

CSCI 1470/2470
Spring 2022

Ritambhara Singh

January 26, 2022
Wednesday

Welcome 😊

Deep Learning



About your instructor!

4th year CS faculty and a CCMB member!

Research Interests

Machine Learning, Data Mining, Computational Biology, Health Sciences



B.E
208-2012



Ph.D.
2012-2018



Postdoc
2018-2019



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

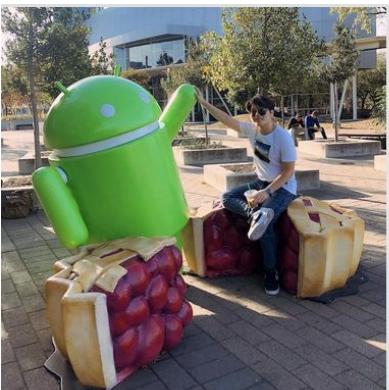


Robert Scheidegger
he/him • rscheide



Vadim Kudlay
he/him • vkudlay

Your TAs!



Bumjin Joo
he/him • bjoo2



Dave Lubawski
he/him • dlubawsk



**Jitpuwapat (Earth)
Mokkamakkul**



Eric Han
he/him • ehan31



**Shirley Loayza
Sanchez**
she/her • sloayzas



Evan Lu
he/him • elu14



Henry Sowerby
he/him • hsowerby



Iris Cheng
she/her • icheng3



Joe Dodson
he/him • jdodson4



Will Guo
he/him • wguo25

Your TAs!



Jun Suk Ha
he/him • jha38



Karan Kashyap
he/him • kkashyap



Logan Bauman
he/him • lbaumana



Michael Lu
he/him • mlu54



Taishi Nishizawa
he/him • tnishiza



Nange Li
she/her • nli32



Preeti Nagalamadaka
she/her • pnagala1



Ray Del Vecchio
he/him • rdelvecc



Ray Wang
he/him • xwang356



Xianghao Xu
he/him • xxu43

Your STAs!



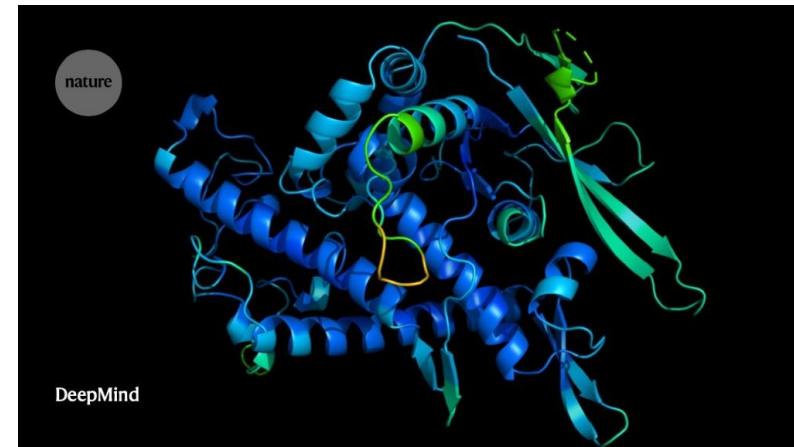
Brendan Ho
he/him • bho15



Faizaan Vidhani
he/him • fvidhani

Why take this course?

You may have heard of “Deep Learning” or “Artificial Intelligence (AI)”



10:24

How do you say I do not want sour cream in my burrito in Spanish

Tap to Edit

osxdaily.com

TRANSLATION

English

I do not want sour cream in my burrito

Spanish

No quiero crema agria en mi burrito

You may have heard of “Deep Learning” or “Artificial Intelligence (AI)”



S DALL-E History Collections

Edit the detailed description

a painting of deep underwater with a yellow submarine in the bottom right corner

Surprise me Upload →| Generate

The image shows a user interface for generating images with DALL-E. At the top, there are navigation links for 'S', 'DALL-E', 'History', and 'Collections'. Below that is a text input field with placeholder text: 'Edit the detailed description' and 'a painting of deep underwater with a yellow submarine in the bottom right corner'. To the right of the input field are buttons for 'Surprise me', 'Upload', and 'Generate'. Below the input field are four generated images. Each image depicts a yellow submarine in a blue underwater environment with various marine life like coral reefs and bubbles. The submersibles are positioned differently in each panel: one is on the left, one is near the center, one is on the right, and one is at the bottom right.

