FLORIDA ATLANTIC UNIVERSITY

COT6930
GENERATIVE AI AND SOFTWARE DEVELOPMENT LIFECYCLES

Date: TR, 12:30 – 1:50 PM
Building: TBA Room: TBA
3 Credit(s)

Instructor Information

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Course Description

This course is designed to explore the intersection of Generative Intelligence (genAI) and Multi-Agent Systems in the scope of Software Development Lifecycles.

Imagine a scenario where the startup founders, solution architects, or software developers can collaborate with Generative AI-based tools to ideate, design, and develop an MVP of their solutions. The use Generative Intelligence and Mutli-Agent Systems in Automated Software Development is already in place, albeit in preliminary stages. Aspects of Multi-Agent Systems, such as collaboration, coordination, negotiation, and decision-making, play a key role in these scenarios. The evolution of these techniques will lead to a new scenario in software development with collaboration Human-

Machine or complete automation of key tasks like e.g. solution definition, requirement analysis, user-interface experimentation, source code generation, and others.

The course adopts an active learning approach where presentations work as gateway to a series of practical labs. The course will immerse students in the realm of Generative Intelligence and Mutli-Agent Systems, where students will learn on to create software agents and multi-agent-systems through a use case of Automated Software Development. In these scenario, agents can mirror their human counterparts performing roles such as Product Manager, Solution Architect, Software Engineer, and UX engineer. In the labs, students will take on the personas of startup founders embarking on the development of specific IT solutions. This practical approach ensures that students not only grasp the theoretical foundations but also acquire the practical skills in applying these technologies.

The objective of this course include:

- Provide students with an understanding of the future role of Generative Intelligence, Multi-Agent Systems, and automated Software Development Lifecycles.
- Explore how GenAI-Multi-Agent Systems have the potential to redefine the essence of collaborative creative process, with the focus on software development but extensible to other areas of creative thinking.
- Investigate innovative processes and methodologies in Generative Intelligence, Multi-Agent Systems, and automated Software Development Lifecycles.
- Having fun acting as a startup founder who created a project from idea to running prototype using Generative AI all the way through the process.

Prerequisites

- **Introductory Knowledge of Artificial Intelligence**: students should have a basic understanding of AI concepts, including machine learning, neural networks, and natural language processing. The course will provide preparatory and self-study material prior coursework.
- **Exposure to Generative AI and Multi-Agent Systems**: students will benefit from having some exposure to generative AI and multi-agent systems. This includes understanding what generative AI is and how it is applied in various contexts, as well as the basics of how autonomous agents work and interact within a system.
- **Familiarity with Programming Languages and Concepts**: students should be comfortable with coding, debugging, and understanding basic software development principles. Proficiency

in Python is required.

- **Familiarity with Cloud Services and APIs is beneficial:** students should understand how to integrate and utilize external services within their software projects.
- **Collaborative Mindset and Teamwork Skills**: As the course involves practical labs where students will work in teams, the ability to collaborate effectively and contribute to group projects is important. Previous experience working in collaborative environments, whether in academic, professional, or personal projects, will be advantageous.
- **Readiness for Active Learning**: The course is designed with an active learning approach, where students will engage in hands-on labs and real-world scenarios. Students should be prepared to actively participate, take initiative, and immerse themselves in the learning experience.

Corequisites

Students are encouraged to concurrently enroll in or review the following corequisite subjects:

- **Introduction to Artificial Intelligence:** a course, preparation material, or module that covers the fundamental principles of AI, including machine learning, neural networks, and natural language processing.
- **Software Engineering Principles**: a course, preparation material, or module focusing on the core principles and practices of software engineering, including requirements analysis, software design, development methodologies, and testing strategies.
- **Cloud Computing and Services:** a course, preparation material, or module that covers the basics of cloud computing, including cloud architecture, services (IaaS, PaaS, SaaS), and cloud deployment models. Familiarity with cloud services such as AWS, Google Cloud, or Azure will be valuable for understanding how to leverage cloud-based AI services in software projects.
- **Introduction to Multi-Agent Systems:** a course or module that introduces the concepts of multi-agent systems, especially in the scope of Generative AI Multi-Agent paradigm. This includes agent communication, coordination, negotiation, and decision-making processes. This knowledge will support students in designing and implementing systems where multiple autonomous agents interact to achieve complex goals.

