CS343
Introduction to Artificial Intelligence
Spring 2012

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TA: Daniel Urieli

Department of Computer Science
The University of Texas at Austin

Good Afternoon, Colleagues

Welcome to a **fun**, but **challenging** course.

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Goal

- Learn about **Artificial Intelligence**

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  – Prepare you for **Topics Courses** and/or **Research**

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- Learn about **Artificial Intelligence**

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- **Breadth** over **Depth**

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Definition

- Artificial Intelligence is....

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> **Textbook: Autonomous Agents**

Definition

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- No generally accepted definition

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- I know one when I see one…

Definition

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- …By the end of this course, so will you

Science and Engineering

- AI is one of the **great intellectual adventures** of the 20th and 21st centuries.

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    – What is a mind?

Science and Engineering

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  - How can a physical object have a mind?

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    - Can we build a mind?

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        Is a running computer (just) a physical object?

    - Can we build a mind?

    - Can trying to build one teach us what a mind is?

Today

1. An introduction to **What AI can Do**

2. A walk through the **syllabus**

A Goal of AI

Robust, **fully autonomous** agents in the real world

A Goal of AI

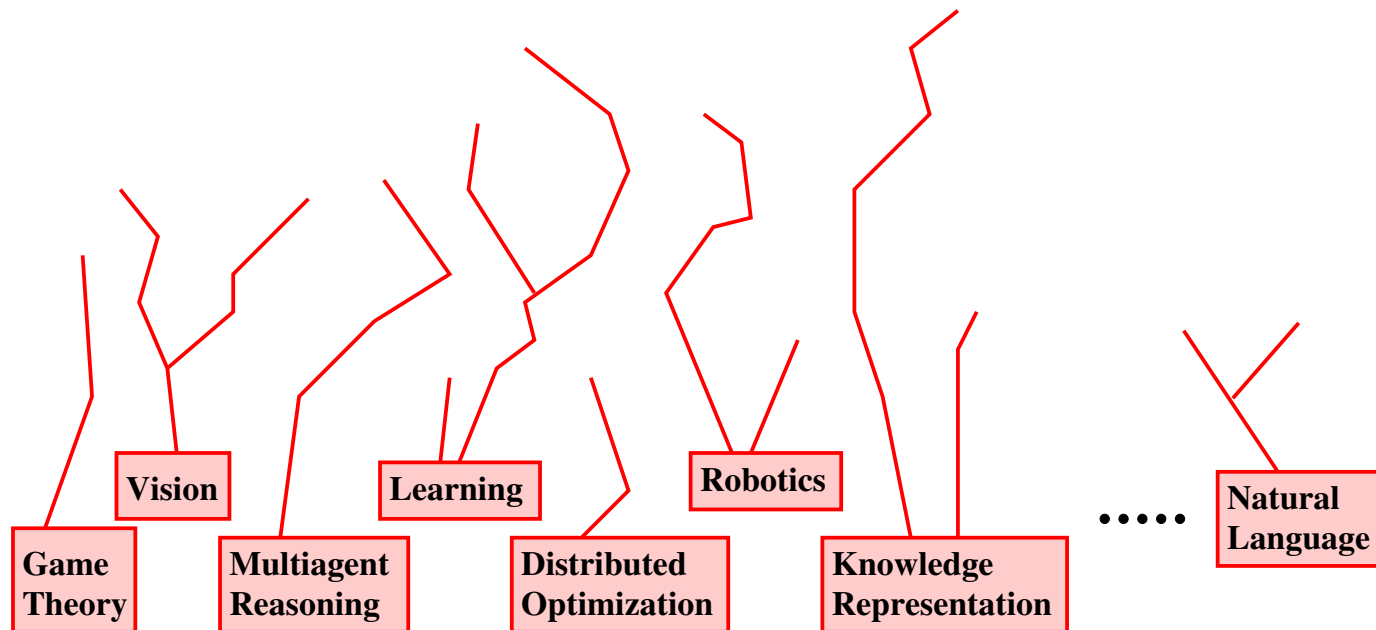Robust, **fully autonomous** agents in the real world

How?

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A Goal of AI

Robust, **fully autonomous** agents in the real world

How?