You may have heard of “Deep Learning” or “Artificial Intelligence (AI)”



 3 reasons to take deep learning class?


- 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.

You may have heard of “Deep Learning” or “Artificial Intelligence (AI)”



Gender Classifier	Darker Male	Darker Female	Lighter Male	Lighter Female	Largest Gap
Microsoft	94.0%	79.2%	100%	98.3%	20.8%
FACE++	99.3%	65.5%	99.2%	94.0%	33.8%
IBM	88.0%	65.3%	99.7%	92.9%	34.4%



COOKING	
ROLE	VALUE
AGENT	WOMAN
FOOD	∅
HEAT	STOVE
TOOL	SPATULA
PLACE	KITCHEN

You may have heard of “Deep Learning” or “Artificial Intelligence (AI)”



Artificial intelligence / Machine learning

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

Deep learning has a terrible carbon footprint.

by Karen Hao

June 6, 2019

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

By David Shepardson

4 MIN READ



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 answers some important questions

- What is deep learning?
- What are the different types of deep learning models?
- How to implement a deep learning models?
- 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



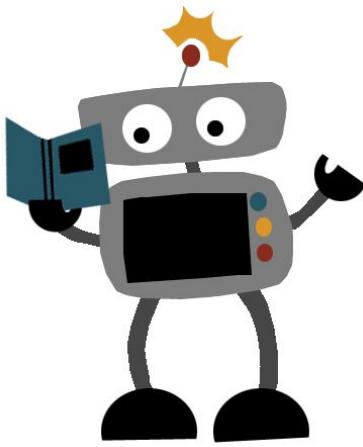
Function: f



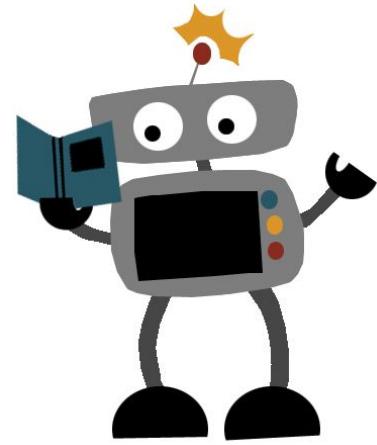
$$f(X) \square Y$$

Output: Y

"Cooking?"



What is Machine Learning?



Supervised
Learning

Input: X



Learned
function: f

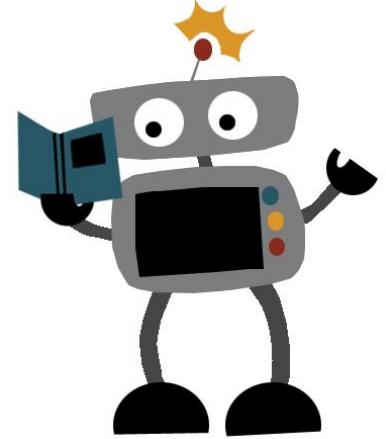


Output: Y
"Cooking?"



$f(X) \square Y$

What is Machine Learning?