Instructional Method

In-Person

This course may be offered in in-person, hybrid, or fully online modes

Required Texts/Materials

Course Objectives/Student Learning Outcomes

At the end of this course, students should be able to:

- **Understand the Concepts and Technologies,** with comprehensive understanding of Generative Intelligence and Multi-Agent Systems. Explain the role of these technologies in the context of automated software development lifecycles.
- **Apply Generative AI Tools,** knowing how to utilize generative AI tools for ideation, design, and development of software solutions. Implement generative AI in key software development tasks such as requirement analysis, user-interface experimentation, and source code generation.
- **Develop Multi-Agent Systems,** knowing how to create software agents that can perform roles such as Product Manager, Solution Architect, Software Engineer, and UX Engineer. Design and implement multi-agent systems that facilitate collaboration, coordination, negotiation, and decision-making.
- **Collaborate in Human-Machine Teams**, grasping the concept of how GenAi and Multi-agent system can lead to teams composed of human and AI agents to develop software solutions. Engage in collaborative creative processes with AI to enhance innovation and efficiency.
- **Assess the Future Impact of Generative AI**, able to evaluate the potential future impacts of Generative Intelligence and Multi-Agent Systems on the software development industry. Equipped to discuss ethical, social, and professional implications of integrating AI in software development.

Faculty Rights and Responsibilities

Florida Atlantic University respects the rights of instructors to teach and students to learn. Maintenance of these rights requires classroom conditions that do not impede their exercise. To ensure these rights, faculty members have the prerogative to:

• Establish and implement academic standards.

• Establish and enforce reasonable behavior standards in each class.

• Recommend disciplinary action for students whose behavior may be judged as disruptive under the

Student Code of Conduct University Regulation 4.007.

Disability Policy

In compliance with the Americans with Disabilities Act Amendments Act (ADAAA), students who require reasonable accommodations due to a disability to properly execute coursework must register with Student Accessibility Services (SAS) and follow all SAS procedures. SAS has offices across three of FAU's campuses – Boca Raton, Davie and Jupiter – however disability services are available for students on all campuses. For more information, please visit the SAS website at www.fau.edu/sas/.

Course Evaluation Method

Your grade in the class will be broken into the following components:

- **Lab Exercises: 30%**
    - Participation and performance in the lab sessions are crucial as they provide hands-on experience with Generative AI and Multi-Agent Systems. Each lab will be graded based on completeness, accuracy, and innovation in solving the given problems.
- **Midterm Exam: 15%**
    - The midterm exam will test your understanding of the fundamental concepts and applications of Generative AI and Multi-Agent Systems in software development. The exam will include multiple-choice questions, short answers, and problem-solving questions.
- **Final Exam: 25%**
    - The final exam will be comprehensive, covering all topics discussed in the course. It will assess your ability to apply theoretical knowledge to practical scenarios, including case studies and problem-solving exercises. The exam will consist of multiple-choice questions, short answers, and essay questions.
- **Final Project: 30%**
    - The final project will involve developing a virtual startup project utilizing Generative AI and Multi-Agent Systems. The project will be evaluated based on innovation, application of course concepts, functionality, and the quality of the final presentation.

Code of Academic Integrity

Students at Florida Atlantic University are expected to maintain the highest ethical standards. Academic dishonesty is considered a serious breach of these ethical standards, because it interferes with the university mission to provide a high quality education in which no student enjoys an unfair advantage over any other. Academic dishonesty is also destructive of the university community, which is grounded in a system of mutual trust and places high value on personal integrity and individual responsibility. Harsh penalties are associated with academic dishonesty. For more information, see University Regulation 4.001.

