Course Description (from catalog):
What will our artificial intelligence (AI) overlords look like? The world is abuzz with deep learning, machine learning, data science, and artificial intelligence. There are countless videos with artificial neural networks depicted as simple circles interconnected with lines or tutorials that are long on the mathematical concepts; however, the truth is a bit more complicated. If you want to know enough to write a neural network, you find precious little out there. If you want to model real neurons, neural networks fall short. In this course we explore the true physical neuron found in nature and in our heads, how it works, how it can be modelled in a very limited way, and how the nodes in artificial neural networks are very different from these. We explore why AI is suddenly hot again, after thirty years in hibernation. We learn how to create an artificial neural network and see inside the black box of libraries that do this automagically for us. We explore some of the ethical, political, and socio-economic ramifications and questions highlighted by advances in these fields. There is much work that can still be done to help enhance these networks to better approximate natural networks of neurons, and how it may be possible to meld different versions of networks and more traditional programmatic control (as is being used in autonomous vehicles) to create far more complex emergent systems behavior. This course is not intended to replace other artificial intelligence courses but is intended to be a survey course of sufficient depth to allow you to better understand the technology, its potential benefits and pitfalls, and to be able to speak intelligently about the subject matter.

Introduction
Artificial Intelligence, one of a number of Machine Learning paradigms, has seen accelerated advances in the past decade that only stand to get more interesting as time passes. It is therefore important for those who are interested to understand what it is, what is it no (at least not yet), how it works, and what are the opportunities and risks associated with it.

This course has the lofty aim of helping you learn the difference between artificial neural networks, natural neural networks (e.g., the human brain), and what those differences may mean. You should also have an intuitive grasp of Neurological and AI concepts, had played around with some AI (Deep Learning) code, understand a bit of the history and trajectory, and be well informed enough to discuss the potential implications of the progress of the field.

Notes
Below is a DRAFT Syllabus which is subject to change. There may be guest lecturers in the fields of study pending ability to arrange schedules.

Individuals taking this course for graduate credit will have some additional readings and assignments.
Syllabus
Tuesday Jan 24

Part 1
1. Intro to the class:
   1.1. Learning objectives
   1.2. Prerequisites
   1.3. Topics
   1.4. Expectations
      1.4.1. Homeworks
      1.4.2. Tests
      1.4.3. Grades
      1.4.4. Participation
   1.5. Instructors and student Intros
2. In the News

Part 2
3. Disambiguation (aka “uh, wut?”):
   3.1. Natural Intelligence
      3.1.1. (Contested) Definitions
      3.1.2. Nature vs. Nurture
      3.1.3. Genetics
      3.1.4. Environment
   3.2. Neurons, Nerves, and more
   3.3. Brains
      3.3.1. General
      3.3.2. Human
   3.4. Machine Learning
   3.5. Artificial Intelligence
   3.6. Neuroinformatics

Jan 31

Part 1
4. Neuroanatomy: History
5. The Neuron: Physiology
   5.1. Classical representation
   5.2. Subtypes
      5.2.1. Histological examples

Part 2
5.3. Neurophysiology
   5.3.1. Membrane
   5.3.2. Myelin Sheaths
   5.3.3. Sodium/Potassium Pumps
   5.3.4. Synapses
   5.3.5. Vesicles
   5.3.6. Neurotransmitters
   5.4. "Firing", Action Potentials, Refractory periods

Feb 7

Part 1
6. The Neuron: Function
   6.1. Encoding
      6.1.1. Temporal
      6.1.2. Spatial
      6.1.3. Capacity
   6.2. Processing
      6.2.1. Input / Output complexity

Part 2
7. Natural Neuronal Networks
   7.1. Examples
   7.2. Complexity
   7.3. Functional Connectome
   7.4. TEM Connectome

Feb 14

Part 1
8. Artificial Intelligence: History
   8.1. Mythology & Ancient
   8.2. Principia Mathematica (1910)
   8.3. 1950's
      8.3.1. Turing
      8.3.2. Logic Theorist (Allen Newell et. al)
      8.3.3. Dartmouth & “The Birth”
      8.3.4. Reasoning as search
      8.3.5. General problem solver
   8.4. Golden Age (60's and 70's)
      8.4.1. STUDENT
      8.4.2. ELIZA
      8.4.3. SHRDLU
      8.4.4. Animal Game

Part 2
8.5. The Dark Ages (1974-1980)
8.6. Expert Systems (80's)
8.7. Pause v. 2.0
8.8. Restart (90's-ish)
9. Artificial Intelligence: History
   9.1. New Millennium (Y2K)
   9.2. The missing weight
   9.3. The hardware
   9.4. Deep Learning reborn
   9.5. Watson & Jeopardy

Feb 21

Part 1
10. Artificial Intelligence: Networks
<table>
<thead>
<tr>
<th>Chapter</th>
<th>Title</th>
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<tbody>
<tr>
<td>10.1.</td>
<td>Flat (Infinite Theory)</td>
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<td>10.2.</td>
<td>Deep</td>
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<td>10.3.</td>
<td>Cyclic vs. Acyclic</td>
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### Part 2

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<thead>
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<th>Title</th>
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<tr>
<td>11.</td>
<td>Artificial Intelligence: General Principles</td>
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<tr>
<td>11.1.</td>
<td>Nodes</td>
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<td>11.2.</td>
<td>Edges</td>
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<td>11.3.</td>
<td>Weights</td>
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<td>11.4.</td>
<td>Transformational Function</td>
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<td>11.5.</td>
<td>Outputs</td>
</tr>
</tbody>
</table>

### Feb 28

#### Part 1

- 12.1. Classical
- 12.2. Bayesian

#### Part 2
- 12.3. Bayesian (Continued)

### Mar 7

#### Part 1

13. Classification
14. Task completion
15. Aggregated complexity

#### Part 2

Midterm Exam
Mar 14 – Spring Break

### Mar 21

#### Part 1

16. Turing Test and beyond
17. Consciousness

#### Part 2

18. Intent
19. Emotions (Desire)

### Apr 4

#### Part 1

20. Rights of Sentient Beings
- 20.1. Existing discourses
21. Rights of Artificial Intelligence
- 21.1. In the news

#### Part 2

22. The general ethical questions of AI
- 22.1. Historical
  - 22.1.1. Asimov
- 22.2. Current

### Apr 10

#### Part 1

23. Trolley Problem
23.2. Training control (Mercedes Benz)

#### Part 2

24. Economic Models
- 24.1. Post-producer economies

### Apr 18

#### Part 1

25. Policies and Laws
- 25.1. Liability
- 25.2. Funding
- 25.3. Resources
- 25.4. Rights

#### Part 2

26. Coding Examples

### Apr 25

#### Part 1

27. The Future
- 27.1. The exponential problem
- 27.2. Don Quixote and Chicken Little
- 27.3. Benevolent Robot Overlords

#### Part 2

28. Coding Examples

### May 1

#### Part 1

29. Of Robots and Luddites
- 29.1. History of Hysteria
- 29.2. Is this different?
30. Of Skynet and Terminator

#### Part 2

31. Coding Examples and/or Discussion

### May 9

#### Part 1

32. The End (aka “Are we all going to die?”)
33. Course Review for Exam

#### Part 2

34. Further Review & Discussion

### Final Exam