CS 615 – Deep Learning

Introduction

Objectives

- ML vs DL
- Course Overview

AI vs ML vs DL vs DS (oh my!)

- First off, what's the difference between Artificial Intelligence (AI), Machine Learning (ML), Deep Learning (DL), and Data Science (DS)?

AI vs ML vs DL vs DS (oh my!)

- Artificial Intelligence is a large domain
- It includes a lot of topics, but in a nutshell describes a set of algorithms that attempt to make decisions.

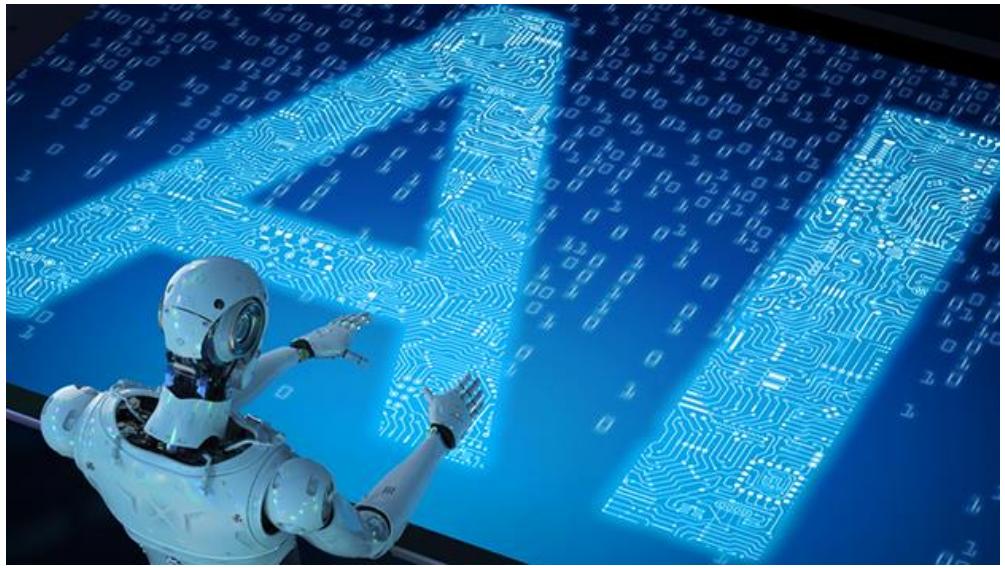


Image from newyork.cbslocal.com

AI vs ML vs DL vs DS (oh my!)

- Machine Learning is a *subset* of AI, where algorithms attempts to build (learn) a system using previous data, that can make predictions on new data.
- Deep Learning is a *subset* of Machine Learning
  - A particular set of ML Algorithms
- Data Science is the analysis and use of data
  - This includes stuff from AI/ML/DL but also includes other things.
  - Like simple statistical analysis, database management, etc…

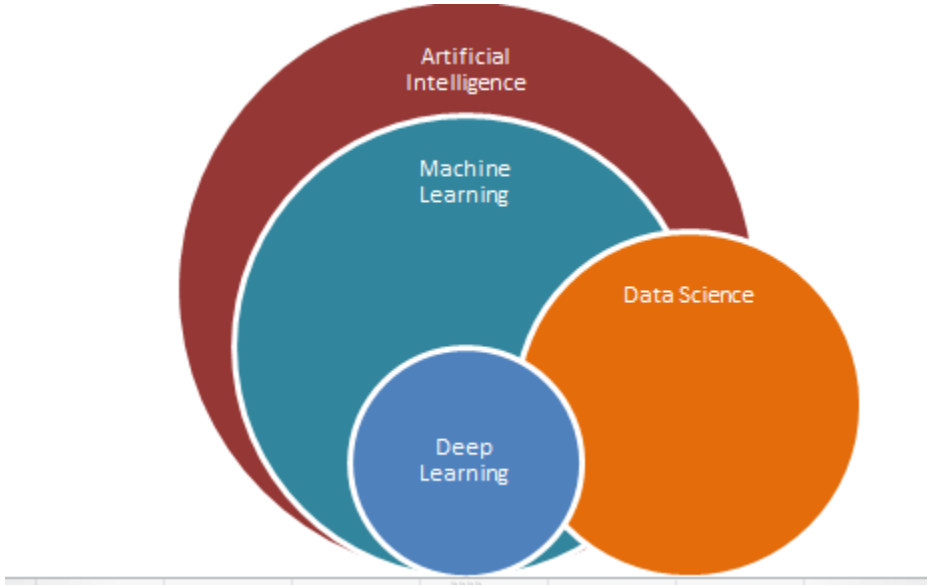


Image from becominghuman.ai

CS613 vs CS615

- Here at Drexel we opted to make ML and DL separate and independent courses.
- Why?
  - For one thing, 10 weeks isn't enough to cover both
  - On a more logistic note, this way we can alternate when they're offered.
- Therefore there will be some redundancy.
  - Which isn't necessary bad.
  - But sorry for those of you who took CS613 (hope I don't bore you too much)

