CSE 40171: Artificial Intelligence

Course Introduction / Introduction to AI
Course Info:

- CSE 40171: Artificial Intelligence
- Instructor: Walter Scheirer (wscheire@nd.edu; @wjscheirer)
- Office: 321C Stinson-Remick
- Lectures: MWF 3:30-4:20pm DeBartolo Hall 125
- Office Hours: Mon. & Weds. 1-3:15pm and by appointment.

Course Website: https://www.wjscheirer.com/teaching/ai/ai-fall-2018/
Course Slack Channel

#cse-40171-fa18
nd-cse.slack.com
Grad TA:

- Abby Graese
- agraese@nd.edu
- Office Hours: Fri. 10-12pm Eastern
  - Engineering Library
Undergrad TA:

- Mike Eiseman
- meiseman@nd.edu
About me

• Joined Notre Dame Summer 2015
  - Ph.D. from the University of Colorado 2009
  - 2012 — 2015 Harvard University Center for Brain Science

• Research in Computer Vision and Machine Learning

Reverse engineering biological vision
Tools for Neuroscience
Statistical methods for visual recognition
Digital Humanities
How about you?

• Introduce yourself.

• Any experience with Game AI, Data Science, or Machine Learning?

• What interests you about artificial intelligence?
Course Overview

- 35 lectures
- 8 homework assignments
- 2 quizzes (in-class)
- 1 group project
  - Project proposal
  - Project update
  - Team project presentations (11/26 - 11/30)
  - Final deliverable in lieu of exam
Course Overview

Grading

<table>
<thead>
<tr>
<th>Component</th>
<th>Points</th>
</tr>
</thead>
<tbody>
<tr>
<td>Participation</td>
<td>100</td>
</tr>
<tr>
<td>Participation in class, office hours, and slack discussions.</td>
<td></td>
</tr>
<tr>
<td>Homeworks</td>
<td>$8 \times 100$</td>
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<tr>
<td>Homework assignments.</td>
<td></td>
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<tr>
<td>Project</td>
<td>700</td>
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<tr>
<td>Final group project.</td>
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<tr>
<td>Quizzes</td>
<td>$2 \times 200$</td>
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<tr>
<td>In-class quizzes.</td>
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<tr>
<td>Total</td>
<td>2000</td>
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Important Dates

<table>
<thead>
<tr>
<th>Assignment</th>
<th>Release Date</th>
<th>Due Date</th>
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</thead>
<tbody>
<tr>
<td>Homework #1 (Problem Solving)</td>
<td>Released: 9/3; Due: 9/10</td>
<td></td>
</tr>
<tr>
<td>Homework #2 (Problem Solving)</td>
<td>Released: 9/12; Due: 9/19</td>
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<tr>
<td>Homework #3 (Problem Solving)</td>
<td>Released: 9/21; Due: 9/28</td>
<td></td>
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<tr>
<td>Quiz 1</td>
<td>9/28</td>
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<tr>
<td>Homework #4 (Probabilistic Reasoning)</td>
<td>Released: 10/5; Due: 10/12</td>
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<tr>
<td>Homework #5 (Probabilistic Reasoning)</td>
<td>Released: 10/22; Due: 10/29</td>
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<tr>
<td>Homework #6 (Machine Learning)</td>
<td>Released: 10/31; Due: 11/7</td>
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<td>Homework #7 (Machine Learning)</td>
<td>Released: 11/9; Due: 11/16</td>
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<td>Quiz 2</td>
<td>11/14</td>
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<tr>
<td>Homework #8 (Machine Learning)</td>
<td>Released 11/19; Due: 11/28</td>
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*Full syllabus on course website*
Prerequisites

Required prerequisite course: N/A

You need to be comfortable programming in Python, and have some familiarity with Linux
Other readings will be posted to the course website; keep an eye on the class schedule
Course Objectives

• **Understand** the philosophical underpinnings of the field and motivations for pursuing the replication of certain competencies of the brain.

• **Relate** real-life problems to perceptual and cognitive models that are able to solve aspects of them in an efficient manner.

• **Deploy** general search algorithms that can be applied to a wide variety of tasks.

• **Formulate** decision making processes that can be used for planning and classification purposes.
Course Objectives

• **Build** intelligent agents that perform simple tasks in an autonomous fashion.

• **Learn** task-specific models from large collections of labeled training data samples using algorithms that are optimized using numeric solvers.

• **Utilize** state-of-the-art software frameworks for building solutions to problems related to games, computer vision, natural language processing, etc.

• **Identify** problems that are solvable with today's AI algorithms and others that require novel solutions.
Course Roadmap

Introduction
(week 1)

Problem Solving
(weeks 3 - 6)

Machine Learning
(weeks 11 - 16)

Biological Intelligence
(week 2)

Probabilistic Reasoning
(weeks 7 - 10)
A brief history of AI
Once a historical footnote...
...now big business
The early years
The 1950s…

Artificial Brain?

Theory of Computation

Cybernetics

Information Theory
Dartmouth Summer Program in Artificial Intelligence, June-August 1956

Photo Source: Achievement.org
The mid 50s to mid 70s:
The (so-called) golden years
Reasoning as search

A example of greedy algorithm, searching the largest path in a tree. © Swfung8
The Blocks World

Photo Source: MIT Technology Review
SHRDLU

https://www.youtube.com/watch?v=bo4RvJYOzI
I am the psychotherapist. Please, describe your problems.

Each time you are finished talking, type RET twice.

I have a terrible headache.

Maybe you should consult a doctor of medicine, I am a psychiatrist.

Okay, I'll do that then.

Can you elaborate on that?

What are you talking about? No I cannot elaborate. See you later.

Why do you say that?

Now you're just talking nonsense!

What makes you believe now I am just talking nonsense?

You are not making any sense.

Perhaps your plans have something to do with this.

1:23:34 [u:*doctor* (Doctor Fill)]
Brash Optimism

“within ten years a digital computer will be the world’s chess champion" and "within ten years a digital computer will discover and prove an important new mathematical theorem.”

- H.A. Simon and Allen Newell

“machines will be capable, within twenty years, of doing any work a man can do.”

- H.A. Simon

“Within a generation... the problem of creating ‘artificial intelligence’ will substantially be solved.”

- Marvin Minsky

“In from three to eight years we will have a machine with the general intelligence of an average human being.”

- Marvin Minsky
The First AI Winter (the second half of the 1970s)

What went wrong?

• Computing resources were meager
• Better understanding of intractability
• Hard to collect data pre-Internet
• Moravec’s paradox
• Limits to logical inference