

ITIS 6336/8336 and DSBA 6010
Software Engineering for AI-Enabled Systems
(Fall 2026)
Course Syllabus

Faculty Information

Instructor:	Rrezarta Krasniqi, Ph.D., Assistant Professor
Email:	rrezarta.krasniqi@charlotte.edu (preferred way of contact)
Office:	Information available on Canvas
Office Hours:	Information available on Canvas
Course Hours:	Information available on Canvas
Course Mode:	Information available on Canvas
Campus:	Information available on Canvas

Course Information

Credit Hours:	3 credit hours
Required Textbook:	None
Recommended Textbooks:	(1) Building Intelligent Systems by Geoff Hulten (2) Hands-On Machine Learning with Scikit-Learn, Keras, and TensorFlow by Aurélien Géron (3) Designing Data-Intensive Applications by Martin Kleppmann (4) Hands-On Large Language Models by Jay Alammar and Maarten Grootendorst
Course Material:	Lecture notes and supplemental materials will be provided via Canvas

TA Information

- **Abanti Chakraborty Shruti (TA)**
 - Office Hours: Information available on Canvas
 - Email: achakr13@charlotte.edu
 - Office: Information available on Canvas
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Course Description

This course bridges software engineering and AI development, focusing on key aspects such as understanding AI model requirements and system constraints. It emphasizes strategically planning AI component integration, including modern generative AI components such as LLMs, within AI-enabled systems. Topics cover the deployment of AI applications via APIs, connecting applications with tools and external resources, implementation of advanced architectural patterns such as Retrieval-Augmented Generation (RAG) for efficient factual grounding, and the design and deployment of multi-agent systems. The course also ensures responsible and reliable development using machine and deep learning techniques, emphasizing the role of software architecture and quality assurance in maintaining robust models beyond accuracy across various development stages while mitigating the effects of data drift. It also highlights the importance of explainability and interpretability, moving beyond the traditional "black box" view of AI models, and provides hands-on experience with debugging, design considerations, and thorough system-level testing. It requires a foundational understanding of machine learning and deep learning and intermediate programming skills.

Topics Covered in this Course

The topics covered in this course include:

- Software Requirements for AI
- Software Development with ML, DL, and LLM Perspective
- Software Architecture for AI
- Data Quality, Processing and Management for AI
- Data Version Control and Data Provenance for AI
- Explainability and Interpretability of AI
- Invariant Testing and Model Evaluation

Expected Learning Outcomes

Upon the completion of this course, among others, students should be able to:

- Understand system quality goals and the lack of requirements for AI-components
- Understand and construct risk-mitigating plans on how to develop robust AI components
- Identify and measure quality attributes beyond model accuracy
- Analyze tradeoffs for designing software systems with AI-components
- Learn how to detect poor data quality, poor model quality, and capture data drift phenomena
- Build robust AI-components through version control, provenance, and test automation

Course Structure and Teaching Methods

The course is designed with a weekly progression that integrates lectures, small team activities emphasizing experiential learning and regular in-class paper reading discussions. The course schedule outlines the expected weekly progress. Students are strongly advised to follow the outlined schedule on Canvas to stay updated with coursework and any tentative syllabus changes. Please note that all deadlines for course deliverables are posted on Canvas. The instructor will **not** make recordings of lectures available unless she is required to attend/present in a Research Conference.

Course Communications

Regular announcements and important reminders will be posted on Canvas. Please log in regularly to stay updated on new announcements, reminders, and course-related information. Throughout the semester, feel free to contact your instructor via email or during office hours. Every effort will be made to address your questions or concerns promptly, typically within 24 hours or sooner whenever possible.

Course Credit Workload

This 3-credit course involves **three** hours of online virtual classroom sessions led by faculty each week, along with an additional six hours of weekly out-of-class student work over a **15 or 16-week period**. Out-of-class activities may include readings research papers, programming tasks, and active team projects participations.

Prerequisites

Because this is a graduate upper-level course, it does not have formal prerequisites. But a foundational understanding of machine learning and deep learning, including **intermediate programming** skills are essential for successful project completion which covers majority of course grade. Prior software engineering experience is not required.