Bottom-Up Metaphor

Russell, '95

"Theoreticians can produce the AI equivalent of bricks, beams, and mortar with which AI architects can build the equivalent of cathedrals."
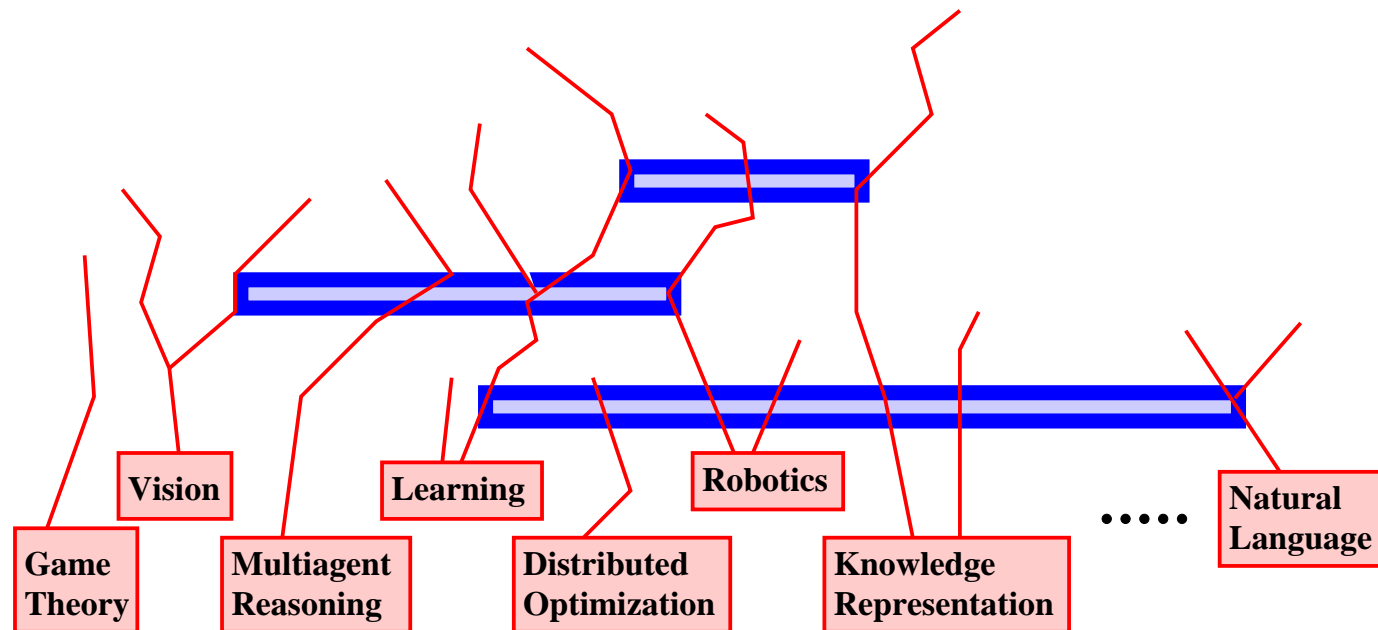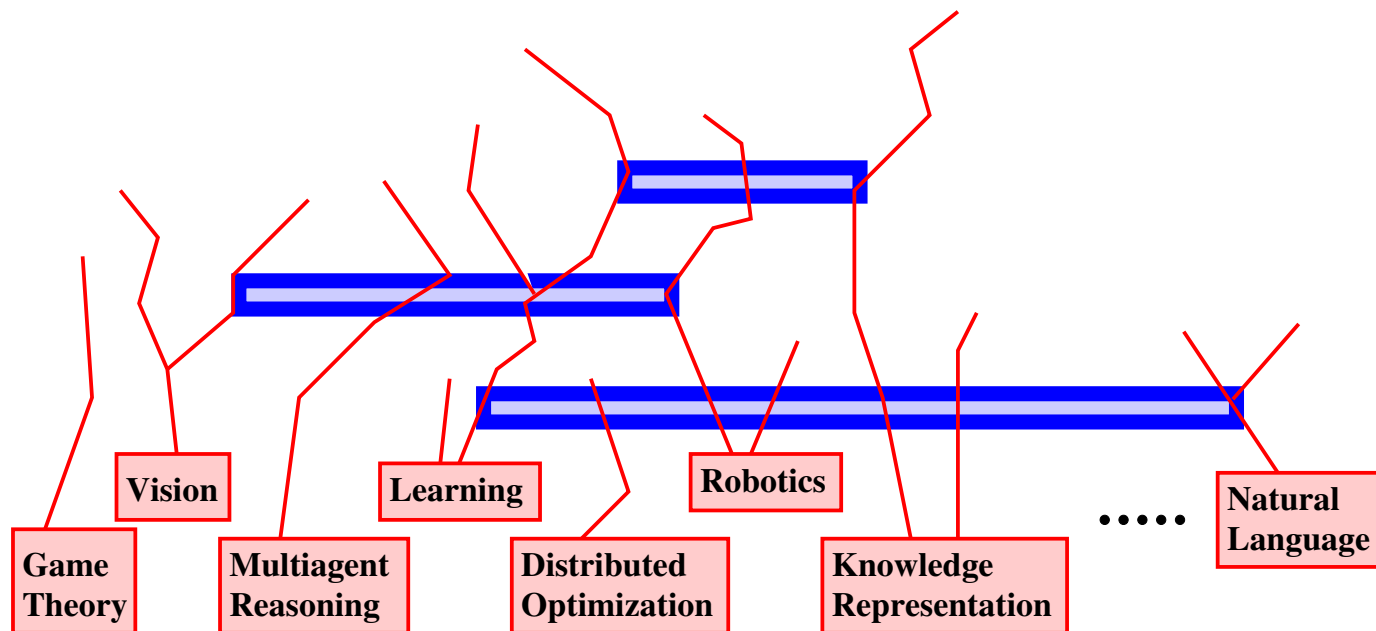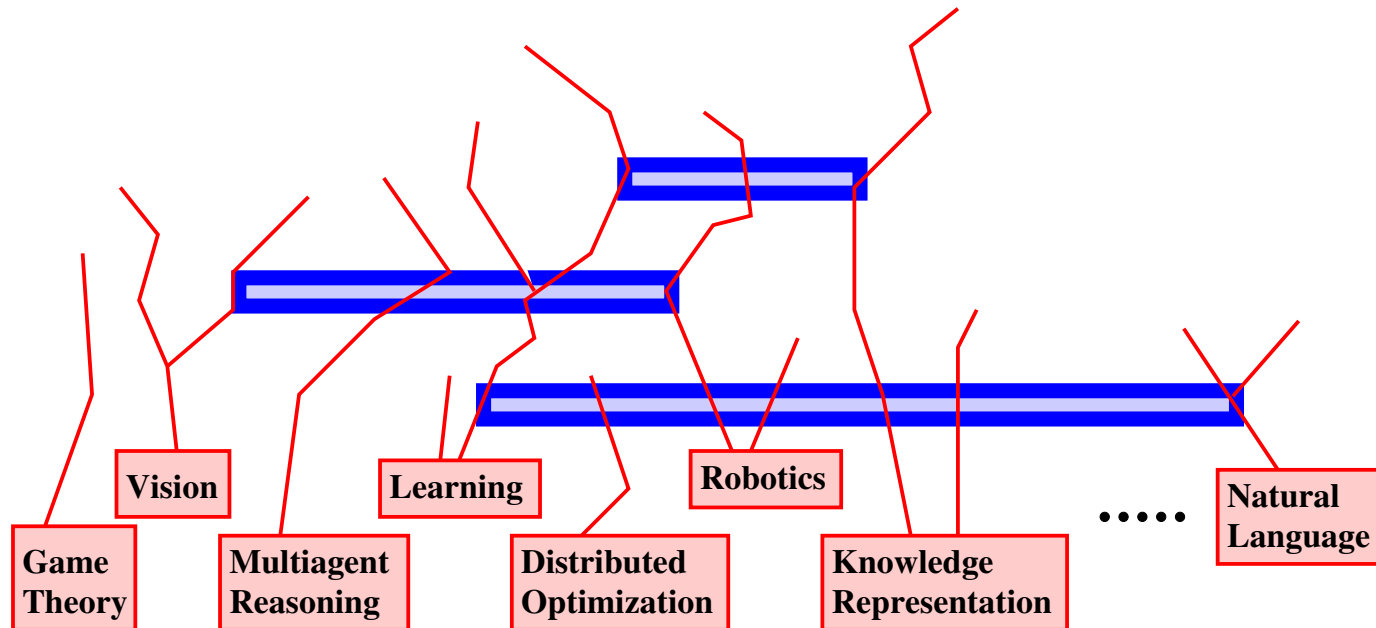
Dividing the Problem

