CS5260: Neural Networks and Deep Learning II

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Spring of 2022

1. Course Description

This course gives a graduate-level introduction to deep learning and in-depth coverage of new and advanced methods in deep neural networks, as well as their underlying theory. It emphasizes approaches with practical relevance and discusses a number of recent applications of deep learning in areas like recommender systems, computer vision, natural language processing and robotics. The methods and platforms for implementation and evaluation of deep learning systems would be discussed. Furthermore, learners will practise employing deep learning to deal with a few applied examples using distributed computing environments. An open research project is a major part of the course.

2. Tentative Schedule

Week 1 (January 14th):
Adversarial Machine Learning

Week 2 (January 21th):
Deep Reinforcement Learning
Tutorial 1: Adversarial Machine Learning, hw1

Week 3 (January 28th):
Generative Adversarial Networks
Tutoria 2: Deep Reinforcement Learning, hw2

Week 4 (February 4th):
Neural Architecture Search
Tutorial 3: Generative Adversarial Networks, hw3

Week 5 (February 11th):
Mixture of Experts
Tutorial 4: Neural Architecture Search

Week 6 (February 18th):
Contrastive Learning/Self-Supervised Learning
Tutorial 5: Mixture of Experts

Week 7 (March 4th):
Latest on Transformers: New Techniques after BERT
Tutorial 6: Contrastive Learning/Self-Supervised Learning, hw4

Week 8 (March 11th):
Advanced deep learning optimizers and convergence
Tutorial 7: Latest on Transformers: New Techniques after BERT, hw5
Week 9 (March 18th):
Distributed deep learning, TPU Pod, and Google's MLPerf results
Tutorial 8: Advanced deep learning optimizers and convergence, hw6

Week 10 (March 25th):
Distributed optimization: large-batch training
Tutorial 9: guidance on final project

Week 11 (April 1st):
Practical techniques to handle huge models

Week 12 (April 8th):
Student presentation (5 minutes per team) or poster session

Week 13 (April 15th):
Public holiday, no class

3. Evaluation and Grading

Weekly homework (40%)
Please form a team of 2-4 students for the final project

1. Each team gives a talk or presents a poster (20%)
2. Each team finishes a report (40%)

The workload can be reduced (depending on the feedback from the students)

- Homework requirement and deadline
    - **6** assignments (assigned on weeks 2, 3, 4, 7, 8, 9, due in one week). Each assignment will take two to four hours to finish for most students. Week 10, 11, 12 will be left to prepare the final report.
    - Every week, TA will give a brief introduction of assignments in the tutorial.

    - The assignments are published by Jupyter notebook, which can be run on google colab. Each assignment will have several tasks, e.g., implementing some key functions/algorithms.
    - Please finish the tasks according to the instructions. Only change the code in the required snippets and **DO NOT** change others or add new code/text snippets.
    - Submission: rename the assignment file as "StudentNumber_your-Name_assignment_1.ipynb". e.g., 'a0100000J_Wang-Wenjie_assignment_1.ipynb'. And submit it to **Luminus**. We will create a new folder for each assignment.
    - In addition to the ".ipynb" file, you may need to submit another ".py" file. More details can be found in the assignments.
    - The submission deadline for each assignment is 23:59pm on Friday of the next week.
    - Please follow the instructions strictly, otherwise you might be **penalized**.
    - If you have any questions on assignments and tutorial, please contact LIU Yong (e0672130@u.nus.edu) and QIN Ziheng (e0823059@u.nus.edu)
- Final project report
    - Send it to yang.you.cs@gmail.com before 1st of May
    - Use NeurIPS format
        - https://nips.cc/Conferences/2020/PaperInformation/StyleFiles
        - The report should have at most 9 pages (contents & references)

4. Module Information

- Class Time: Friday 6:30-8:30pm
- Tutorial Time: Friday 8:30-9:30pm (From 3rd week)
- Location: zoom (due to COVID-19)