CSCI 8945 Advanced Representation Learning
Syllabus

Fall 2024

Instructor: Prof. Jin Sun
4 Credit Hours

Catalog Description: Advanced Representation Learning is a course designed to delve deeper into the fundamental concepts of representation learning and its applications. In this class, students will explore various representation learning techniques, including both classical and deep learning methods, and learn how to apply these techniques to solve complex problems in computer vision, natural language processing, audio, and other areas. By working on the research project component of the course, the students will develop novel methods and theories about representation learning and prepare manuscripts describing their findings. By the end of this course, the students will have a solid understanding of the state-of-the-art in representation learning and be able to apply these techniques to solve real-world problems.

Prerequisites: Students should have a solid understanding of machine learning basics and relevant math concepts.

Class Location and Times:

Tue & Thu	12:45 pm - 2:00 pm	222 Boyd	Lectures
Wed	12:40 pm - 1:30 pm	222 Boyd	Projects and research topics discussion

Recommended Readings:

- Machine Learning: a Probabilistic Perspective by Kevin Murphy.
- Foundations of Data Science by Avrim Blum, John Hopcroft, and Ravindran Kannan.
- Dive Into Deep Learning, https://d2l.ai/
- Recent research papers

Student Outcomes:

1. Demonstrate understanding of machine learning and deep neural network fundamentals.
2. Gain experience deploying deep learning models in computer vision, natural language processing, and audio domains.

Instructor Contact:

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Evaluation and Grading: The final course grade will be weighted as follows:

Paper presentations:	20%
Homework:	20%

Midterm exam:	20%
Project and Presentation:	40%

Homework assignments: Your homework submission should be in PDF format. You are encouraged to use LaTeX (for online editing, use Overleaf). Cite any references used (including books, online webpages, and code). Your homework should be done by yourself, not as a group.

The PDF file should contain all essential text, equations, figures, code, and program outputs. Attach your code as the appendix.

Midterm exam: You will take an in-class exam to test your knowledge on the essential concepts covered in the class including general representation learning techniques and various domain-specific representations such as word embeddings.

Paper presentation: You will choose one research paper to present in the later part of the semester. Make sure you cover all the essential components and main messages about the paper and lead insightful discussions with the class.

Team Project: You will work in a team on a course project. Each team should have 2-3 members. You are encouraged to design the project to solve a real-world application using deep learning and computer vision. Feel free to use any programming language or software packages of your choice. The schedule for the project is as follows:

1. **Project Proposal**: The project proposal should clearly state what your team plan to do. It should be four pages long (not including references). It should contain a timeline. You should list the questions the project will address and that will be discussed in the report. You should list what software you will be using or will build upon. Describe the datasets you will use and how will you know if the project is successful. Describe the hypotheses you will test and the related work. You should be able to reuse much of the text for the final report.

2. **Project Milestone**: You can re-use the project proposal for this report but expand it with additional content. You should talk about preliminary results and/or other measurable items listed in the proposal.

3. **Project Report and Presentation**: The final report contains a complete description of the project: what you have done and what the result looks like. It should be about six to eight pages long (not including references). You are encouraged to format it in CVPR format. We will have a presentation session for all projects at the last day of the class. Make sure every member in your team participate in the presentation.

Course Topics:

Data representation space and structures
Visual representations
Language representations
Audio representations
Graph networks
Multi-modal representations
Advanced Topics: Meta-learning, adapter approach, beyond perception, etc

School of Computing
Policy Statement on Academic Honesty

The Computer Science Department recognizes honesty and integrity as necessary to the academic function of the University. Therefore all students are reminded that the CS faculty requires compliance with the conduct regulations found in the University of Georgia Student Handbook. Academic honesty means that any work you submit is your own work.

Common forms of academic dishonesty against which students should guard are:

1. Copying from another student's test paper or laboratory report, or allowing another student to copy from you;
2. Fabricating data (computer, statistical) for an assignment;
3. Helping another student to write a laboratory report or computer software code that the student will present as his own work, or accepting such help and presenting the work as your own;
4. Turning in material from a public source such as a book or the Internet as your own work.

Three steps to help prevent academic dishonesty are:

1. Familiarize yourself with the regulations.
2. If you have any doubt about what constitutes academic dishonesty, ask your instructor or a staff member at the Office of Judicial Programs.
3. Refuse to assist students who want to cheat.

All faculty, staff and students are encouraged to report all suspected cases of academic dishonesty. All cases of suspected academic dishonesty (cheating) will be referred to the Office of the Vice President for Instruction. Penalties imposed by the Office of Judicial Programs may include a failing grade in the course and a notation on the student's transcript. Repeated violations are punishable by expulsion from the University. For further information please refer to the UGA Code of Conduct, available at the URL below.

https://honesty.uga.edu/Academic-Honesty-Policy/