan ahead?**
- **How to learn from experience?**

IS AI SCIENCE OR ENGINEERING?

A **science** is a field of study that leads to the acquisition of empirical knowledge by the scientific method, which involves falsifiable hypotheses about what is.

A pure **engineering** field can be thought of as taking a fixed base of empirical knowledge and using it to solve problems of interest to society.

What are examples of AI systems that support your answer to this question?

ALPHA ZERO



WHAT YOU SHOULD KNOW

- What is AI? Why study AI?
- What is a performance measure? Rational action? Why are they important for an agent?
- What is the relationship between the agent and task environment? How does the environment affect the agent design?
- Why is the boundary between agent and environment important?
- How is this demonstrated by the recent AI successes?
- What is the Turing Test? How has it shaped the field of AI?

WANT MORE?

Chapter 1 Problem# 1.14

Chapter 2 Problem# 2.2, 2.5

Chapter 3 Problem# 3.9, 3.14