Welcome 😊

CSCI 1470/2470
Spring 2022

Ritambhara Singh

January 26, 2022
Wednesday

DALL-E 2 prompt “a painting of deep underwater with a yellow submarine in the bottom right corner”
About your instructor!

4th year CS faculty and a CCMB member!

Research Interests
Machine Learning, Data Mining, Computational Biology, Health Sciences

Office Location
Room 313, Center for Computational Molecular Biology (CCMB)
3rd Floor, 164 Angell Street

Office Hours (Starting this week!)
Thursdays, 2:30-4:30 PM or by appointment
Where: TBD (zoom for this week)

Email: ritambhara@brown.edu
Website: www.ritambharasingh.com

I also teach:
CSCI 2952-G: Deep Learning in Genomics
Introducing...

Your Awesome Course Staff!
Your HTAs!

Dylan Hu  
he/him • dhu24

Nitya Thakkar  
she/her • nthakka3

Raymond Dai  
he/him • rdai4

Robert Scheidegger  
he/him • rscheide

Vadim Kudlay  
he/him • vkudlay
Your TAs!

Jun Suk Ha  
he/him • jha38

Karan Kashyap  
he/him • k Kashyap

Logan Bauman  
he/him • l bauman

Michael Lu  
he/him • ml u54

Taishi Nishizawa  
he/him • tnishiza

Nange Li  
she/her • n l32

Preeti Nagalamadaka  
she/her • pnagala1

Ray Del Vecchio  
he/him • rdelvec

*Grad TA

Ray Wang  
he/him • xwang356

Xianghao Xu  
he/him • xxu43
Your STAs!

Brendan Ho
he/him • bho15

Faizaan Vidhani
he/him • fvidhani
Why take this course?
You may have heard of “Deep Learning” or “Artificial Intelligence (AI)” 😊
You may have heard of “Deep Learning” or “Artificial Intelligence (AI)” 😄

https://openai.com/dall-e-2/
You may have heard of “Deep Learning” or “Artificial Intelligence (AI)” 😊

<table>
<thead>
<tr>
<th>3 reasons to take deep learning class?</th>
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1. **Enhance career opportunities**: Deep learning is a highly sought-after skill in the tech industry, with demand for professionals with deep learning expertise continuing to grow. Taking a deep learning class can help you gain the skills and knowledge needed to pursue a career in this field.

2. **Solve complex problems**: Deep learning allows you to build models that can automatically learn from large amounts of data, and achieve state-of-the-art performance on a wide range of tasks. The ability to train deep neural networks on vast amounts of data allows for the creation of models that can generalize well to new data, and achieve high accuracy on a wide range of tasks.

3. **Be part of cutting-edge technology**: Deep learning is a rapidly evolving field, with new breakthroughs and advancements being made regularly. Taking a deep learning class will give you the opportunity to learn about the latest research and techniques, and be part of shaping the future of this technology.

https://openai.com/blog/chatgpt/
You may have heard of “Deep Learning” or “Artificial Intelligence (AI)” 😞

<table>
<thead>
<tr>
<th>Gender Classifier</th>
<th>Darker Male</th>
<th>Darker Female</th>
<th>Lighter Male</th>
<th>Lighter Female</th>
<th>Largest Gap</th>
</tr>
</thead>
<tbody>
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<tr>
<td>FACE++</td>
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<tr>
<td>IBM</td>
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<td>65.3%</td>
<td>99.7%</td>
<td>92.9%</td>
<td>34.4%</td>
</tr>
</tbody>
</table>
You may have heard of “Deep Learning” or “Artificial Intelligence (AI)”.

Training a single AI model can emit as much carbon as five cars in their lifetimes.

Deep learning has a terrible carbon footprint.

In review of fatal Arizona crash, U.S. agency says Uber software had flaws

By David Shepardson

WASHINGTON (Reuters) - An Uber self-driving test vehicle that struck and killed an Arizona woman in 2018 had software flaws, the National Transportation Safety Board said Tuesday as it disclosed the company’s autonomous test vehicles were involved in 37 crashes over the prior 18 months.
Our goal is to answer some important questions

• What is deep learning?
• What are the different types of deep learning models?
• How to implement a deep learning model?
• What models are appropriate for different applications?
• Will our approach improve our understanding of the data or the problem?
• What are the ethical considerations when using deep learning models?
Next time when you come across “Deep Learning” you will know:

What is Deep Learning?

(1) What is Machine Learning?

(2) How does it connect to Deep Learning?

(3) What is NOT Deep Learning?
What is Machine Learning?

Input: X

Output: Y

"Cooking?"

Function: f

f(X) \rightarrow Y
What is Machine Learning?

Input: X

Learned function: f

Output: Y
"Cooking?"

f(X) ▸ Y

Supervised Learning
What is Machine Learning?

Input: X

I do not want sour cream in my burrito

Learned function: f

Output: Y

No quiero crema agria en mi burrito

f(X) → Y
What is Deep Learning?

Input: \( X \)

\[
f_4(f_3(f_2(f_1(X)))) 
\]

Output: \( Y \)
What is Deep Learning?

Input: X

Output: Y

"Cooking?"

Deep Learning DOES NOT mimic the brain!

TURN ANY PHOTO INTO AN ARTWORK – FOR FREE!

We use an algorithm inspired by the human brain. It uses the stylistic elements of one image to draw the content of another. Get your own artwork in just three steps.