Machine Learning/Deep Learning/LLMs Experience

Basic familiarity with the process of feature selection, feature extraction, ML, DL, or LLM model building, and evaluation model techniques is recommended. Prior experience with Python and/or platforms such as Jupyter Notebooks is helpful.

Programming Experience

This is an upper-level graduate course with a strong emphasis on programming. To succeed, you should be proficient in at least one programming language. While the course does not require a specific language, Python is commonly used by student teams. You should be able to install and use necessary libraries (e.g., scikit-learn) and have a solid understanding of version control systems such as Git and GitHub. Additionally, familiarity with Unix/Linux environments and basic command-line operations is essential. If you lack these skills, you may face significant challenges in completing the course team project and may need to dedicate extra time to develop them independently.

Paper Reading Assignments and Group Project

Paper reading assignments will be assigned on a weekly basis, focusing on course topics. Expect around six to seven paper reading assignments along with a semester project comprising six deliverables. Throughout the semester, module-based class activities will promote active participation.

The course will have **neither a midterm nor a final exam**. The focus will be on the realization of a multi-milestone group project deliverables with a research focus. The project will be set in groups of **4-5**, which will give you the opportunity to conduct a project with broader impact. The project will be finalized with a high-quality written report.

These course projects and their scopes aim for you to either:

1. Develop a new tool using ML, DL, or LLM models
2. Tweak existing ML, DL, or LLM models with emphasize in the SE domain
3. Conduct an extensive re-evaluation or empirical study of an existing ML, DL, or LLM model
4. Re-implement or reproduce an ML-, DL-, or LLM-based algorithm within the SE domain
5. Create a benchmark suite within the frames of SE domain

If you are unsure if a project is in scope, feel free to schedule a meeting or attend office hours with me prior to submitting the project proposal.

Canvas Course Management System

This course uses the UNC Charlotte Canvas course management system. It is mandatory to use Canvas for this class, and regular daily checks are strongly recommended. Canvas will serve as the platform for assignments, projects, exams, content distribution, and crucial announcements. Access the UNC Charlotte Canvas at: <https://canvas.charlotte.edu>.

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Grading Criteria

Course grading criteria will be based on the following activities.

Activities	Percentage
Paper Reading Assignments (4)	30%
Team Project Deliverables (6)	60%
Attendance (mandatory)	10%
Total	100%

*Rubrics will be posted on Canvas for all homework assignments and group project.

Grading Scale

The following grade scales will be used to award the final grades:

Grade Scale	Letter Grade
90% – 100%	A
80% – 89.9%	B
70% – 79.9%	C
60% – 69.9%	D
<60%	F

Course and Grading Policies

- Paper reading assignments and project deliverables are due by the deadlines specified in the course schedule or on [Canvas](#) content pages.
- **Late Submissions:** Reading Assignments and project task completions submitted late (as indicated by the Canvas timestamp and “late” flag) **will receive a grade of 0**. Project team members should adequately plan to complete team projects throughout the semester. In the event of an emergency that significantly impedes a team's ability to meet a deadline, permission and documentation must be obtained **BEFORE** the due date at least a week in advance, along with a plan for submission after the due date.
- **Attendance:** Attendance in class is **mandatory** and requires being present and attentive for the entire duration of each session. Attendance will be recorded at every class. Missing more than **five classes will result in a (U) grade** for this course. Regardless of absences, students are responsible for all materials and assignments covered. If you are unable to attend class due to illness and wish to have your absence excused, you must provide documentation of approval from [Student Assistance and Support Services \(SASS\)](#). Absences will be excused only upon receipt of such verification via email. Please refer to the absence verification policies [here](#).
- **Class Punctuality:** Students are expected to arrive promptly at the time specified by the University. Arriving late is disruptive to your **classmates** and the **instructor**, and it may cause you to miss important announcements or in-class graded work (such as the in-class quiz password).
- **Grade Disputes:** Any concerns regarding grading must be raised within **one week** of the grade being posted on Canvas. If you believe an assignment was graded incorrectly and it was in fact graded correctly, we aim to resolve any confusion promptly to ensure comprehension of the material. If an error in grading occurred, we will promptly acknowledge the mistake and adjust the score accordingly.