AI

Vision

Learning

Robotics

Natural
Language

Game
Theory

Multiagent
Reasoning

Distributed
Optimization

Knowledge
Representation

The Bricks

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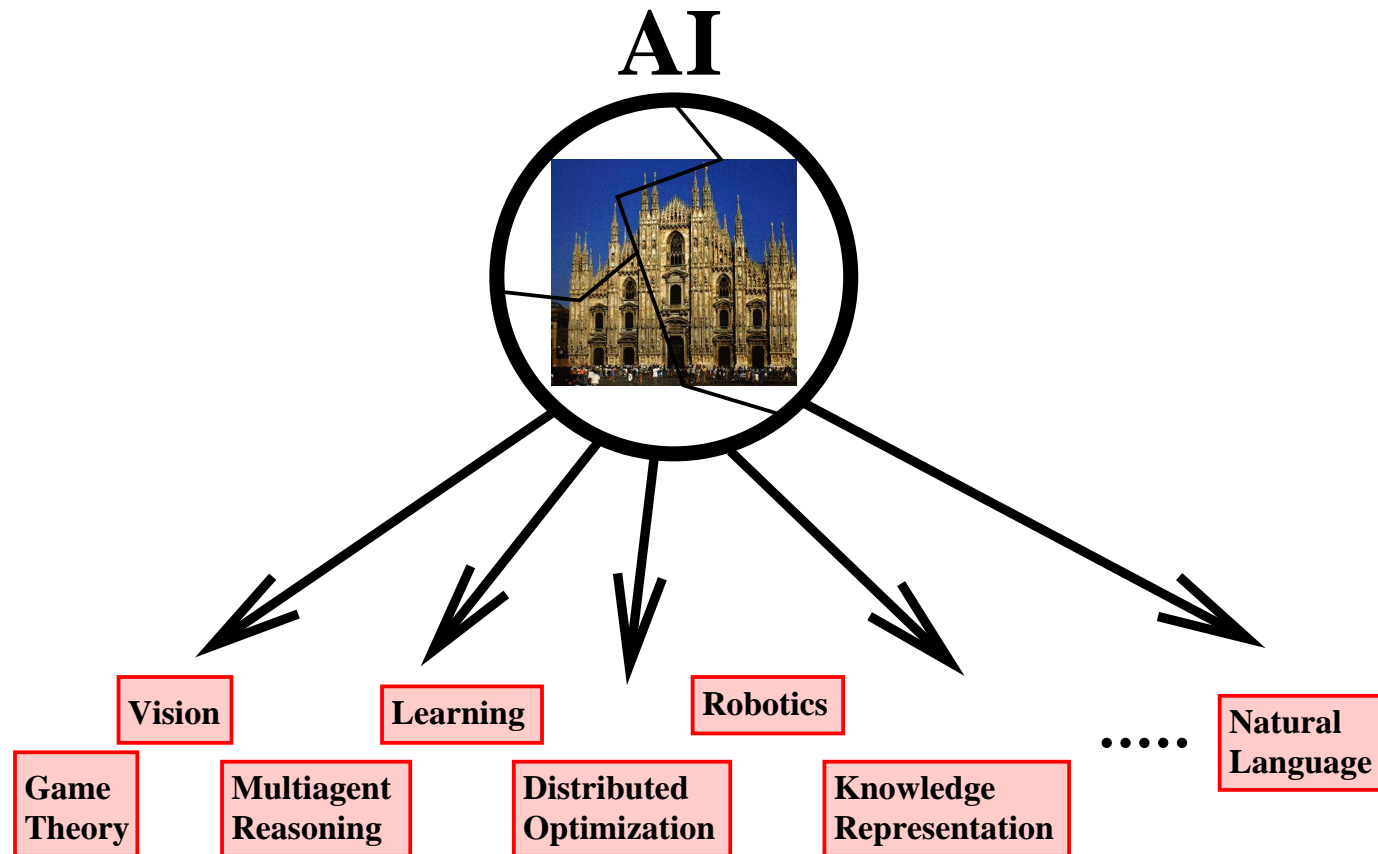
The Beams and Mortar

Towards a Cathedral?

?

Vision

Learning

Robotics

Natural Language

Game Theory

Multiagent Reasoning

Distributed Optimization

Knowledge Representation

Or Something Else?

?