Input: X

I do not want sour
cream in my
burrito



Learned
function: f



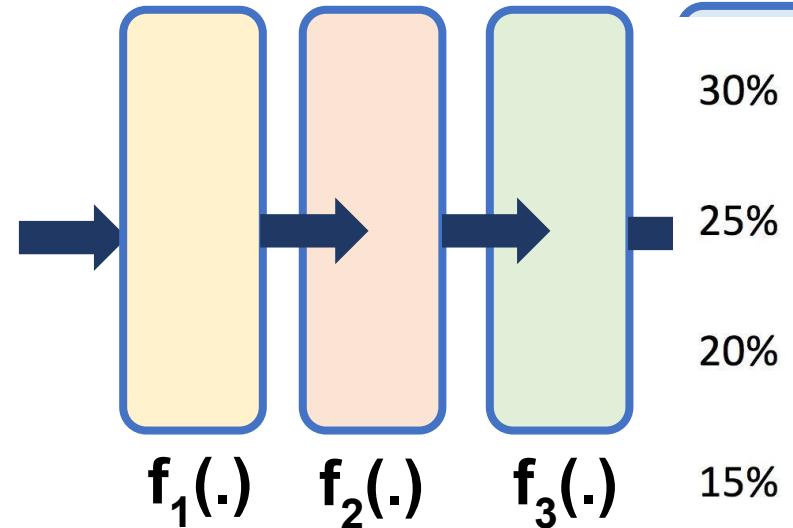
Output: Y

No quiero crema
agreya en mi
burrito

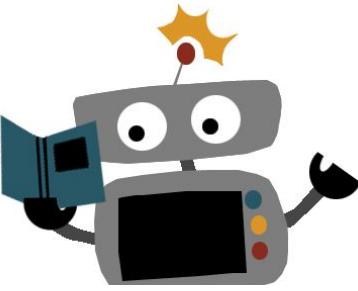
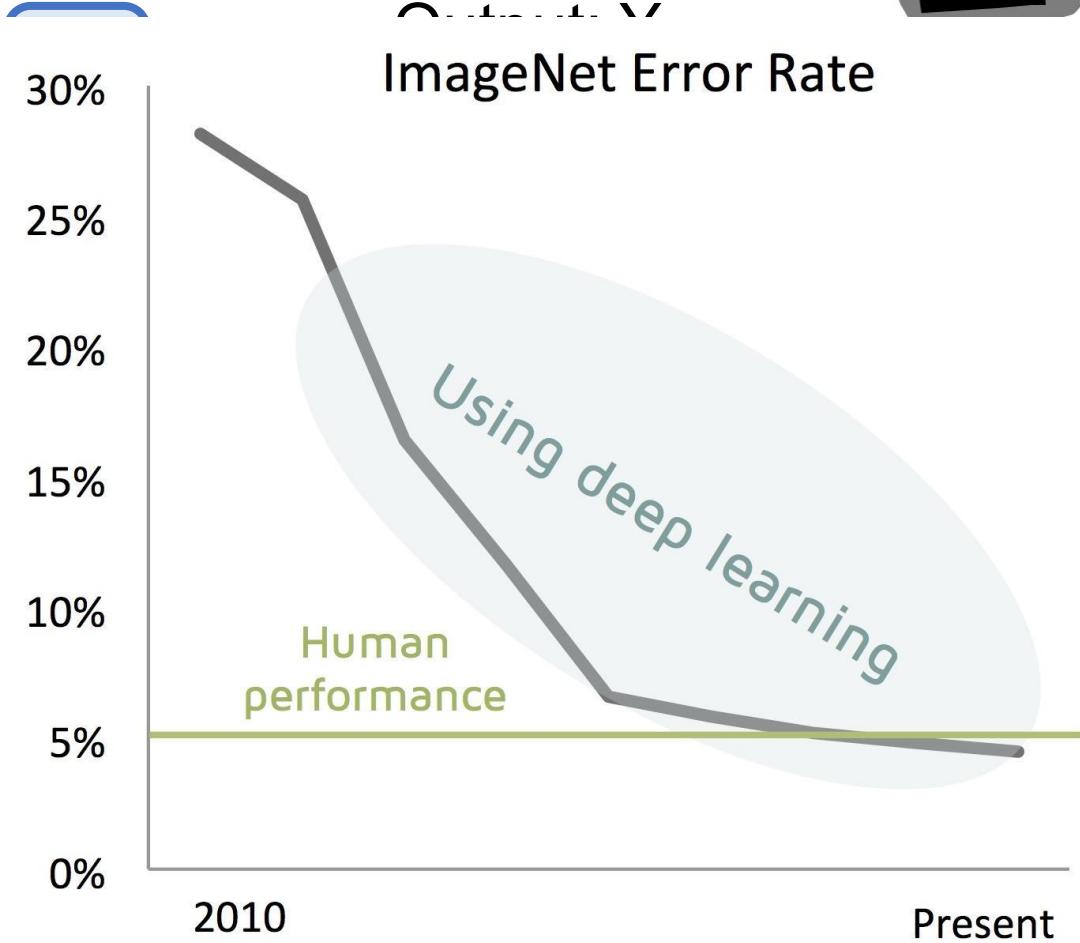
$$f(X) \square Y$$

What is Deep Learning?