Preliminaries

- So we'll start off with some fundamental ML stuff needed for DL
- In particular
  - Basic Terminology
  - Evaluation methods
- But first let's get into some course logistics (yay!)

Administrative Stuff…

Contacts

- Instructor:
  - Matt Burlick, mjburlick@drexel.edu, 3675 Market Street, Room 1139
- Teacher Assistant:
  - Maryam Daniali, md3464@drexel.edu
- Office Hours will be on Zoom!
  - These will be one-on-one meetings with a waiting room.
  - Links to the rooms are in the Office Hours sections in Bblearn.
  - To the right are the times.
- Lectures:
  - Section 001 Thursdays 6:30pm-9:20pm Bblearn Collaborate
  - Section 900 Online N/A

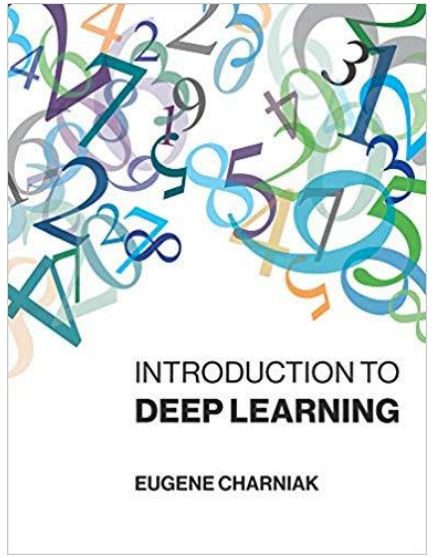
	Monday	Tuesday	Wednesday	Thursday	Friday
4pm	Daniali				
5pm	Daniali			Burlick	
6pm			Daniali		
7pm			Daniali		
8pm					
9pm				Burlick	
10pm				Burlick	

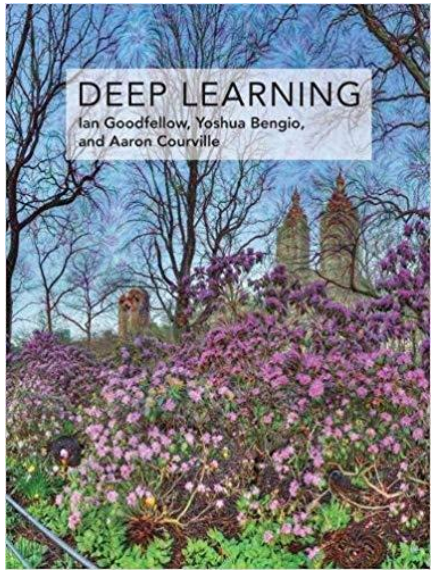
Pre-Requisites

- CS 520 (Computer Science Foundations)
- CS 570 (Programming Foundations)
- CS 571 (Advanced Programming Techniques)
- The idea is that you should be a proficient programmer such that you can pick up a new language “on the fly” and use it as a tool.
- You should also be comfortable with linear algebra, probability, statistics, and calculus.
  - There’s an area on Bblearn with “Math Primers”. Review those ASAP

Course Resources

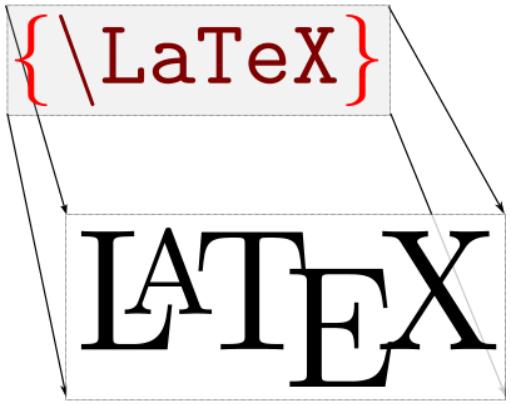
- Official Textbook:
  - Deep Learning, by Ian Goodfellow, et al, The MIT Press. ISBN: 978-0262035613
- Recommended Textbooks:
  - Introduction to Deep Learning by Eugene Charniak, ISBN: 978-0-262-03951-2
- Blackboard
- Zoom (office hours)
- Slack
  - Use this as your first place to pose questions
    - Hopefully not just I can help
  - But don't post code.
  - drexelcs615spring2020.slack.com