Vision

Learning

Robotics

Natural Language

Game Theory

Multiagent Reasoning

Distributed Optimization

Knowledge Representation

A Different Problem Division

Top-Down Approach

Vision

Learning

Robotics

Natural Language

Game Theory

Multiagent Reasoning

Distributed Optimization

Knowledge Representation

. . . . .
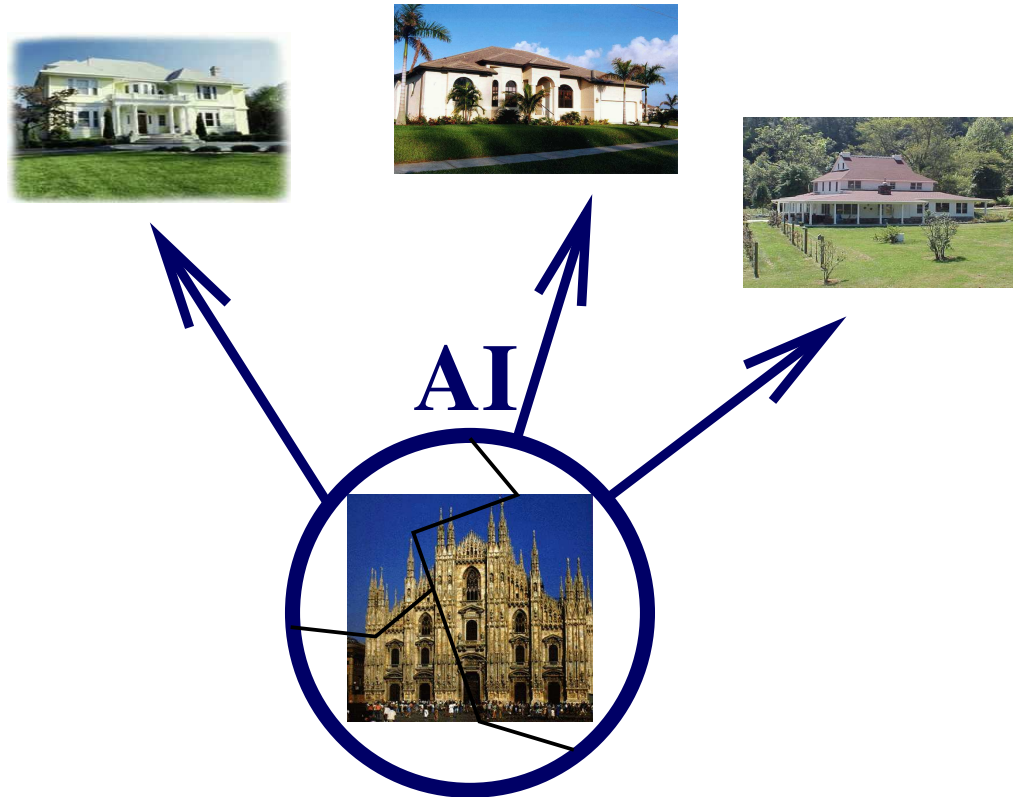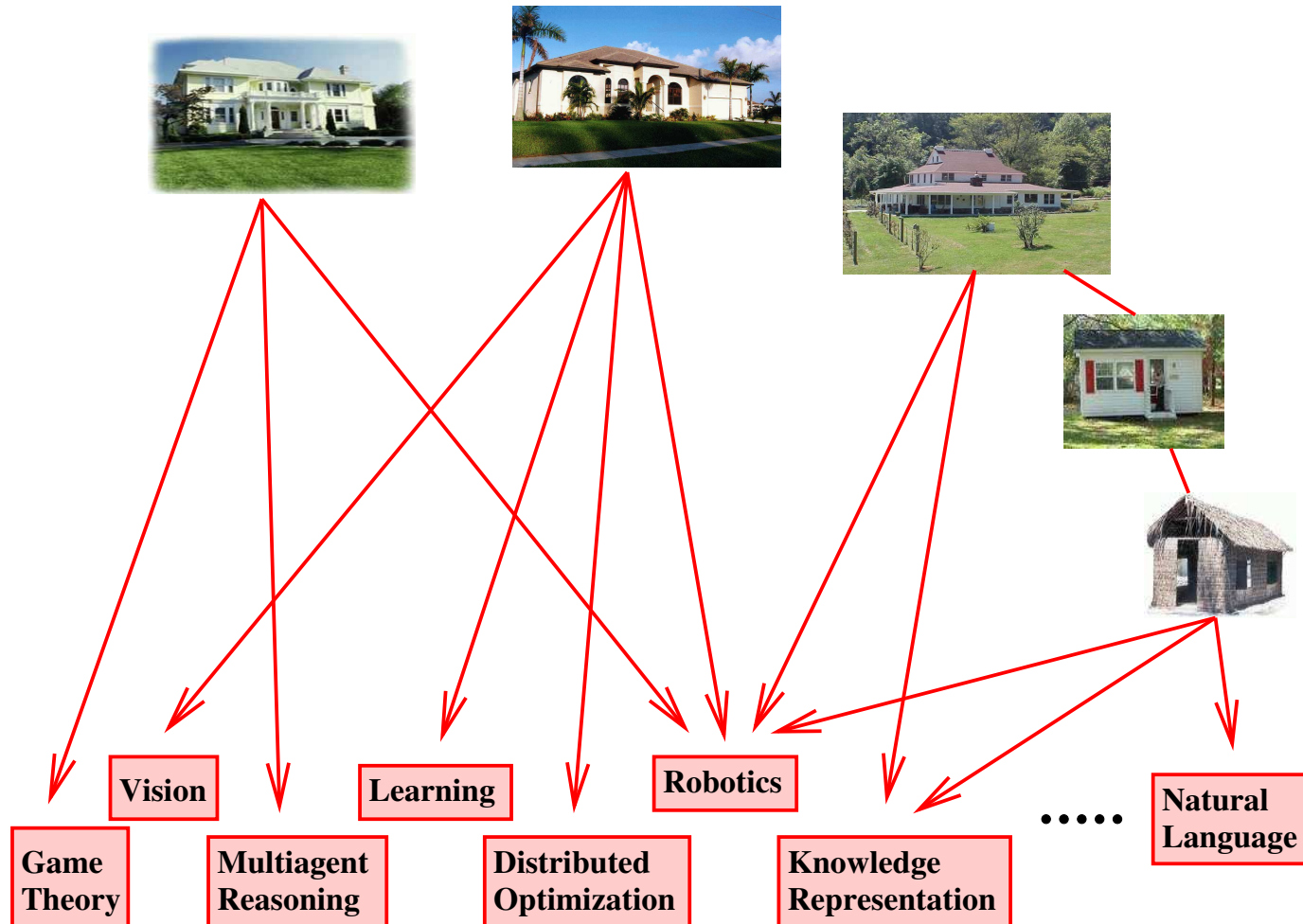
"Good problems . . . produce good science" [Cohen, '04]