Input: X

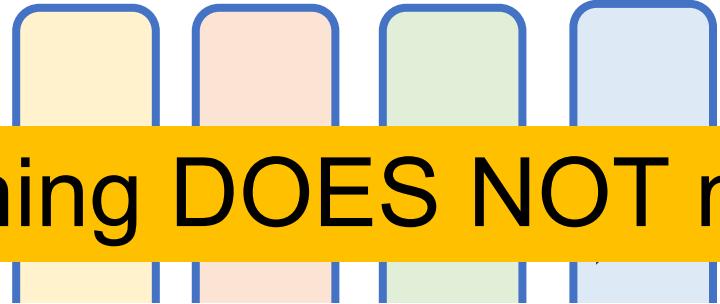


$$f_4(f_3(f_2(f_1(X))))$$



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.

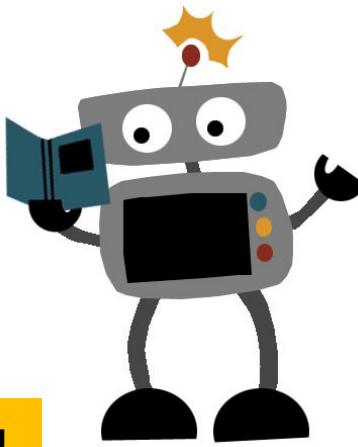
[<https://deepart.io>]

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>]

"Cooking?"



What is NOT Deep Learning?

Deep Learning is NOT AI



HOME > AI-POWERED SOLUTIONS

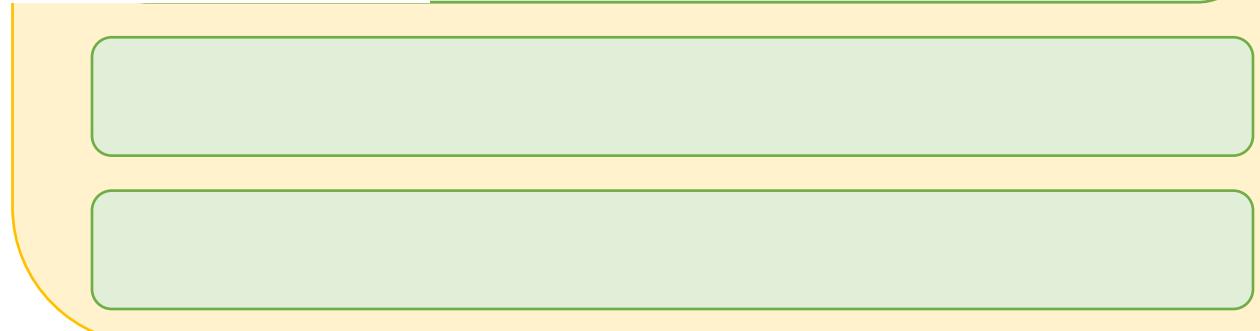
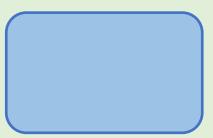
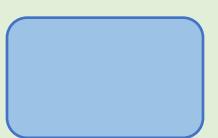
AI-Powered Solutions

[https://www.arubanetworks.com/solutions/ai-powered-solutions]

Artificial Intelligence (AI)

Learning

ing



Recap

Input: X



Machine Learning

$$f(X) \square Y$$

Output: Y

"Cooking?"