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- **Grade Requests:** Requests for incomplete grades (**I**) and withdrawals (**W**) must adhere to University policies, which can be found [here](#) for incomplete grades and [here](#) for withdrawal procedures.

Statement of Copyrighted Materials

All materials provided by the instructor and other course materials, whether distributed in class or online, are original works and represent the intellectual property of the instructor or the author (excluding published reference materials such as course textbooks). These materials, including readings, lecture notes, tutorials, and/or handouts are intended solely for the individual use of students. You are not permitted to distribute or reproduce these materials for commercial purposes without the explicit written consent of the instructor. Students who sell or distribute these materials for any purpose other than their own use are violating the University's Copyright Policy available [here](#). Breaching the instructor's copyright may lead to course sanctions and violate the Code of Academic Integrity.

Recording of Classroom Sessions

To protect the privacy of other students, students are not permitted to make their own recordings of class sessions (audio or video) or to share or distribute University recordings without the express written or verbal consent of the instructor, which must be obtained at the time of the recording. Students with specific electronic recording accommodations authorized by the Office of Disability Services may record classes; however, the instructor must be notified of any such accommodation prior to recording. Any distribution of such recordings is strictly prohibited. This policy adheres to University Policy 402, Student Education Records (FERPA).

Medical, Personal or Family Emergencies

In case of emergencies that significantly impact your ability to complete coursework, please immediately contact the Office of the Dean of Students available [here](#). The Dean of Students can provide support and advocate for you to request appropriate accommodations across your classes. To ensure fairness for all students, I require everyone facing emergencies to use the Dean of Students resources. This ensures a consistent and documented process for handling such situations.

University Academic Policies and Procedures

Academic Policies and Procedures

As a student at UNC Charlotte, it is your responsibility to understand and adhere to the university's policies and procedures. The complete document can be accessible [here](#).

Code of Student Responsibility

The UNC Charlotte Code of Student Responsibility outlines specific rights and responsibilities related to student discipline. It defines these responsibilities and ensures your rights are protected, safeguarding you against unfair imposition of disciplinary actions. It is important to familiarize yourself with the procedures outlined in the Code. The complete document can be accessible [here](#).

Academic Integrity

This course maintains a strict policy against violations of academic integrity. It is essential that all individual work, such as **assignments**, be completed independently. Cheating or discussing solutions, code sharing with others constitutes a serious offense and will result in automatic failure of the course. Collaboration that does not meet acceptable standards will be treated as a breach of the Code of Student Conduct and will also lead to a failing grade. Any violations of the Code of Student Academic Integrity, including instances of plagiarism of submitted reading assignments, will result in disciplinary measures outlined in the Code. Definitions and examples of plagiarism and other violations can be found in the Code, accessible through the Dean of Students Office [here](#).

Academic Dishonesty

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Refers to any action or attempted action that unfairly advantages or disadvantages a student or any member of the academic community. Such actions are subject to sanctions under the Code of Academic Integrity, which may include written warnings, grade reductions, disciplinary probation, loss of credit for assignments, course failure, suspension, and/or expulsion.

Academic Misconduct

Refers to any behaviors that do not align with established standards or rules within the academic community. Such misconduct is subject to sanctions under the Code of Conduct, including restricted access to university facilities, administrative holds, warnings, probation, suspension, and/or expulsion. Examples of academic misconduct include disruptive behavior, threats, theft, or damage to university property, among others. For further details and examples, please visit UNC Charlotte's Academic Misconduct Policies page [here](#). The UNC Charlotte Writing Resources Center offers valuable tips on avoiding plagiarism, accessible [here](#). Selling course materials to other students or third parties without the instructor's explicit consent is strictly prohibited and constitutes a violation of the Code of Academic Integrity. Violations, including misuse of Canvas or NinerNet email for such purposes, may also constitute copyright infringement and will be subject to disciplinary action under the Code of Conduct.