Meeting in the Middle

Vision

Learning

Robotics

Natural Language

Game Theory

Multiagent Reasoning

Distributed Optimization

Knowledge Representation

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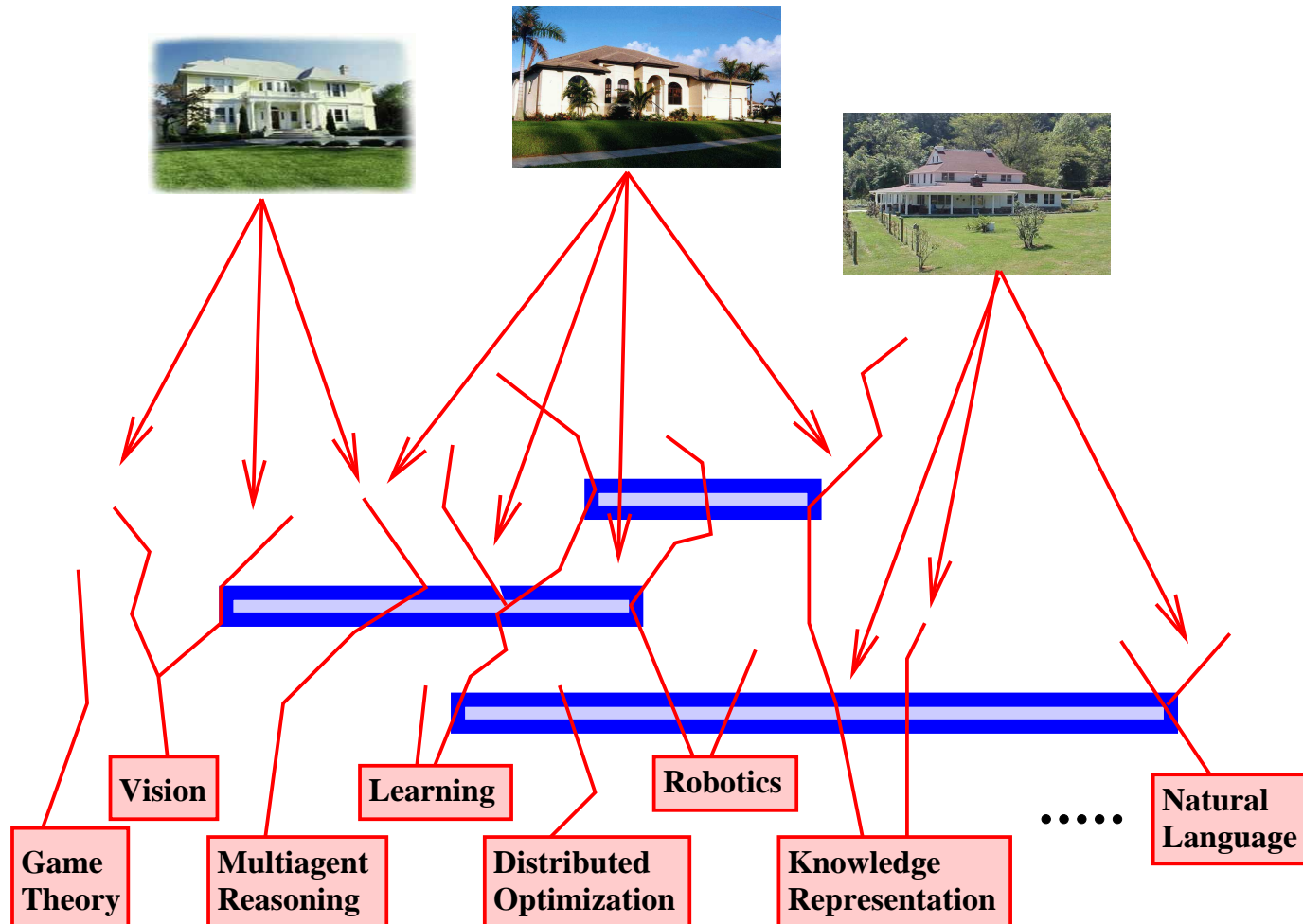
Good Problems Produce Good Science

Manned flight

Apollo mission
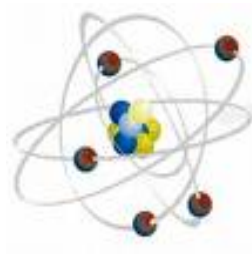
Manhattan project

Good Problems Produce Good Science

Manned flight

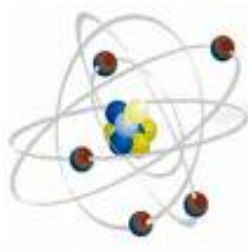Apollo mission

Manhattan project

RoboCup soccer

Goal: By the year 2050, a team of humanoid robots that can beat the human World Cup champion team.
[Kitano, '97]

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RoboCup Soccer

- Still in the early stages

- Many virtues:

  – Incremental challenges, closed loop at each stage
  – Relatively easy entry
  – Multiple robots possible
  – Inspiring to many

