COMP 5970/6970

Federated and Collaborative Machine Learning

Instructor: Jiaqi Wang

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AUBURN UNIVERSITY

About Me

Jiaqi (Jack) Wang

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Bio

I am an assistant professsor in Department of Computer Science and Software Engineering at Auburn University. I received my Ph.D. degree from The Pennsylvania State University in 2025, where I was advised by Prof. Fenglong Ma. My research interests include machine learning, healthcare informatics, foundation models, and large language models (LLMs). More about my research can be found in the Group Page. Prior to that, I obtained my M.S. from The University of Georgia and B.E. from Zhejiang University.

[Recruitment] The opportunities of Ph.D. students and research interns can be found in the Group Page.

Research Topics

Jack's research interests are machine learning, healthcare informatics, foundation models, and LLMs. More about research directions can be found in the Group Page.

- Collaborative Machine Learning: Heterogeneous Model Cooperation, Unified Collaboration System
- Healthcare Informatics: Collaborative Diagnosis, Healthcare Disparities, Multimodal Biomedical Informatics
- Foundation Models and LLMs: Large Model Distributed Learning, Multimodal Foundation Model

About My Lab

Group Introduction

Welcome to our lab in the Department of Computer Science and Software Engineering at Auburn University. Our research is driven by a passion for uncovering the elegance of foundational science and expanding the frontiers of knowledge. We focus on collaborative machine learning, multimodal foundation models, and the grounding of AI in real-world applications, especially healthcare.

Research Directions

The following are my interested research directions, which means they might not be yours. I am open to discuss further with you to find the topics we are both excited about based on your interest and background.

- **Machine learning**
  - Federated learning, collaborative machine learning system
  - Multi-agent cooperation, swarm intelligence
  - Human imitative learning, artificial intelligence grounding
- **Foundation model and LLMs**
  - Multimodal learning, knowledge conflict, editing, and alignment
  - Neural network understanding, generation, and evaluation
  - Practical distributed deployment, capability boundary, humanity regulations
- **Healthcare and other applications**
  - Human-involved medical decision support, rare and complicated disease detection, mental disease treatment
  - Comprehensive medical foundation model, medical industry optimization
  - Interpretable and responsible delivery for science, engineering, and policy making

About You

- Undergrad? Grad?

About You

How do you use AI?

About You

- What is your understanding of AI?

About You

Have you heard about federated learning or collaborative machine learning?
If not, what is your guess?

What is a traditional way to train ML models?

Any drawbacks?

Think about hospitals, finance companies, or other sensitive scenarios?

Sony AI

About This Course

- Introduction of federated learning and collaborative machine learning
- Research training: paper reading and presentation
- Project training: course project
- Dissert: internship experience share, guest speakers…

Course Overview and Syllabus

Instructor: Jiaqi Wang
Lecture: MWF 14:00-14:50
TA: Darryl Cherian Jacob

Course Overview

This course explores advanced techniques in federated learning, collaborative machine learning, and multi-agent systems that enable decentralized model training across distributed data sources. Also, we will examine recent developments in deploying large language models (LLMs) and foundation models in federated and collaborative settings, with a focus on real-world applications in computer vision, Internet of Things (IoT), and healthcare. Students will engage with state-of-the-art literature, identify open research problems, and critically analyze recent advances shaping the future of collaborative intelligence.

Grading

- **Paper Presentation and Slides (20%)**:
  - There are two paper presentations. Each student is required to present one paper in each round.
  - Each slides and each presentation count towards **5%** of the final grade.
  - Online students need to share the link of the video recording for the presentation.
- **Project Proposal (30%)**
  - Project proposal writing report counts towards **10%** of the final grade.
  - Project proposal pitch presentation counts towards **20%** of the final grade.
  - Online students need to share the link of the video recording for the presentation.
- **Final Project (50%)**
  - Project proposal writing report counts towards **20%** of the final grade.
  - Project proposal pitch presentation counts towards **30%** of the final grade.
  - Online students need to share the link of the video recording for the presentation.

Bonus

- **Bonus**
  - **Idea bonus**: Each submission is 1-page of what you may think is interesting or any bold reseach ideas based on the lectures. Each submission adds 5 points to the actural grade. We totally have 2 submission opportunities.
  - **Paper submission**: You are encouraged to submit your project paper to AI/ML/DM conferences. The instructor will provide a comprehensive evaluation of the work before the final grading day. The submission is required to be reviewed and approved by the instructor. The approved paper adds 10 points to the actural grade. Please notice that the bar of the paper submission could be (much) higher than a course project.
  - **Course survey**: The survey completion rate >80% leads to an additional 10% for everyone's actual grades, i.e., your_final_grade = your_actual_grade * 110%

Policy

Late Policy

- Late assignments are generally not accepted. If you are unable to meet a deadline due to extenuating circumstances, you must notify the instructor as early as possible in advance.
- May be submitted late with a 25% penalty for every 12 hours late, up to 48 hours (2 days). After 48 hours, no credit will be given for the submission.

Accommodation Policy

Our lectures strictly follow the Auburn University policies on accommodations for students. If you have a disability and require accommodations, please contact the Office of Accessibility at Auburn University. Also, please discuss your accommodations and needs with the instructor as early as possible before the course begins. I will work with you to ensure that accommodations are provided appropriately.

Grading

A [90, 100], **B** [80,90), **C** [70,80), **D** [60,70), F [0,60)

The instructor reserves the right to adjust it based on the final statistics of the grades.

Thank you.

Questions?