CS 584 – Machine Learning

Topic: Syllabus

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Instructor

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  - Associate Professor in CS
  - Director of MAS-AI
  - Director of the Machine Learning Laboratory
- Office Hours
  - TBD

TA

- Ruo Yang
  - PhD student at the Machine Learning Laboratory
- Office hours
  - TBD

Course Description

http://bulletin.iit.edu/search/?search=cs+584

Introduce fundamental problems in machine learning. Provide understanding of techniques, mathematical concepts, and algorithms used in machine learning. Provide understanding of the limitations of various machine learning algorithms and the way to evaluate performance of learning algorithms. Topics include introduction, regression, kernel methods, generative learning, discriminative learning, neural networks, support vector machines, graphical models, unsupervised learning, and dimensionality reduction.

Topics

- Concept learning
- Decision trees
- Evaluating classifiers
- Naïve Bayes
- Logistic regression
- Regression
- Neural networks
- SVMs
- Clustering
- MDPs
- Reinforcement learning

Textbook

- There is no required textbook for this course
- You might find the following textbook
  - http://www.cs.cmu.edu/~tom/mlbook.html
  - (Free pdf is available on the book's website)

What This Course is and What it isn't

- This is not a deep learning course
  - We'll cover DL but not in depth
- This is not a reinforcement learning course
  - We'll cover RL but not in depth
- This is not about big data
  - We'll use datasets that can be processed using personal computers
- This is an overview course; we'll cover both
  - Theory (optimization for example)
  - Applications (Python programming using small datasets)

Related CS Courses

- http://bulletin.iit.edu/courses/cs/
- 400-level
  - CS 422, CS 429, CS 480, CS 481, CS 482, CS 484
- 500-level
  - CS 512, CS 522, CS 529, CS 577, CS 578, CS 579, CS 580, CS 581, CS 582, CS 583, CS 585

Course Objectives and Outcomes

- Understand the why and how of ML
- Derive fundamental algorithms starting from basic mathematical and probabilistic principles
- Apply several algorithms to real-world datasets
- Perform model and hyperparameter selection
- Elaborate the limitations of ML models

Course Logistics

Dates and Times

- This course has no set time
- I'll record lectures via Zoom twice a week
  - Mostly on Tuesdays and Thursdays

Websites

- Blackboard/Lumina
  - Assignments, lecture videos, discussions
- GitHub
  - Slides, notebooks
  - https://github.com/cs584/CS584-F22
- Piazza
  - Questions & answers
  - https://piazza.com/iit/fall2022/cs584section03
- OneNote
  - Instructor's handwritten notes
  - See BB/Lumina for the link

GRADING

Assignments	20%
Project	10%
Midterm Exam	30%
Final Exam	40%

Assignments (20%)

- 5 – 7 assignments
- Most assignments will have two parts
  - Written
  - Programming
- Possible assignment topics
  - Decision trees
  - Naïve Bayes
  - Logistic regression
  - Regression
  - SVMs
  - Neural networks
  - Clustering
  - Reinforcement learning

Project (10%)

- One-month long project
- Will consist of
  - Programming
  - A presentation document
  - A final report
- Current idea (might change later)
  - Pick a reasonable size dataset
  - Conduct an analysis of several algorithms and hyperparameters using learning curves and several performance metrics

Late Submission Policy for Assignments

- 5-minute grace period, without any penalty
- After that, every late minute will cost
  - $\frac{100}{48 \times 60} \cong 0.03472$ points per minute

Exams

- A midterm (30%) and a final (%40)
- Like written assignments
- Via Blackboard/Lumina
- Midterm exam date
  - October; date TBD
- Final exam date
  - December 5 – 10
  - The date is TBD by the university

Academic honesty

- https://web.iit.edu/student-affairs/handbook/fine-print/code-academic-honesty

Accommodations

- Reasonable accommodations will be made for students with documented disabilities. In order to receive accommodations, students must obtain a letter of accommodation from the Center for Disability Resources
- https://www.iit.edu/cdr

Simple Exercise

You are training a model for loan approval/rejection. Inputs are: MissedPayments, Income, Wealth. The output is the decision to approve or reject the loan application. Here is a training dataset.

MissedPayments	Income	Wealth	Decision
Yes	Low	Low	Reject
No	High	High	Accept
No	Low	Low	Reject
No	Low	High	Accept

Here are the test cases. How should your model decide on these cases? Why?

MissedPayments	Income	Wealth	Decision
Yes	Low	High	??
Yes	High	Low	??
Yes	High	High	??
No	High	Low	??