Deep Learning is NOT AI

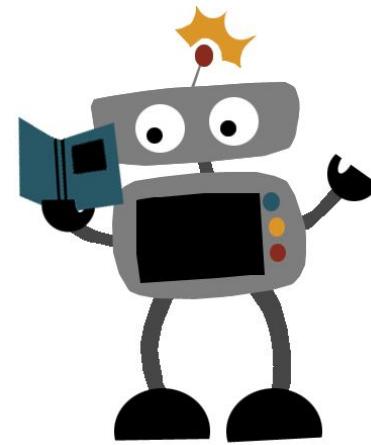


Deep Learning DOES NOT mimic the brain!



Deep Learning

$$f_4(f_3(f_2(f_1(X)))) \square Y$$



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

<http://cs.brown.edu/courses/csci1470>



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

The Canvas Website

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

2023 Spring

Home

Syllabus

Quizzes

Media Library

Ed Discussion

Announcements

GradeScope

Zoom

CSCI1470/2470 Spring23 Deep Learning

[Jump to Today](#)



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

The collage includes:

- A scatter plot with three green 'x' points and a red diagonal line.
- A neural network diagram with two layers of nodes (green and blue) connected by black lines.
- A grid of nine small images with labels:
 - Row 1: 6: frog, 9: truck, 9: truck, 4: deer, 1: automobile
 - Row 2: 1: automobile, 2: bird, 7: horse, 8: ship, 3: cat
 - Row 3: 1: automobile, 2: bird, 7: horse, 8: ship, 3: cat
- The TensorFlow logo and the word "TensorFlow".
- The PyTorch logo and the text "..and a tiny bit of Pytorch".
- Three horizontal labels at the bottom: "Language modeling", "a cake with a slice cut out of it", and "Variational Autoencoders".
- The central label "Image Captioning" in orange.

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!

Lectures

Monday, Wednesday, and Friday at 12:00-12:50pm in Salomon Center 001

Course offered in-person with recordings made available for reviewing.

[Week 1-4] Deep Learning Basics

[0-2] 01/25 Welcome to Deep Learning

[0-3] 01/27 Supervised Learning - Classification/Regression, Training/Validation/Testing

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!**

Hours

[External] CSCI1470 Calendar

Today ◀ ▶ Jan 29 – Feb 4, 2023 ▾

Print Week Month Agenda ▾

Sun 1/29	Mon 1/30	Tue 1/31	Wed 2/1	Thu 2/2	Fri 2/3	Sat 2/4
			HW1 Released		HW0 Conceptual +	
10am	10 – 12p TA Hours [Shirley & Ray W.] TBD	12p – 1p Deep Learning Salomon Center,		10 – 12p TA Hours [Joe & Raymond] TBD		
11am						
12pm			12p – 1p Deep Learning Salomon Center,		12p – 1p Deep Learning Salomon Center,	
1pm						
2pm					2p – 4p TA Hours [Eric] TBD	2p – 4p Lab 9 [HeTA Hours Earth] [Jun & Logan] TBD
3pm					3p – 5p Lab 8 [Preeti & Logan] CIT 201	2p – 4p 2p – 4p Lab 9 [HeTA Hours Earth] [Jun & Logan] TBD
4pm	4p – 6p Conceptual Hours [Rob & Dave] CIT 165 (Motorolla)	4p – 6p Lab 3 [NaTA Hours Dylan] CIT 265	4p – 6p Lab 4 [ShTA Hours Iris] CIT 201	4p – 6p TA Hours [Iris & Dylan] TBD	5p – 7p TA Hours [Will & Raymond] CIT 165 (M) TBD	4p – 6p TA Hours [Henry] TBD
5pm						
6pm	6p – 8p TA Hours [Dave & Rob] CIT 201	6p – 8p Lab 1 [Taishi & Bumjin] CIT 201	6p – 8p Lab 4 [ShTA Hours Iris] CIT 201	6p – 8p TA Hours [Will & Raymond] CIT 165 (M) TBD	7p – 9p Conceptual TA Hours [Will & Raymond] CIT 165 (M) TBD	
7pm	TBD					
8pm		8p – 10p Lab 2 [NiTA Hours Jun] CIT 201	8p – 10p Lab 5 [Eric & Will] CIT 201	8p – 10p Lab 6 [RaTA Hours Earth & Jun] CIT 201		