- Visible progress

Small-sized League

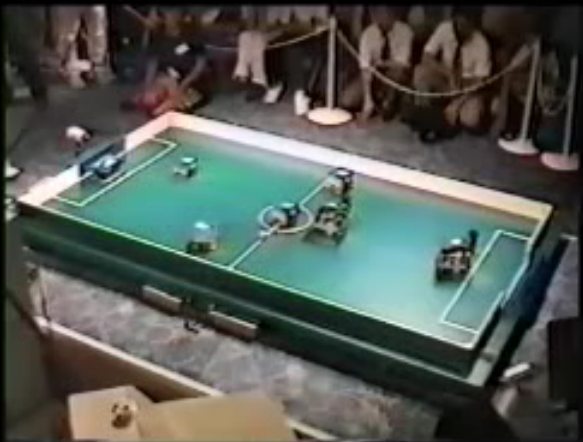Middle-sized League

Legged Robot League

Simulation League

Humanoid League

The Early Years

RoboCup 1997-1998
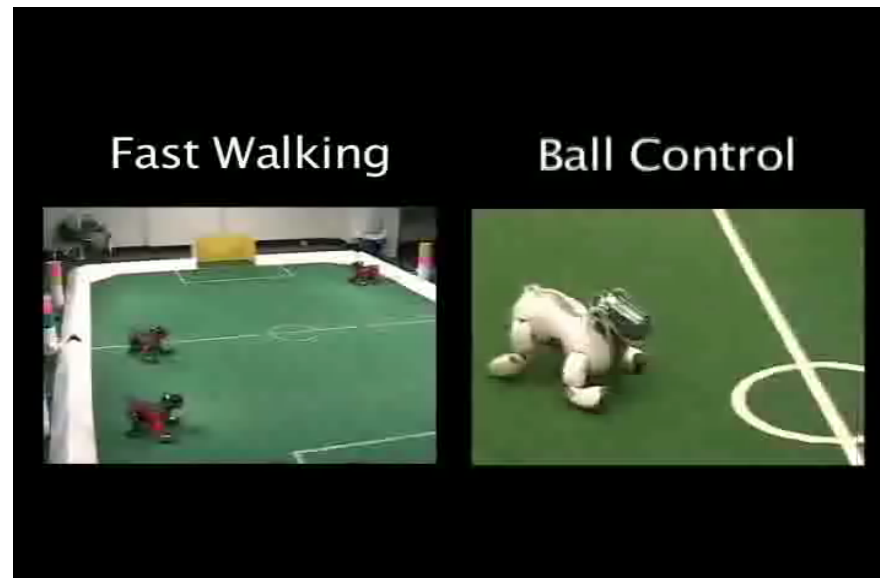
A Decade Later

RoboCup 2005–2006

Learning in RoboCup
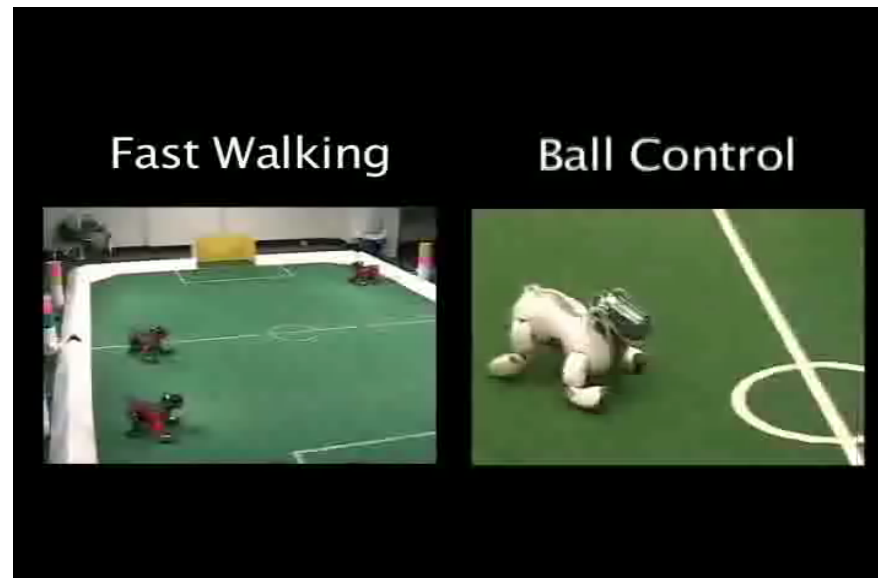
1999 Champion Simulation team

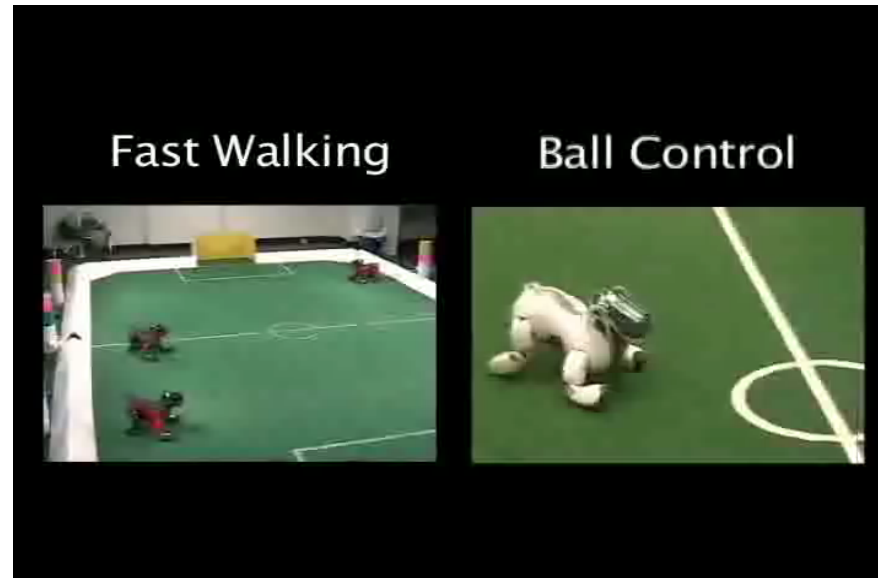# Learning in RoboCup

1999 Champion Simulation team

Fast Walking   Ball Control

Learning in RoboCup

1999 Champion Simulation team

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2011 Champion Simulation team

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Learning in RoboCup
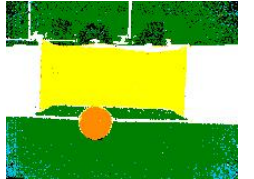
1999 Champion Simulation team

2011 Champion Simulation team

- Initial walk, During learning, Final walk, Game highlight

Vision

- Computer vision
  - Shape modeling, object recognition, face detection…

- Robot vision
  - Mobile camera, limited computation, color features

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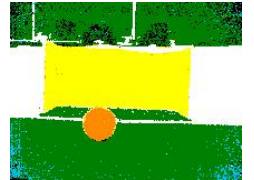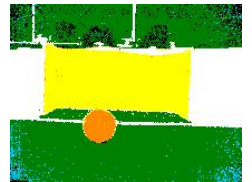 - Object detection in real-time, on-board a robot

