Welcome

CISC 7026 - Introduction to Deep Learning

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Course Background

Course Background

Please provide feedback privately to me

- Email smorad at um.edu.mo
- Chat after class

I would like to make the class **interactive**

The best way to learn is to **ask questions** and have **discussions**

Course Background

I will tell you about myself, and why I am interested in deep learning

Then, **you** will tell me why you are interested in deep learning

It will help me alter the course towards your goals

Course Background

I was always interested in space and robotics

Course Background

Most of the classical robotics learned in school **does not work** in reality
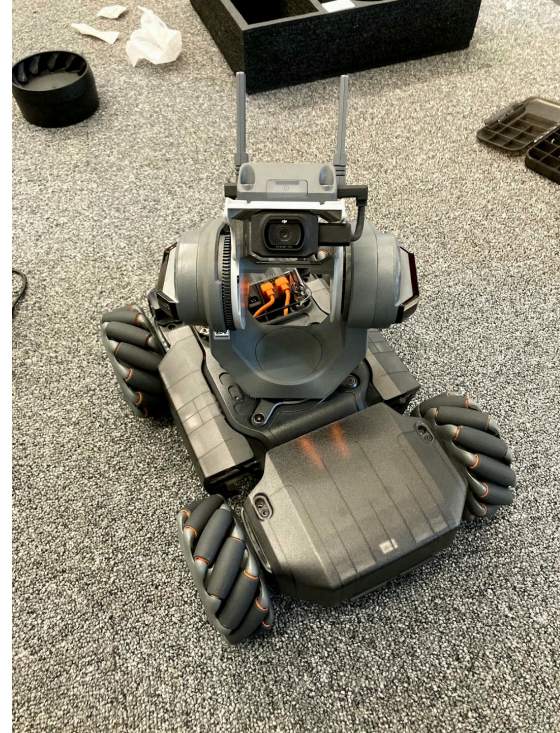

Today's robots are stupid – important robots are human controlled

Course Background

Since then, I have focused on creating less stupid robots

Robots that **learn** from their mistakes

Course Background

There are many tasks that humans do not like, but must be done

- We can solve these tasks with intelligent robots
- Humans can focus on passions like sports, art, studies, etc

I am interested in **deep learning** because I believe it is the only way to create intelligent robots that learn from their mistakes

Question: Why are you interested in deep learning?

Course Background

I lead the Behavior Optimization and Learning Theory (BOLT) Lab

I am looking for a research student focusing on deep reinforcement learning and robotics **with a strong mathematical background**

If the course is too easy, send me an email or come to office hours
- I give all applicants a 3-4 week project to measure their capabilities

Prerequisites

Prerequisites

- Programming in python
  - ▸ Should be able to implement a stack, etc
  - ▸ GPT/DeepSeek is **not enough**, you will fail
    - – I pick rare libraries that DeepSeek does not understand
- Linear algebra
  - ▸ Multiply matrices
  - ▸ Invert matrices
  - ▸ Solve systems of equations $Ax = b$
- Multivariable calculus
  - ▸ Computing gradients $\left(\frac{\partial f}{\partial x_1} \quad \frac{\partial f}{\partial x_2} \quad \cdots \right)^{\top}$

Prerequisites

Good to Know:

- Probability and statistics
  - ▸ Bayes rule, conditional probabilities $P(a \mid b) = \frac{P(b \mid a) P(a)}{P(b)}$

- Numerical/array programming
  - ▸ Numpy, matlab, octave, etc.

Grading

Grading

- 30% assignments
- 30% exams
- 30% final project
- 10% participation
  - ‣ 5% group participation
  - ‣ 5% individual participation

Grading - Assignments

Turn in assignments on time!

Late penalties:

- -25% 0-1 days late
- -50% 1-2 days late
- -75% 2-3 days late
- -100% 3+ days late

Grading - Exams

There are 3 exams in this course, I will only score your best two exams

Example 1: You are sick and miss exam 2, but you take exam 1 and 3

Exam 1: 70/100   Exam 2: 0/100   Exam 3: 90/100   Score: 80/100

Example 2: You take all three exams

Exam 1: 70/100   Exam 2: 80/100   Exam 3: 90/100   Score: 85/100

Example 3: If you are very smart you can skip exam 3

Exam 1: 100/100   Exam 2: 100/100   Exam 3: 0/100   Score: 100/100

Grading - Final Project

Final project instructions already on Moodle

- Listen to lectures to understand deep learning
- Form of a group of 4 or 5 members
- Think of an interesting deep learning project
- Create and submit your project plan
- Submit your final project