Events shown in time zone: Eastern Time - New York

+ Google Calendar

Assignment logistics

- Assignments
 - Get stencils via Github Classroom
 - Submission via Gradescope



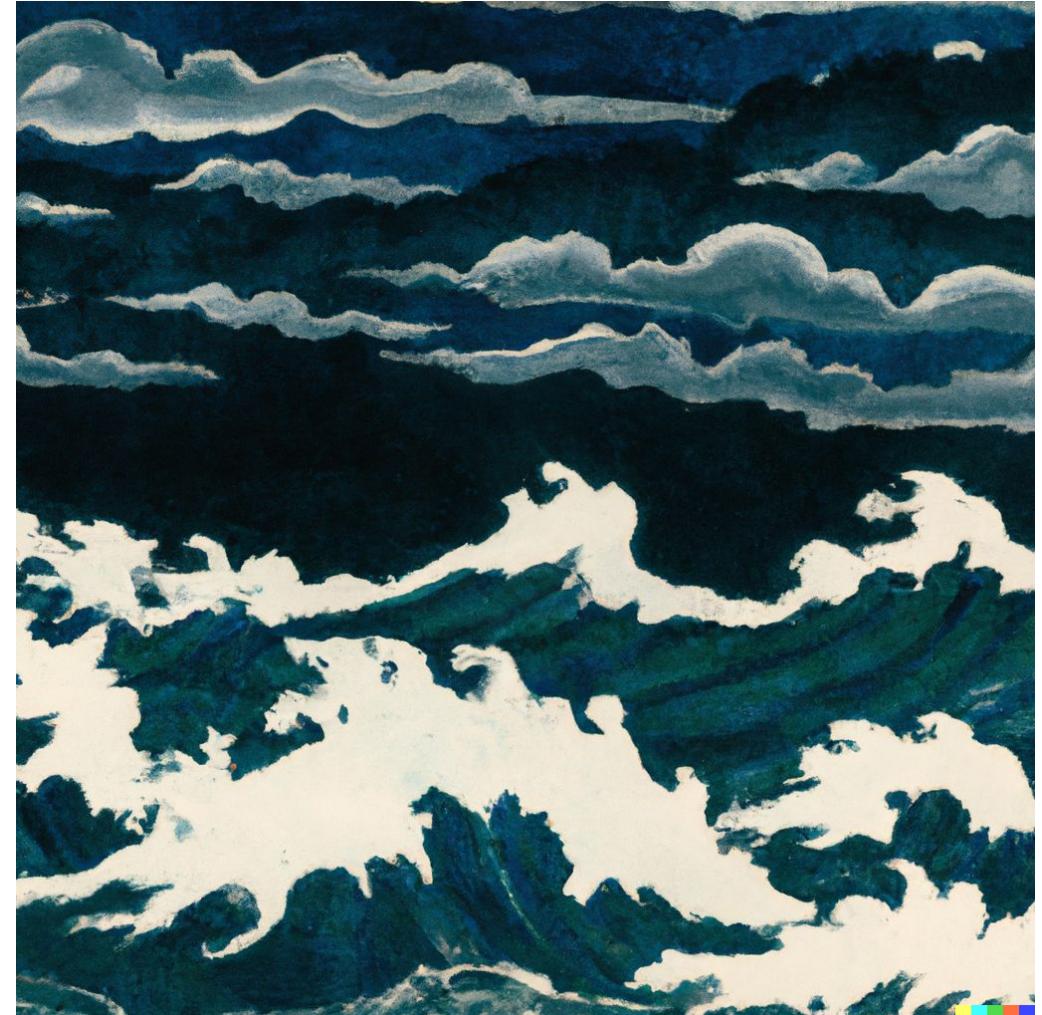
Homework and Lab 0 + SRC discussions

somewhat
NEW!!

- 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 😞



DALL-E 2 prompt "japanese painting of a stormy ocean"

This course is also offered in the Fall!



Professor Chen Sun
(taught in Fall 2022)

Acknowledgements



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

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?