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Other Good AI Challenges

Trading agents

Autonomous vehicles

Autonomic computing

Socially assistive robots

Challenge Problems Drive Research

Vision

Learning

Robotics

Natural Language

Game Theory

Multiagent Reasoning

Distributed Optimization

Knowledge Representation

. . . . .
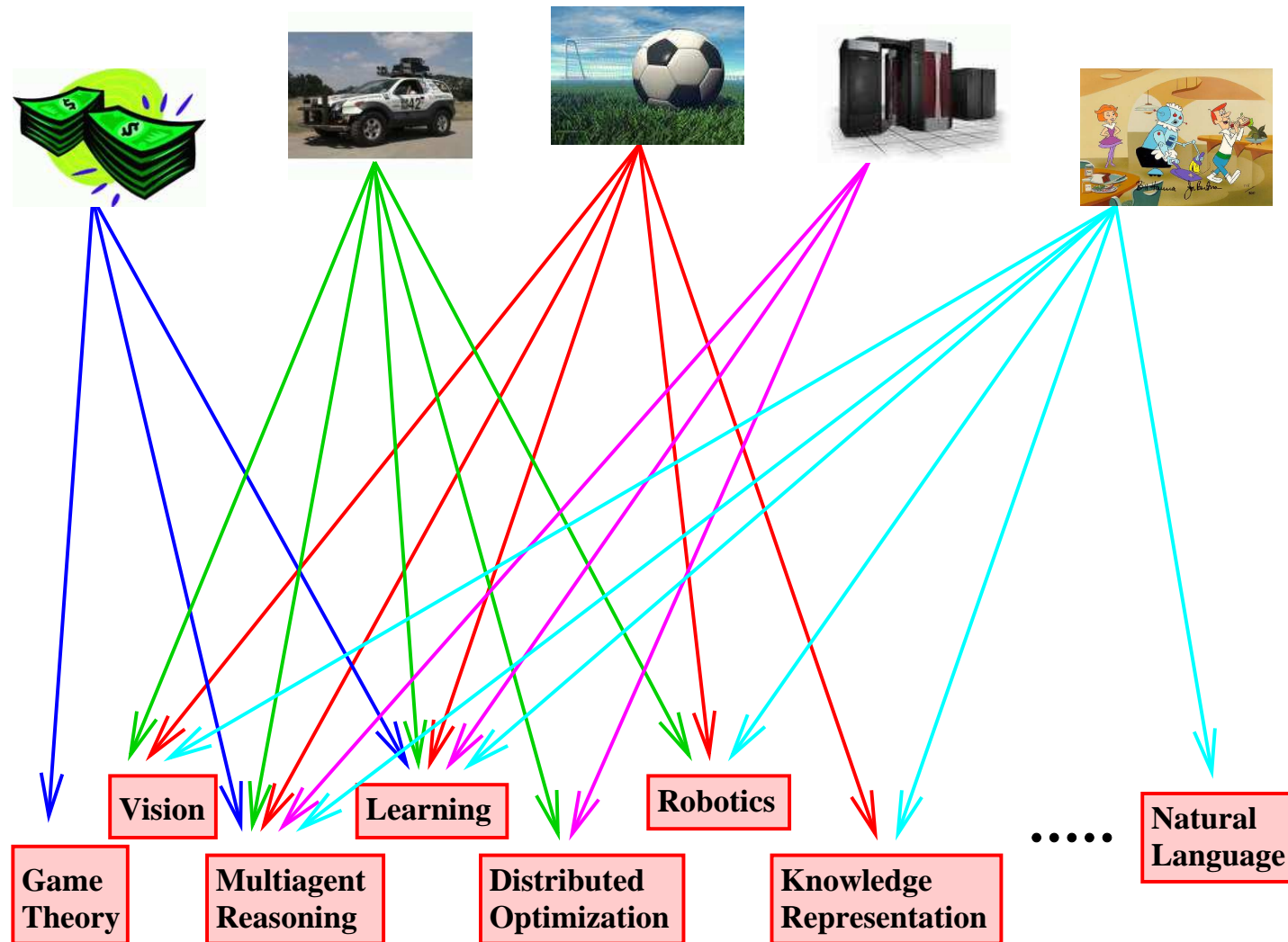
Learning and Multiagent Reasoning

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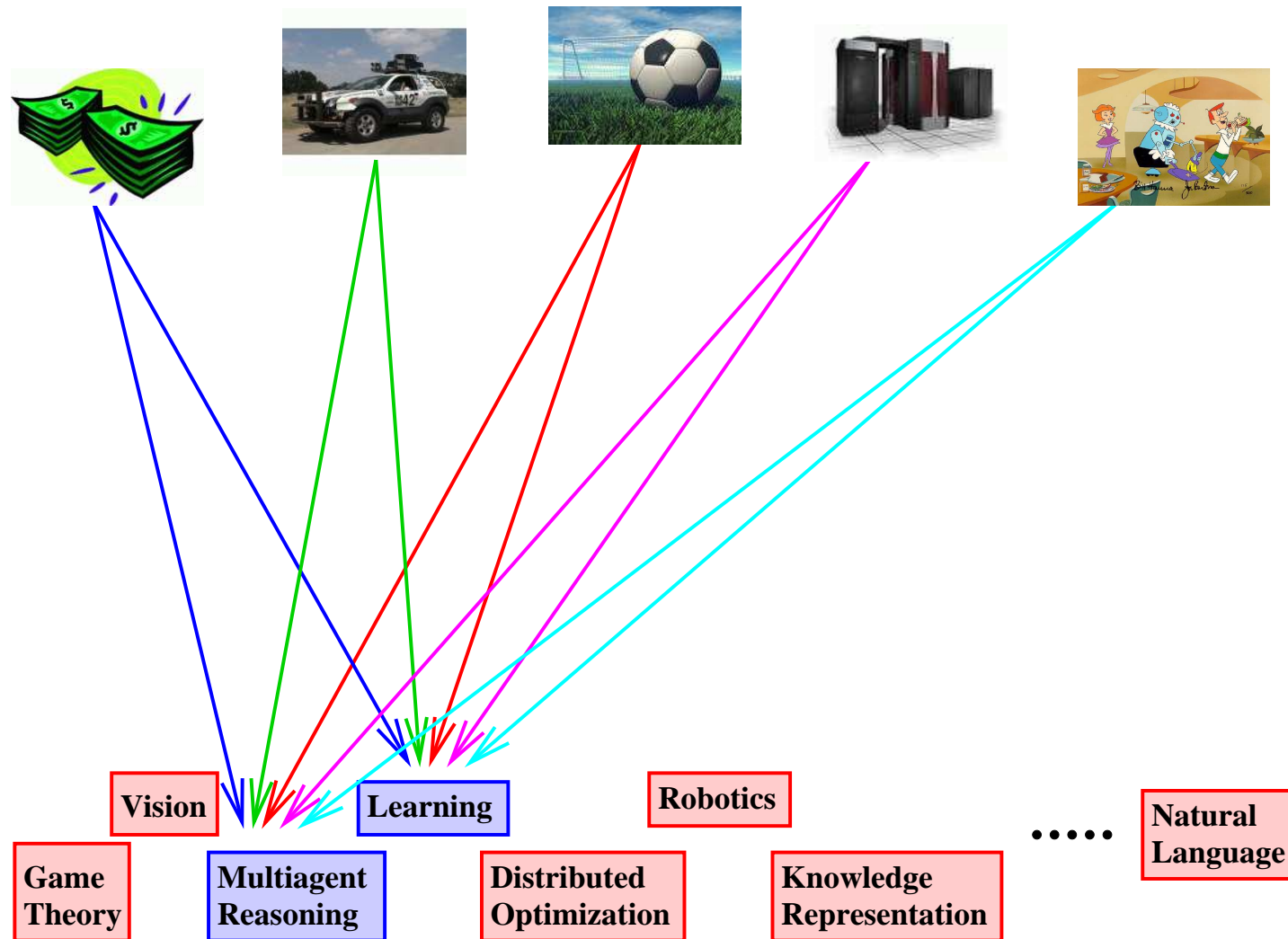
Machine Learning