Grading - Participation

5% group participation, 5% individual participation

- All students share group score, work together!
- Individual participation for asking/answering questions in class
- If you never speak, **you will get 0 individiual participation points**

It is my job to prepare you for success in deep learning

- Some of you are shy or have poor English skills
- To succeed, you need **confidence** and **English skills**
  - Maybe in 10 years, best papers will be in Chinese, **but not today**
  - Andrew Ng, Yann LeCun, and Yoshua Bengio
    - Learned English as a second language and confident speakers
    - Other great scientists are forgotten

Course Structure

Course Structure - Office Hours

Office Hours: Thursday 14:00-16:00

Review assignments early, so you can attend office hours

Office hours may be crowded before deadlines
- You will not have much time if you have not started!

Course Structure - Planned Topics

- (08.22): Course Introduction
- (08.29): Linear Regression
- (09.05): Neural Networks
- (09.12): Backpropagation and Optimization
- (09.19): Exam 1
- (09.26): Classification
- (10.03): Training Tricks
- (10.10): Convolutional Neural Networks

- (10.17): Exam 2
- (10.24): Recurrent Neural Networks
- (10.31): Autoencoders and Generative Models
- (11.07): Diffusion Models
- (11.14): Attention and Transformers
- (11.21): Exam 3
- (11.28): Foundation Models

Course Structure - Homework Assigments

- (08.22 - 08.29): (Optional) Array Programming
- (08.29 - 09.12): Linear Regression
- (09.12 - 09.26): Neural Networks and Backpropagation
- (09.26 - 10.10): MLP Regression
- (10.10 - 10.24): Convolutional MNIST Classification
- (10.24 - 11.07): RNN Stock Market Prediction
- (10.31 - 11.07): Final Project Plan
- (11.07 - 12.05): Final Project

Course Structure - Resources

Most communication will happen over Moodle

- I will try and post lecture slides after each lecture
- Assignments
- Grading

Course Structure - Resources

I designed the course material myself

- Assignments inspired by Prof. Dingqi Yang
- You can view presentation source code online
  - ▸ https://github.com/smorad/um_cisc_7026
- I will upload slides to moodle after lecture

Course Structure - Resources

If you do not like my teaching style, it is ok

You can instead follow the *Dive into Deep Learning* textbook

- Available for free online at https://d2l.ai
- Syllabus contains corresponding textbook chapter
- Also available in Chinese at https://zh.d2l.ai

Course Structure - Breaks

First time I taught this course, all lectures were 3 hours

- Students hate this
- Stop paying attention around 2 hours
- After exam students cannot learn

I will try to keep lectures less than 2.5 hours

- I will always stay later to answer questions
- After exam there will be no lecture, you can go sleep

I might also provide short breaks

- Leave the classroom
- Use the toilet
- Ask me questions

Cheating

Cheating

I take cheating **very seriously**

If caught, you get a 0 in the course and **fail the course**

- Will drop your GPA, and may cause removal from Master program

I failed cheating students last year, it is not worth it

- I already drop your lowest exam score

Cheating

The value of education is in learning, not the degree

- Just study and do your best

Cheating is not possible for Baidu/DeepSeek/etc interview

- Invite you on-campus for 5-hour whiteboard interview
- Cannot cheat, cannot get lucky
- Only way to succeed is to understand the material

Cheating

Data Scientist Interview

Sep 10, 2024 • • •

⚇ Anonymous Interview Candidate

⊙ Shanghai, Shanghai

✗ No offer   ✓ Positive experience   ✗ Difficult interview

Application
I applied online. I interviewed at ByteDance (Shanghai, Shanghai) in Aug 2024

Interview
The interviewer focus on interviewee's understanding on machine learning concepts from Boosting algos to Deep Learning. It would be difficult if someone didn't prepare all those conceptual detail well. However, the question list is a nice guidance for preparing interviews of similar roles.

Cheating

Machine Learning Engineer Interview   16 May 2024 •••

⊖ Anonymous interview candidate

✗ No offer   — Neutral experience   ✗ Difficult interview

Application
I interviewed at Baidu in 16/5/2024

Interview
it has 5 rounds of interviews, each of them is very long. I only managed to get to the second round with technical interview, and I failed. It's not a pleasent experience

Interview questions [1]
Question 1
describle tree algorithm and wirte in python

Answer question →

👏 Helpful   ⇗ Share

Questions or Comments?

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https://ummoodle.um.edu.mo/pluginfile.php/1298433/mod_resource/content/7/syllabus.pdf

Introduction to Deep Learning