Outline

• Course administration

• What is AI? (Chapter 1)
  - Definitions
  - History
  - What we will cover

• Rational Agents (Chapter 2)
Course Administration

- CS 486/686: Introduction to Artificial Intelligence
  - Section 1: PHY 313 Tues/Thurs 11:30-12:50
  - Section 2: PHY 313 Tues/Thurs 08:30-09:50
- Course Personnel:
  - Kate Larson (klarson@uwaterloo.ca)
    - Office Hours: Tuesdays 1:30-2:30 in DC 2518
  - John Doucette (j3doucet@uwaterloo.ca)
    - Office Hours: Thursdays 10:15-11:15 in DC 2580
  - TAs: Hadi Hosseini, Milad Khaki, Nam Pham, Daniel Recoskie, Chi Zhang
Course Administration

- **Website:**

- **Newsgroup:**
  - We will be using Piazza for the newsgroup. Details on how to sign up are in the syllabus.

- **Texts:**
  - *Artificial Intelligence: Foundations of Computational Agents*, D. Poole and A. Mackworth (available online)
Evaluation

<table>
<thead>
<tr>
<th>CS 486</th>
<th>CS 686</th>
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<tbody>
<tr>
<td>• 6 Assignments: 60%</td>
<td>• 6 Assignments: 40%</td>
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<tr>
<td>• Final: 40%</td>
<td>• Final: 35%</td>
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<tr>
<td>• Project (Optional): up to 5 bonus marks</td>
<td>• Project: 25%</td>
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Assignment Late Policy

- Assignments are due as announced
  - For each assignment, you can pass it in up to 48 hours late
    - No doctor’s note required, etc

- **BUT**
  - No assignment will be accepted after the 48 hour grace period
  - No questions about the assignment will be answered during the 48 hour period
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What is AI?

- According to media/popular perception
  - What socially-inept hackers do
  - Hal, Data, Sonny
  - “When Robots Attack”
  - ...

- "How to Survive a Robot Uprising: Tips on Defending Yourself Against the Coming Rebellion" by Daniel H. Wilson
What is AI?

- Definition of AI differ along two dimensions
  - Reasoning vs behaviour
  - Fidelity to human behaviour vs rationality

<table>
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<tr>
<th>Systems that think like humans</th>
<th>Systems that think rationally</th>
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<td>Systems that act like humans</td>
<td>Systems that act rationally</td>
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What are the Goals of AI?

• AI is about duplicating what the (human) brain **DOES**
  - Turing Test

• AI is about duplicating what the human brain **SHOULD DO**
  - Rationality
Behaving Like a Human

- Alan Turing (1950) “Computing machinery and intelligence”
Computing Machinery and Intelligence

• Predicted that by 2000 a computer would have a 30% chance of fooling a lay person for 5 minutes

• Anticipated all major arguments against AI

• Suggested major components of AI:
  - Knowledge, Reasoning, Language Understanding, Learning
The Turing Test

• The test is still relevant today
  - The Loebner Prize

• However, AI researchers spend limited effort on it
  - It is not reproducible or amenable to mathematical analysis
  - More important to understand underlying principles of intelligence than copy them?
What are the Goals of AI?

• AI is about duplicating what the (human) brain **DOES**
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  - Rationality
Rational Behaviour

- Rational behaviour
  Doing the Right Thing
- Doing what is expected to maximize goal achievement, given available information
  - Does not necessarily require thinking
    - But often thinking serves rational behaviour
Abridged History of AI

- 1943: McCulloch & Pitts: Boolean circuit of the brain
- 1950: Turing’s “Computing machinery and intelligence”
- 1950s: Early AI Programs including Samuel’s checkers, Newell and Simon’s Logic Theorist
- 1956: Dartmouth meeting: “Artificial Intelligence”
- 1970s: Knowledge-based systems
- 1980’s: Expert-systems industry
- 1988-now: Probabilistic and decision theoretic methods

“The AI Winter”
Classical AI

• Reasoning was seen as THE AI problem
  - Chess was considered pivotal to understanding intelligence

• **Goal**: General Problem Solver
Recent AI

• Focus on solving specific problems
• Heavy use of probability theory, decision theory, statistics,...
• Collection of subfields
  - Perception (including vision) is usually separate
  - Robotics is mostly separate
  - Deliberative reasoning is “AI”
    - But lots of different approaches
Course Contents

- Search
- Knowledge Representation and Reasoning
- Planning
- Reasoning Under Uncertainty
- Learning
Rational Agents

- An entity that perceives and acts
  - Function from percept to actions $f: P \rightarrow A$

- Performance measures
  - Goal achievement, resource consumption, ...

- **Caveat**: Computational limitations and environmental constraints mean we do not have perfect rationality
Task Environment

• To design a rational agent, the task environment must be specified
  - Performance measure
  - Environment
  - Actuators
  - Sensors
Performance Measures

- **Percepts:** [Location, Dirty or Clean]
- **Actions:** Right, Left, Vacuum, NoOp, Dump
- **Function:** ([A, Clean], Right), ([A, Dirty], Vacuum), ([B, Dirty], Vacuum), ([B, Clean], Left)...

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A

B
Properties of Task Environment

• Fully Observable vs Partially Observable
• Deterministic vs Stochastic
• Episodic vs Dynamic
• Discrete vs Continuous
• Single agent vs Multi agent
State of the Art

• Chess was **THE** AI challenge for decades

I could feel – I could smell – a new kind of intelligence across the table”
-Gary Kasparov

“Saying Deep Blue doesn’t really think about chess is like saying an airplane doesn’t really fly because it doesn’t flap its wings.”
– Drew McDermott
State of the Art

- Checkers?
- Poker?
- Jeopardy?
State of the Art

- Airport Security?
State of the Art

- Autonomous Vehicles?
State of the Art

- Real Time Translation?
State of the Art

- Journalism?
Questions?

• Next lecture: Problem Solving Agents (Chapter 3)