Attendance Policy Statement

Students are expected to attend all their scheduled University classes and to satisfy all academic objectives as outlined by the instructor. The effect of absences upon grades is determined by the instructor, and the University reserves the right to deal at any time with individual cases of non-attendance. Students are responsible for arranging to make up work missed because of legitimate class absence, such as illness, family emergencies, military obligation, court-imposed legal obligations, or participation in University-approved activities. Examples of University-approved reasons for absences include participating on an athletic or scholastic team, musical and theatrical performances, and debate activities. It is the student's responsibility to give the instructor notice prior to any anticipated absences and within a reasonable amount of time after an unanticipated absence, ordinarily by the next scheduled class meeting. Instructors must allow each student who is absent for a University-approved reason the opportunity to make up work missed without any reduction in the student's final course grade as a direct result of such absence.

Religious Accommodation Policy Statement

In accordance with the rules of the Florida Board of Education and Florida law, students have the right to reasonable accommodations from the University in order to observe religious practices and beliefs regarding admissions, registration, class attendance, and the scheduling of examinations and work assignments. University Regulation 2.007, Religious Observances, sets forth this policy for FAU and may be accessed on the FAU website at www.fau.edu/regulations.

Any student who feels aggrieved regarding religious accommodations may present a grievance to the executive director of The Office of Civil Rights and Title IX. Any such grievances will follow Florida Atlantic University's established grievance procedure regarding alleged discrimination.

Time Commitment Per Credit Hour

For traditionally delivered courses, not less than one (1) hour of classroom or direct faculty instruction each week for fifteen (15) weeks per Fall or Spring semester, and a minimum of two (2) hours of out-of-class student work for each credit hour. Equivalent time and effort are required for Summer Semesters, which usually have a shortened timeframe. Fully Online courses, hybrid, shortened, intensive format courses, and other non-traditional modes of delivery will demonstrate equivalent time

and effort.

Course Grading Scale

Letter Grade	Letter Grade
A	94 - 100%
A-	90 - 93%
B+	87 - 89%
B	83 - 86%
B-	80 - 82%
C+	77 - 79%
C	73 - 76%
C-	70 - 72%
D+	67 - 69%
D	63 - 66%
D-	60 - 62%
Letter Grade	**Letter Grade**
F	Below 60

Grade Appeal Process

You may request a review of the final course grade when you believe that one of the following conditions apply:

• There was a computational or recording error in the grading.

• The grading process used non-academic criteria.

• There was a gross violation of the instructor's own grading system.

University Regulation 4.002 of the University Regulations contains information on the grade appeals process

Policy on Make-up Tests, Late work, and Incompletes

Late submissions will not be accepted or graded.

No makeup exams will be offered.

Throughout the semester, multiple homework assignments will be posted via Canvas. For each homework assignment, you will have about a week to complete and submit your solution via Canvas. Allow enough time to submit your work since once the system is closed there will not be other possibilities to submit (don't send your work via email). Please note that the due date for homework assignments will not be updated after the assignment is posted.

Policy on the Recording of Lectures

Students enrolled in this course may record video or audio of class lectures for their own personal educational use. A class lecture is defined as a formal or methodical oral presentation as part of a university course intended to present information or teach students about a particular subject. Recording class activities other than class lectures, including but not limited to student presentations (whether individually or as part of a group), class discussion (except when incidental to and incorporated within a class lecture), labs, clinical presentations such as patient history, academic exercises involving student participation, test or examination administrations, field trips, and private conversations between students in the class or between a student and the lecturer, is prohibited. Recordings may not be used as a substitute for class participation or class attendance and may not be published or shared without the written consent of the faculty member. Failure to adhere to these requirements may constitute a violation of the University's Student Code of Conduct and/or the Code of Academic Integrity.