Classroom Etiquette Policy and Technology Use

To promote a positive and productive learning environment, both students and the instructor share responsibility for maintaining a respectful, inclusive, and collaborative classroom. Our goal is to create a space where all students feel welcomed, valued, and encouraged to participate actively in the learning process. As computing professionals, students are expected to demonstrate professionalism, respect, and accountability in their interactions with instructors, classmates, and project teams, reflecting the standards expected in professional software development environments. In this course, we are committed to maintaining a focused and respectful classroom environment by following guidelines that promote engagement, effective collaboration, and mutual respect. Students are expected to contribute positively to classroom discussions, respect diverse perspectives, and support an atmosphere where everyone can learn and succeed. The following expectations apply to all classroom interactions and course-related activities:

- To maintain a focused and respectful learning environment, students must refrain from **disruptive behavior**. Specifically, this means no **phone calls or texting, no loud conversations (no side conversations or excessive whispering that distracts nearby students), no shouting or aggressive gestures (such as pointing fingers to instructor or TAs), and no web surfing** unless it is directly related to the current lesson.
- **Laptops & tablets** are permitted only for note-taking and class-related activities. All other use (web browsing, gaming, social media) is prohibited. Cell phones must be silenced and put away for the entire class duration.
- Students are not permitted to **record any part of the class session** (audio or video) without the express written consent of the instructor.
- During face-to-face interactions, it is essential to select your words thoughtfully, articulate your sentences clearly, and remain focused on the subject matter.
- When emailing the instructor or TAs, **please use a professional tone and include the course number and title in the subject line** (e.g., 'TTIS 6336/8336: Question about Assignment 2'). We generally respond within 24–48 hours during the business week.
- Please refrain from eating full meals during class; only quiet snacks and covered drinks are permitted.
- Exercise caution when using humor or sarcasm in emails or discussion posts, as digital communication may make it challenging to accurately interpret tone.
- Share personal experiences using “I” statements to convey thoughts and feelings. Refrain from speaking on behalf of groups or individuals' experiences.
- Apply critical thinking skills to challenge others' ideas rather than targeting individuals personally.

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- Students are expected to give their full attention when the instructor, guest speakers, or classmates are speaking. Avoid interrupting others and allow classmates the opportunity to express their ideas fully.
- Students are expected to arrive on time and remain for the duration of the class session. If an unavoidable circumstance requires arriving late or leaving early, students should do so with minimal disruption to the class.
- During group discussions and project activities, students should contribute constructively, respect team members' ideas, communicate professionally, and support an inclusive and productive team environment.
- Students should avoid behaviors that distract other students from learning, including unnecessary movement, conversations unrelated to class activities, or other actions that interfere with classmates' ability to participate.
- Students are encouraged to respectfully question research findings or classmates' opinions, as this is a natural part of academic discourse. However, it is important to refrain from disparaging others' views. Please be aware that this course adheres to university policies regarding disruptive behavior. For more information, please refer to UNC Charlotte's Policy [here](#).

Prohibition of Discrimination

UNC Charlotte firmly prohibits discrimination and harassment based on race, color, national origin, religion, sex, sexual orientation, gender identity, gender expression, age, disability, genetic information, veteran status, or any other characteristic protected under federal or state law. This policy extends across all application and admission processes, educational programs and activities, employment policies and procedures, and university facilities. The University actively takes measures to prevent such conduct, investigating and taking appropriate remedial actions when necessary. For more information, please visit UNC Charlotte Policy [here](#).

Sexual Assault Prevention

All students are required to comply with the UNC Charlotte Sexual Harassment Policy that is found [here](#) and the policy regarding Responsible Use of University Computing and Electronic Communication Resources that can be found [here](#). Sexual harassment, as defined in the UNC Charlotte Sexual Harassment Policy, is strictly prohibited, including instances occurring through computers or other electronic communication systems, such as course-based chat rooms or message boards.

Special Need Accommodation

If you have a documented disability and require accommodation in this course, contact **Disability Services @ Fretwell 230**, email questions to disability@charlotte.edu or call 704-687-0040 (tty/v) during the first week of the semester. Information about available services can be found [here](#). The Disability Services office will coordinate accommodations for your learning needs and communicate them to your instructor.

