

ECE 8930 AI for Wireless Systems

Fall 2023

Class Location/Time: 219 Riggs

Instructor: Linke Guo

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Office Hours: TBD

Course Description

This is a 3-credit course. In this course, student will be able to learn how to use AI/ML approaches to handle the advanced wireless systems. The focused areas include using AI/ML approaches for routing, resource management, spectrum access, wireless security, and wireless sensing. This course mainly consists of lectures, seminars, discussions, and course project.

Course Objectives

The primary goal of the class is to expose students to cutting edge research and prepare them for conducting research independently. Specifically, the following objectives are expected to meet upon completion of this course,

- Basic understanding of the importance of applying AI/ML approaches in wireless systems
- Independent research capability in wireless research domain
- Understanding wireless networking challenges in a broader range of applications
- Training the capabilities for using AI/ML in practical wireless problems in daily life
- Mastering the reading capability of learning through most up-to-date research literatures
- Conducting a thorough and rigorous independent research project

Required Materials

The course material will be textbooks and papers from top journals and conferences.

Topical Outline

1. Overview of Current Wireless Systems

2. AI/ML Approaches in Wireless Systems
3. Wireless Networking
 - 3.1. AI/ML for Wireless Routing
 - 3.2. AI/ML for Resource Management (Reinforcement Learning)
 - 3.3. Federated Learning for Distributed Wireless systems
4. Advanced Communication Systems
 - 4.1. AI/ML for IoT Communication
 - 4.2. Dynamic Spectrum Access
 - 4.3. AI in 5G Communication
 - 4.4. AI in Wireless Coexistence
 - 4.5. AI in Wireless Security
5. Wireless Sensing
 - 5.1. Introduction to Wireless Sensing Technologies
 - 5.2. Application-driven discussion
 - 5.3. AI/ML in Wireless Signal Processing
6. AI in future wireless systems, e.g., B5G

Grading

- Paper Reading/Presentation Assignments 40%
 - Paper Discussion and Presentations (10% x 2)
 - Paper Reading Reports (4 ~ 5 pages) (10% x 2)
- Research Project 50%
 - Project Proposal (10%)
 - Project Presentation (20%)
 - Final Project Report (10 ~ 12 pages) (20%)
- Participation 10%

Letter-number grade mapping: [95-100] is A; [90-95) is A-; [87-90) is B+, [83-87) is B, [80-83) is B-, [77-80) is C+, [73-77) is C, [70-73) is C-, F<70.

Attendance

Unless otherwise stated on the course specific syllabus, **students are expected to attend class, and to arrive on time.**

In the event of an **emergency**, students should contact the course instructor, preferably before class or the exam. Students should speak with instructors regarding any scheduled absence as soon as possible and develop a plan for any make-up work, if allowed by the instructor. It is the student's responsibility to secure documentation of emergencies, if required by the instructor. A student with an excessive number of absences may be withdrawn at the discretion of the course instructor.

If the instructor is late, students are expected to wait 15 minutes for the instructor to arrive.

Any further attendance policies in place will be listed on the course specific syllabus, and will serve to supplement these policies.

Inclement Weather Policy

Any exam that was scheduled at the time of a class cancellation due to inclement weather will be given at the next class meeting unless contacted by the instructor. Any assignments due at the time of a class cancellation due to inclement weather will be due at the next class meeting unless contacted by the instructor. Any extension or postponement of assignments or exams must be granted by the instructor via email or Canvas within 24 hours of the weather related cancellation.

Academic Integrity

As members of the Clemson University community, we have inherited Thomas Green Clemson's vision of this institution as a 'high seminary of learning.' Fundamental to this vision is a mutual commitment to truthfulness, honor, and responsibility, without which we cannot earn the trust and respect of others. Furthermore, we recognize that academic dishonesty detracts from the value of a Clemson degree. Therefore, we shall not tolerate lying, cheating, or stealing in any form. In instances where academic standards may have been compromised, Clemson University has a responsibility to respond appropriately to charges of violations of academic integrity.

Further information on Academic Integrity can be found in the [Undergraduate Announcements \(Links to an external site.\)](#) and in the [Graduate School Policy Handbook \(Links to an external site.\)](#).

Access Accommodations

Clemson University values the diversity of our student body as a strength and a critical component of our dynamic community. Students with disabilities or temporary injuries/conditions may require accommodations due to barriers in the structure of facilities, course design, technology used for curricular purposes, or other campus resources. Students who experience a barrier to full access to this class should let the professor know, and make an appointment to meet with a staff member in Student Accessibility Services as soon as possible. You can make an appointment by calling 864-656-6848, by emailing studentaccess@lists.clemson.edu, or by visiting Suite 239 in the Academic Success Center building. Appointments are strongly encouraged – drop-ins will be seen if possible, but there could be a significant wait due to scheduled appointments. Students who receive Academic Access Letters are strongly encouraged to request, obtain and present these to their professors as early in the semester as possible so that accommodations can be made in a timely manner. It is the student's responsibility to follow this process each semester. You can access further information here: <https://www.clemson.edu/academics/studentaccess/index.html> (Links to an external site.) .

Anti-Harassment and Non-Discrimination

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employment, educational programs and activities, admissions and financial aid. This includes a prohibition against sexual harassment and sexual violence as mandated by Title IX of the Education Amendments of 1972. This policy is located at <http://www.clemson.edu/campus-life/campus-services/access/title-ix/> (Links to an external site.). Ms. Alesia Smith is the Clemson University Title IX Coordinator, and the Executive Director of Equity Compliance. Her office is located at 110 Holtzendorff Hall, 864.656.3181 (voice) or 864.656.0899 (TDD).

Emergency Procedures

Emergency procedures have been posted in all buildings and on all elevators. Students should review these procedures for their own safety. Students are required to monitor their university email (see <https://www.clemson.edu/studentaffairs/student-handbook/universypolicies/email-communications.html> (Links to an external site.)) thus establishing this as a convenient method for official communication to students. Students are also encouraged to enroll in CU-Safe alerts. See <https://www.clemson.edu/cusafety> (Links to an external site.) for more information.

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