MSA 8700: Building Generative AI Business Solutions

Instructor: Péter Molnár

Term: Spring 2026

Contents

1 Course Details

This hands-on course focusses on developing generative AI applications. It covers large language models, prompt engineering, and fine-tuning frameworks. Students will explore retrieval-augmented generation, document processing, and vector databases. The course also delves into the architecture and deployment of agentic AI applications, image generation, and safeguarding AI systems. Through class activities, students will apply these concepts to real-world scenarios, ensuring a comprehensive understanding of generative AI's business applications.

Monday (Section 1):	4:30 PM - 7:00 PM
Wednesday (Section 2):	2:45 PM - 5:15 PM
Location:	Buckhead Center and on-line (Zoom)

1.1 Instructor

Instructor:	Dr. Péter Molnár
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Office Phone:	+1.404.413.7713
Office hours:	by Appointment
Office Buckhead:	Buckhead Center, #536
Office Downtown:	55 Park Place, Room #1646

During the term, it is highly recommended that you contact the instructor and TAs, in-person or via email. They are available to help you focus your projects, gain access to resources, and answer your questions. Please try to contact them at least once during the term to discuss your project. Your class members are also a good source of help.

1.2 Course Website

Class information will be posted on the class website and iCollege site. There will be links to other websites with course related material.

2 Overview

The course provides a comprehensive exploration of the rapidly evolving field of AI, focusing on practical applications and underlying technical principles. It begins with foundational concepts in artificial intelligence, including symbolic AI and rule-based reasoning, before examining the current landscape of generative AI, specifically Large Language Models (LLMs) and their associated techniques like prompting and fine-tuning. Students will gain hands-on experience utilizing tools such as Ollama and explore various interfaces, including structured and streaming output methods. The curriculum then progresses to advanced topics like Retrieval Augmented Generation (RAG), incorporating embedding technologies and vector databases to enhance retrieval accuracy.

Furthermore, the course addresses key considerations surrounding the deployment and maintenance of AI systems, encompassing Continuous Integration/Continuous Deployment (CI/CD) pipelines and

practical implementation strategies. Students will examine agent systems, incorporating concepts like guardrails and skills, alongside the use of agentic frameworks and relevant toolsets. The curriculum then focuses on constructing a Document-driven agentic intelligence system, utilizing RAG evaluation metrics and techniques like Token based metrics, retrieval accuracy, and continuous monitoring. Students will investigate LLM to Cypher or SQL, Graph/DB RAG, and explore multi-modal LLMs, including image generation. Finally, the course covers responsible AI practices.

Prerequisite: MSA 8010 - Data Programming for Analytics or IFI 8410 - Introduction to Programming and Predictive Analytics for Business

2.1 Learning objectives

Upon successful completion of this course, you will accomplish the following objectives and outcomes. Students who complete this course will gain “Ready for work” skills, including:

1. Develop a comprehensive understanding of large language models and their applications.
2. Master prompt engineering techniques to optimize AI model outputs.
3. Evaluate and optimize prompts using advanced frameworks.
4. Implement benchmarking techniques to assess AI model performance.
5. Utilize retrieval-augmented generation for enhanced AI outputs.
6. Process documents effectively for use in RAG systems.
7. Understand and apply relational, graph, and vector databases for efficient data management.
8. Design and deploy scalable generative AI applications.
9. Address ethical considerations, including bias detection and privacy in AI systems.
10. Demonstrate the ability to integrate and apply learned concepts through a final project presentation.

3 Schedule

The course schedule is shown in Table 1. However, the topics may change according to the interests and abilities of the class. Materials may be updated up to 24 hours prior to class.

Table 1: Course Schedule

Session	Mon	Wed	Topic	Class	Deliverable (day before)
1	Jan 12	Jan 14	AI Foundations	ACT01	
2	Jan 26	Jan 21	Generative AI & LLMs	ACT02	
3	Feb 02	Jan 28	RAG Implementation	ACT03	M01 Project Definition
4	Feb 09	Feb 04	Solution Deployment	ACT04	
5	Feb 16	Feb 11	Agent Systems	ACT05	M02 Data Pipeline, CI/CD setup

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Table 1: Course Schedule (Continued)

6	Feb 23	Feb 18	Agentic Frameworks	ACT06	
7	Mar 02	Feb 25	RAG Evaluation	ACT07	
8	Mar 09	Mar 04	NLP & Text Processing	ACT08	M03 Agentic Prototype
9	Mar 23	Mar 11	Knowledge Graphs	ACT09	
10	Mar 30	Mar 25	LLMs for Query Languages	ACT10	
11	Apr 06	Apr 01	Data Science on Agentic System	ACT11	M04 Evaluation Framework Base-line
12	Apr 13	Apr 08	Multi modal LLMs	ACT12	
13	Apr 20	Apr 15	Responsible AI	ACT13	M05 Iterative Improvement
14	Apr 27	Apr 22	Last day of class: Presentations		
	May 04	Apr 29	– no class –		M06 Final Deliverables