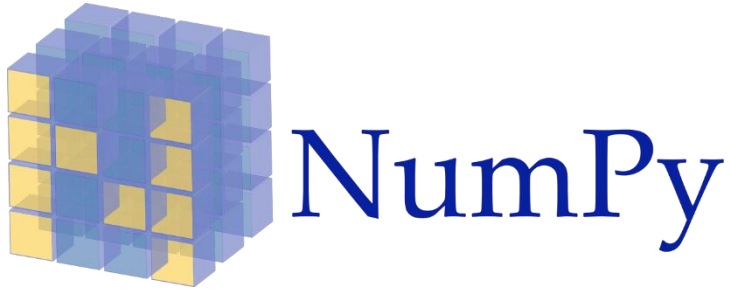




Course Software

- Programming Environment
  - Your choice (most choose Python or Matlab)
  - I recommend MatLab (programming environment)
    - Obtain for free from http://drexel.edu/irt/computers-software/software/
- Typesetting Environment
  - LaTex
    - First download LatTex itself (warning, it's huge!)
      - https://latex-project.org/ftp.html
    - Then (optionally) get a IDE wrapper for it
      - http://www.xm1math.net/texmaker/download.html#window
      - https://github.com/TeXworks/texworks/releases
    - Or use an online Latex typesetter!
      - www.overleaf.com





Evaluation

• Homework Sets	30%
• Midterm Presentation	10%
• Exam	30%
• Final Project	30%

3 x 10%

Homework Sets

- Include theoretical questions as well as implementation of DL algorithms
- Submission is to be made on Blackboard as a single compressed file consisting of:
  - PDF with your solutions to the theory questions
    - **Must be typeset with LaTex**
  - README text file on how to run your code
  - Makefile, in necessary
  - Source code
- Note: If you work in any language other than Matlab, make sure that your code works on tux. We can't be expected to have all your dependencies, etc. on our local system.

Exam

- Based on theory and mathematics.
- Similar to theory questions that are part of assignments.

Project Proposal

- Present a slidedeck containing the following content:
  - What problem are you tackling?
  - Where are you getting your data from and what does it look like?
  - What resources are you basing your approach off of?
  - What your basic approach?

Final Project

- There are three components:
  - Presentation
  - Paper
  - Source code
- Presentation
  - Slide deck should cover
    - What problem are you tackling?
    - Where are you getting your data from and what does it look like?
    - What resources are you basing your approach off of?
    - Details of your approach/algorithm.
    - Results and observations
    - Future Extensions

Final Project

- Paper
  - Should be a Latex typeset “conference style” paper
  - Sections should include:
    - Abstract
    - Background
    - Related work
    - Various sections about your approach, including all applicable mathematics. Imagine that someone wants to be able to recreate your work
    - Evaluation
      - Including info about your dataset
      - Applicable figures
      - Applicable tables/stats
    - Conclusions
    - Future Work
    - Bibliography

Course Policies

- Assignments are to be done individually unless otherwise noted
- While you are encouraged to use a versioning system like github or bitbucket, please make your work for this course **private.**
- Any dispute about an assignment grade must be formally made (email) and resolved within 5 days of receiving your grade. After this period your grade cannot be adjusted.
- You will lose 1% for every hour late (round up) on an assignment up to 48hrs (after which you will receive a zero)

Math, Math, Math,….

- This is mostly an applied linear algebra and multi-variate calculus class.
- If you aren't interested (and good at) that stuff, this course may not be for you.

Notation/Mathematics/Matlab

- I have placed on Blackboard a number of resources to help you review the expected and needed math as well as get you started in Matlab (if you so choose).
- Math Primers
  - Course Notation – There will be a lot of symbols used in this course. This document tries to give you an overview of them.
  - Similarity and Distance Functions – Often we will need to compute the distance and/or similarity between observations. This document includes several commonly used ones.
  - Calculus
  - Linear Algebra
  - Probability and Statistics

Notation/Mathematics/Matlab

- I have placed on Blackboard a number of resources to help you review the expected and needed math as well as get you started in Matlab (if you so choose
- Programming References:
  - Matlab Functions – Here's a list of most of the Matlab functions I used in developing this course.
  - Python Functions – Here's a list of most of the Python functions/libraries I used in developing this course.