Title IX

UNC Charlotte is committed to providing an environment free of all forms of discrimination and sexual harassment, including sexual assault, domestic violence, dating violence, and stalking. If you (or someone you know) has experienced or experiences any of these incidents, know that you are not alone. UNC Charlotte has staff members trained to support you in navigating campus life, accessing health and counseling services, providing academic and housing accommodations, helping with civil protective orders, and more. Please be aware that all UNC Charlotte employees, including faculty members, are expected to relay any information or reports of sexual misconduct they receive to the Title IX Coordinator. This means that if you tell me about a situation involving sexual harassment, sexual assault, dating violence, domestic violence, or stalking, I am expected to report the information to the Title IX Coordinator. Although I am expected to report the situation, you will still have options about how your case will be handled, including whether you wish to pursue a formal complaint. Our goal is to make sure you are aware of the range of options available to you and have access to the resources you need. If you wish to speak to someone confidentially, you can contact the following on-campus resources, who are not required to report the incident to the Title IX Coordinator: (1) University Counseling Center (counselingcenter.uncc.edu, 7-0311); or (2) Student Health Center (studenthealth.uncc.edu, 7-7400). Information about your options is also available at titleix.uncc.edu under the "Students" tab.

Religious Accommodation

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Students are responsible for informing faculty in advance about their planned absences due to religious observances. This should be done by submitting a Request for Religious Accommodation Form to their instructor before the census date of each semester. You can find the census date, usually the tenth day of instruction, listed in UNC Charlotte's Academic Calendar [here](#). For more details, refer to the policy [here](#).

Withdrawals

Students are expected to complete all courses in which they are enrolled after the add/drop period has ended. If you have concerns about your ability to successfully complete this course, please schedule an appointment with me as soon as possible to discuss available options. The University's withdrawal policy permits students only a limited number of opportunities to withdraw from courses. Students should carefully consider the potential financial and academic consequences of withdrawing from a course.

Incompletes:

A grade of **I (Incomplete)** may be assigned at the instructor's discretion when a student who is otherwise passing the course is unable to complete all required work due to circumstances beyond their control. All remaining coursework must be completed by the deadline established by the instructor and no later than 12 months from the date the incomplete grade is assigned. If the incomplete grade is not resolved within the specified timeframe, a grade of **F, U, or N**, as appropriate, will be automatically assigned. An **I** grade cannot be removed by re-enrolling in the same course, and students should not register for the course again while an incomplete grade remains assigned. Please refer to the University policy on Incomplete Grades for additional information [here](#).

Student Assistance and Support Services

Any student who has difficulty affording groceries or accessing sufficient food to eat every day, or who lacks a safe and stable place to live or needs to report an emergency situation and believes this may affect their performance in the course, is urged to contact Student Assistance and Support Services (SASS) (<http://sass.charlotte.edu>) under the Dean of Students Office for support. Furthermore, please notify the instructor if you are comfortable in doing so. This will enable her to provide any resources that she may possess.

Retention of Student Records

Student records for this course are securely maintained by the instructor. This includes exams, answer sheets (with keys), and written papers submitted during the course, which are kept for at least one year after the course ends. Additionally, coursework completed through Canvas, including grades and comments, is stored electronically in a secure environment for one year. Students have the right to access their individual records, but information about a student's records will not be disclosed to others without proper written consent. Students are encouraged to review the Public Information Policy, the Family Educational Rights and Privacy Act (FERPA), and UNC Charlotte Policy 605.3 on Retention, Disposition, and Security of University Records for more information.

University Emergency Notification and Procedures

UNC Charlotte uses **NinerAlert** to promptly inform students about critical emergencies such as severe weather, campus closures, and public safety threats like chemical spills, fires, or violence. For your personal safety, you are strongly encouraged to download and install the free **LiveSafe** mobile app (available for Apple and Android). LiveSafe provides direct access to campus police, supports NinerAlerts and provides a **SafeWalk** feature. For more information, visit [NinerAlerts](#). If the university closes, please check Canvas for contingency plans to cover course materials.