Table 2: Schedule of due dates of the project milestones for each section

Milestone	**Monday**	**Wednesday**
M01 Project Definition	Feb 1, 2026	Jan 27, 2026
M02 Data Pipeline, CI/CD setup	Feb 15, 2026	Feb 10, 2026
M03 Agentic Prototype	Mar 8, 2026	Mar 3, 2026
M04 Evaluation Framework Base-line	Apr 5, 2026	Mar 31, 2026
M05 Iterative Improvement	Apr 19, 2026	Apr 14, 2026
M06 Final Deliverables	May 3, 2026	Apr 28, 2026

4 Required Resources

4.1 Textbooks

Links to selected textbook chapters will be provided. Textbooks are available through the GSU Library subscription to O'Reilly Media at `https://go.oreilly.com/georgia-state-university/home/`.

4.2 Compute Requirements

Programming activities will be performed on the Analytics Research Cluster (ARC) using open-source software and libraries or selected cloud environments.

API Access to Hosted GenAI Models: Limited access to LLMs and other GenAI models will be provided. You may also use cloud hosted APIs like OpenAI (`https://platform.openai.com/docs/overview`) and Google Colab `https://colab.research.google.com/` for GPU supported notebooks and processing environments.

Zoom capable device: You may use any device (laptop, desktop, or tablet) that supports Zoom and other common video conferencing applications. Your device must be capable of transmitting your voice and video to actively participate in the class.

Laptop or desktop computer to complete assignments: ARC provides a web-interface that supports Google Chrome, Firefox and other common web-browsers. A full keyboard and trackpad or mouse are needed to efficiently write code. The browsers on Chrome Books and iPads my not fully support the web-interface.

Virtual Private Network (VPN): VPN access is needed to access ARC and other compute resources. Visit `https://technology.gsu.edu/technology-services/cybersecurity/virtual-private-network/` to configure access to the GSU-VPN on your device. (You may seek help from the Technology Service Desk.)

5 Evaluation

Students are evaluated by the deliverables summarized in the table below:

Assignment	**Percentage**
Class Activities (best 10 out of 13)	20%
Group Project	80%
Total	100%

Grading Scale:

A+	A	A-	B+	B	B-	C+	C	C-	D	F
97%-100%	91-96.9	89.5-90.9	87-89.4	83-86.9	79.5-82.9	77-79.4	72-76.9	69.5-71.9	60-69.4	Below 59.9

6 In-class Activities

There will be a graded class activity in most sessions. Students are expected to participate at the time of the activity. There are no make-up assignments for missed activities. The best ten (10) scores of all activities will be used for the final grade. Class activities are individual work unless otherwise stated.

7 Group Project

Group project assignments are collaborative efforts where teams of up to three (3) members work together to develop an AI application. At the outset of the project, each team is required to submit a group charter that clearly defines the roles and contributions of each member, ensuring accountability and effective collaboration. Teams must use the internal GitLab repository to manage their project, with instructors and TAs granted access from the beginning to provide guidance and support. The project

sol;utions will be deployed This assignment not only fosters teamwork but also helps students build practical skills and create a tangible artifact for future professional use.

Group project deliverables are due at the posted date and time (see Table 2). Late submissions will be penalized with a reduction to 70% of the total score within the first 24 hours, and to 50% thereafter. No submissions will be accepted beyond 72 hours from the original due date.

8 Use of Internet resources and Generative AI

The purpose of assignment is to practice what you learned and verify your understanding of concepts. **The use of Generative AI or any other tools and resources is prohibited during quizzes, tests, and exams.** You are encouraged to utilize Internet resources (like `https://stackoverflow.com/`) and GenAI tools (like ChatGPT, Amazon Q, and GitHub Copilot) for your homework and project assignments. If you make use of these tools indicate in your program code where you found (parts of) the solution or the AI coding tool and prompt that produced the code segment.

9 Student Expectations and Class Policies

Students should plan for 2 - 3 hours of work outside of class each week for each course credit hour. Thus, a 3-credit course averages between 6 and 9 hours of student work outside of the classroom, each week. See GSU site for Academic Success: `https://success.students.gsu.edu/`

9.1 Arbitration

There will be a one-week arbitration period after graded activities are returned. Within that one-week period, you are encouraged to discuss any assumptions and/or misinterpretations that you made on the activity that may have influenced your grade.

9.2 Attendance

If you are unable to attend a class session, it is your responsibility to acquire the class notes, assignments, announcements, etc. from a classmate. The instructor will not give private lectures for those that miss class.

9.3 Submission of Deliverables

Unless specific, prior approval is obtained, no deliverable will be accepted after the specified due date.