- Backgammon [Tesauro, '94]
- Helicopter control [Ng et al., '03]

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- **RoboCup Soccer Keepaway** [Stone & Sutton, '01]

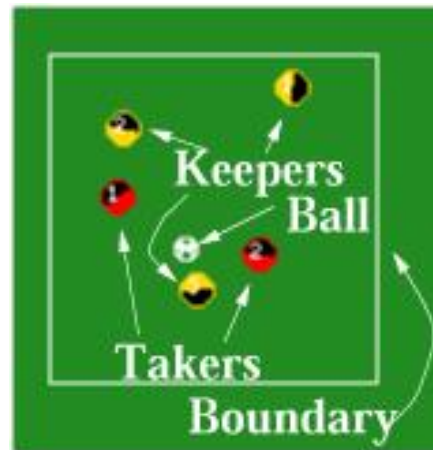# After Learning
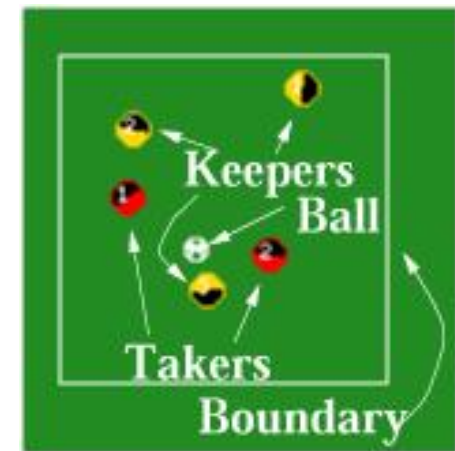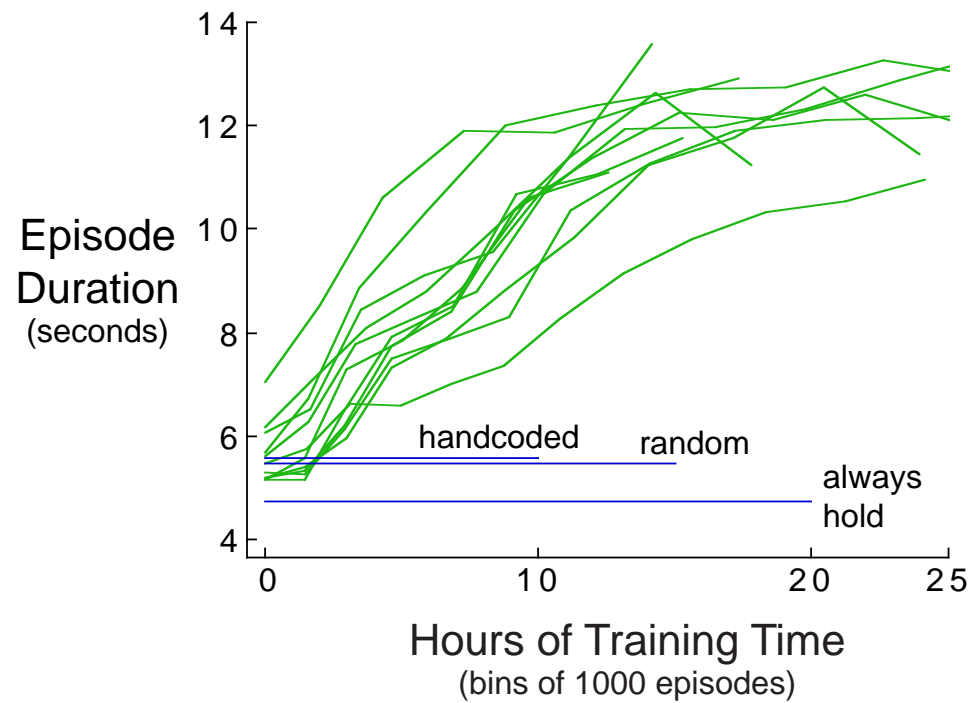
Multiagent Reasoning

Robust, fully autonomous
agents in the real world

- Once there is one, there will soon be many
- To coexist, agents need to interact

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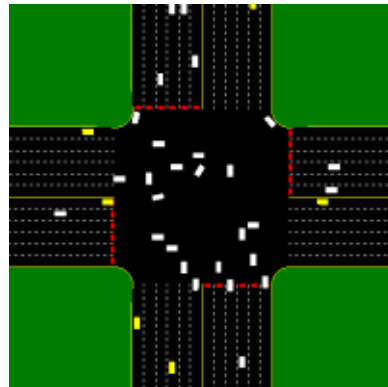
Multiagent Reasoning

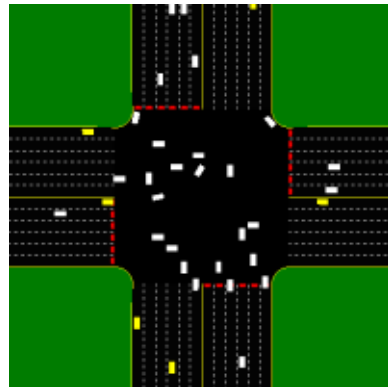Robust, fully autonomous agents in the real world

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Autonomous Bidding Agents

ATTac: champion travel agent

— Learns model of auction closing prices from past data
— Novel algorithm for conditional density estimation

TacTex: champion SCM agent

— Adapts procurement strategy based on recent data
— Predictive planning and scheduling algorithms

TacTex'09: champion Ad-Auctions agent

Other State-of-the-Art AI

- Deep Blue beats Kasparov

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- Watson wins at Jeopardy

Ethics/Implications

Robust, fully autonomous
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What happens **when** we achieve this goal

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A Walk through the Syllabus

Official syllabus is on-line

Workload Summary

- Readings due at least once per week

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- Final   25%

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