Counseling and Psychological Services (CAPS) Center

Life as a university student can be challenging physically, mentally and emotionally. Students who find stress negatively affecting their ability to achieve academic or personal goals may wish to consider utilizing FAU's Counseling and Psychological Services (CAPS) Center. CAPS provides FAU students a range of services – individual counseling, support meetings, and psychiatric services, to name a few – offered to help improve and maintain emotional well-being. For more information, go to http://www.fau.edu/counseling/

Student Support Services and Online Resources

- Center for Learning and Student Success (CLASS)
- Counseling and Psychological Services (CAPS)
- FAU Libraries
- Math Learning Center
- Office of Information Technology Helpdesk
-

Center for Global Engagement

- Office of Undergraduate Research and Inquiry (OURI)
- Science Learning Center
- Speaking Center
- Student Accessibility Services
- Student Athlete Success Center (SASC)
- Testing and Certification
- Test Preparation
- University Academic Advising Services
- University Center for Excellence in Writing (UCEW)
- Writing Across the Curriculum (WAC)

Course Topical Outline

- **Lesson 1: Introduction to Generative AI and Software Development Lifecycles**
  - Understanding the fundamentals of Generative AI and Multi-Agent Systems.
  - Understanding the fundamentals of Software Development Lifecycles.
  - The impact of Generative AI on Software Development Lifecycles.
  - DEMO: Quick examples of the how GenAI can help in Software Development Lifecycles.

- **Lesson 2: Generative AI for Automated Software Development Lifecycles**
  - Automating the Software Development Lifecycles
  - How Generative AI can contribute to Automated Software Development
  - LAB 1: Setting up AI Development Environment; exercise on using Generative AI for Code Generation and requirement analysis.

- **Lesson 3: Multi-Agent Systems and Collaborative Software Development**
  - Introduction to Multi-Agent Systems: Definition and Key Concepts
  - Role of Multi-Agent Systems in Software Development
  - Coordination, Collaboration, and Negotiation in Multi-Agent Systems

- LAB 2: Designing a Multi-Agent System in a Software Project

- **Lesson 4: Generative AI for Creative Problem-Solving**
  - Strategies for creative problem-solving in software development.
  - Case studies on innovative software development approaches supported by Generative AI.
  - LAB 3: enhance role playing of Software Development Agents with creative problem-solving approaches; experimentation on defined use cases for your virtual startup.

- **Lesson 5: Generative AI in Requirement Analysis and Design**
  - Understanding Requirement Analysis
  - Using Generative AI for Requirement Analysis
  - LAB 4 Implementing AI for Requirement Analysis and Design
- **Lesson 6: Multi-Agent Systems in Collaborative Software Component Development**
  - Understanding Software Component Development
  - Collaborative Processes in Multi-Agent Systems
  - Role Allocation and Decision-Making in Multi-Agent Systems
  - LAB 5: Simulating a Collaborative Development Environment with Multi-Agent Systems

- **Lesson 7: Source Code Generation and Optimization with Generative AI**
  - Automated Source Code Generation: Tools and Techniques
  - Optimizing Code Quality and Performance using AI
  - LAB 6: Generating and Optimizing Source Code with Generative AI Tools

- **Lesson 8: Future Directions in GenAI-based Solutions for the Enterprise**
  - Emerging Trends in Generative AI and Multi-Agent Systems
  - Ethical, Social, and Professional Implications
  - Case studies of using Generative AI for other areas of ‘systematic creativity’, such as marketing and advertisement, product development, strategic planning, Corporate Social Responsibility, Research and Development, and others.
  - Predictions for the future and emerging opportunities.

- **Workshop: Virtual Startup Project**
    - During the last 4-weeks of this course, students will collaborate closely with instructors and mentors to work on a ‘virtual startup’ project.
    - Students will receive guidance, feedback, and hands-on assistance from experienced professionals as they refine their virtual startup projects.
    - Individual and group mentorship sessions will be conducted to address specific project challenges and provide expert guidance.
    - In preparation for the Final Project Presentation, students will develop compelling pitches for their virtual startup projects.

- **Final Project Presentation**
    - Simulated shark-tank where Students present their capstone projects, demonstrating their understanding of Generative AI-Driven Software Development.