[https://deepart.io]

WHAT IS DEEP LEARNING?

A newly re-invigorated form of machine learning, which is itself a subset of artificial intelligence, deep learning employs powerful computers, massive data sets, “supervised” (trained) neural networks and an algorithm called back-propagation (backprop for short) to recognize objects and translate speech in real time by mimicking the layers of neurons in a human brain’s neocortex.

[https://builtin.com/artificial-intelligence/deep-learning]
What is NOT Deep Learning?

Deep Learning is NOT AI
Recap

Input: X

Machine Learning

f(X) \rightarrow Y

"Cooking?"

Output: Y

Deep Learning is NOT AI

Deep Learning DOES NOT mimic the brain!

Deep Learning

f_4 \left( f_3 \left( f_2 \left( f_1 (X) \right) \right) \right) \rightarrow Y
Questions?
Ice-breaker
(a.k.a “please-don’t-make-me-do-this” activity)

• Turn to the person sitting next to you and introduce yourself!

• What do you hope to learn/be able to do by the end of this course?

Go to www.menti.com and use the code 1282 0089
Course Logistics
The Course Website

Welcome to Deep Learning

• Your one-stop-shop for:
  • Syllabus
  • Lecture, lab, & assignment schedules
  • Links to important forms, etc.
  • ...

http://cs.brown.edu/courses/csci1470
The Canvas Website

https://canvas.brown.edu/courses/1091047

CSCI1470/2470 Spring23 Deep Learning

Welcome to CSCI 1470/2470! Over the past few years, Deep Learning has become a popular area, with deep neural network methods obtaining state-of-the-art results on applications in computer vision (Self-Driving Cars), natural language processing (Google Translate), and reinforcement learning (AlphaGo). These technologies are having transformative effects on our society, including some undesirable ones (e.g. deep fakes).

This course intends to give students a practical understanding of how Deep Learning works, how to implement deep neural networks, and how to apply them ethically. We introduce students to the core concepts of deep neural networks, including the backpropagation algorithm for training neural networks, as well as specific operations such as convolution (in the context of computer vision) and word embeddings, and recurrent neural networks (in the context of natural language processing).

• Your access to:
  • Ed Discussion
  • GradeScope
  • Lectures
  • Weekly quizzes
  • Weekly course announcements from instructor
Which Version of the Course Should I Take?

**CS 1470**
- Undergrads + grads
- Lectures
- Labs
- Assignments (Code + Written)
- Group final project
  - Implement existing research paper
  - Poster presentation

**CS 2470**
- Grad students only
- Same Lectures
- Same Labs
- Same Assignments, plus:
  - Additional required features
  - Additional written questions
- Group final project
  - Try something new
  - Oral presentation
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Six Awesome Assignments

- Linear regression
- ...and a tiny bit of Pytorch

- TensorFlow

- Language modeling
- Image Captioning
- Variational Autoencoders
Brown Deep Learning Day!

• Course final project

• In-person mini conference!

• Poster sessions and presentations
  • Grouped by theme: e.g. vision, language, robotics, ...

• Tentative Date: May 12, 2023

• Details forthcoming!
Lectures and class participation

• In-person Lectures
  • Lecture recordings available
  • Recordings posted to Canvas (Media Library)

• Weekly quiz on Canvas
  • Released on Wednesday
  • Due on Thursday
  • Minimum time/effort if you attend class or watch lectures regularly
  • No deadline extensions!
Labs and office hours

• In-person lab and office hours
  • Remote options available for office hours
  • Locations will take a week or two to finalize
• Team work highly encouraged for lab hours!
Assignment logistics

• Assignments
  • Get stencils via Github Classroom
  • Submission via Gradescope
Homework and Lab 0 + SRC discussions

• Homework 0 (will be released today!)
  • Review of relevant math and probability concepts
  • Setting up programming environment
  • Points for completion only (deadline Feb 03)

• Lab 0 (will be released today!)
  • Review of python and numpy
  • Complete on your own (preferably by Jan 31)

• SRC discussion sessions
  • Replacing STA office hours
  • Sign up to attend 2 sessions for this semester
  • STAs will provide prompts related to that week’s homework
The only thing set in stone is our excitement to learn!

- Will try things for class engagement
- Due dates might move around
- We might have make-up classes/labs
- The schedule will remain flexible till the end
- Suggestions are welcome!
- Of course, COVID-19 is STILL around 😞
This course is also offered in the Fall!

Acknowledgements

Original course material developed by Professor Daniel Ritchie and previous FABULOUS TA staff

Professor Chen Sun (taught in Fall 2022)
Immediate Action Items

• **Read the course missive;** sign the collaboration policy form

• Make sure you can access the course Ed Discussion page via Canvas (all announcements will happen there)

• Create a GitHub account (if you don’t have one already)

• Make sure you can access the course GradeScope via Canvas (all assignments will be submitted there)

• **Start working on HW0 – Submission deadline Feb 03 (Friday 6PM EST)**

• **Do Lab 0 (Especially if you’ve never used Python and/or numpy before!) – Deadline Jan 31**

• If you want to do work on CS department machines over SSH, you’ll need a CS login
  • All enrolled students automatically have one (it’s the same as your Brown ID)
  • If you are not yet enrolled, you’ll need to email problem@cs.brown.edu
  • More information about CS accounts can be found [here](#).
  • **Note that a CS login is not required for this course, as we are not using handin or any other department infrastructure to manage files or submissions**
Questions?