If you have a legitimate personal emergency (e.g., health problem) that may impair your ability to submit a deliverable on time, you must take the initiative to contact the instructor before the due date/time (or as soon after your emergency as possible) to communicate the situation. Make-up exams will not be given: However, if a student has a planned absence, he or she may take the exam earlier with the permission of the instructor.

All assignments must be submitted using the designated mechanism that is specified in the assignment (usually via iCollege or ARC). Assignments via email will not be accepted.

9.4 Student Behavior

Behavior in class should be always professional. People must treat each other with dignity and respect for scholarship to thrive. Behaviors that are disruptive to learning will not be tolerated and may be referred to the Office of the Dean of Students for disciplinary action.

9.5 Discrimination and harassment

Discrimination and/or harassment will not be tolerated in the classroom. In most cases, discrimination and/or harassment violates Federal and State laws and/or University Policies and Regulations. Intentional discrimination and/or harassment will be referred to the Affirmative Action Office and dealt with in accordance with the appropriate rules and regulations. Unintentional discrimination and/or harassment is just as damaging to the offended party. But it usually results from people not understanding the impact of their remarks or actions on others, or insensitivity to the feelings of others. We must all strive to work together to create a positive learning environment. This means that everyone should be sensitive to the feelings of others, and tolerant of the remarks and actions of others. If you find the remarks and actions of another individual to be offensive, please bring it to their attention. If you believe those remarks and actions constitute intentional discrimination and/or harassment, please bring it to my attention.

10 Teams of Group Projects

Team Management: Early in the semester, teams will form. If there are problems during the semester, the following methods will be used:

- *Terminating team members:* As in any organization, there may be people in your group who are not willing or able to perform to the level of excellence demanded by the team. The process used to improve team member performance and/or to terminate a team member's membership in the team will involve the following steps:
  - Discuss the poor performance with the individual and the standards he or she is expected to meet. As a team, document the discussion including all members' agreed-upon understanding of the standards of performance and the individual's shortfall from those standards. The document should describe what the individual must do to meet the team's standards and the time frame in which the individual will come up to the standards. This agreement should be signed by all team members, and a copy should be sent to the instructors.
  - If the agreement is not met, the team, including the individual in question, will schedule a meeting with the faculty. The team will bring a copy of the contract to the meeting for the faculty and will discuss the individual's performance with the faculty. The individual will be terminated or given a final chance to improve his or her performance during that meeting and within a given time frame.
  - If the performance does not improve within the time frame, the individual will be terminated from the team.
  - If the individual is terminated, the individual may seek to join another team. Alternatively, he or she must complete all course work in its entirety by himself or herself from that point forward.
- *Resigning from a team:* A student may resign from a team and switch to a different one. The work that was done while a team member is the property of both the team and the individual so all can

use the work product. Faculty will facilitate the placement of the resigning person on a different team.

Teams will be allowed for some activities during the term. Please note that unless the activity is explicitly identified as a "team activity", I expect everyone to perform their own work (your hands on the keyboard). For team activities, you will be allowed to work with partners (of your choosing).

- Initial teams must be established by the second week of classes. Established teams may continue working together on subsequent team activities. Team membership may change during the term if problems arise. However, team members must be designated within one week of the due date for the team activity. Exception: you may withdraw from a team at any time and submit an assignment individually.
- Teams will submit one assignment for all team members. In most cases, each member of the team will get the same score. However, an individual's score may be reduced at the discretion of the instructor.
- Each team assignment must include the following:
  - Tasks completed by each member.
  - Percentage of the total work completed by each member.
- Any individual with a low team contribution will be removed from their team.

11 Official Department and University Policies

1. Prerequisites are strictly enforced. Students failing to complete any of the prerequisites with a grade of "C" or higher will be administratively withdrawn from this course with loss of tuition fees. There are no exceptions, except as granted by the instructor with the approval of the department.
2. Students are expected to attend all classes and group meetings, except when precluded by emergencies, religious holidays, or bona fide extenuating circumstances.
3. Students who, for non-academic reasons beyond their control, are unable to meet the full requirements of the course should notify the instructor, by email, as soon as this is known and prior to the class meeting. Incompletes may be given if a student has ONE AND ONLY ONE outstanding assignment.
4. A "W" grade will be assigned if students withdraw before mid-semester if (and only if) they have maintained a passing grade up to the point of withdrawal. Withdrawals after the mid-semester date will result in a grade of "WF". See the GSU catalog or registrar's office for details.
5. Spirited class participation is encouraged and informed discussion in class is expected. This requires completing readings and assignments before class.
6. All exams and individual assignments are to be completed by the student alone with no help from any other person.
7. Collaboration within groups is encouraged for project work. However, collaboration between project groups will be considered cheating.
8. Copying work from the Internet without a proper reference is considered plagiarism and subject to disciplinary action as delineated in the GSU Student Handbook.

9. Any non-authorized collaboration will be considered cheating, and the student(s) involved will have an Academic Dishonesty charge completed by the instructor and placed on file in the Dean's office and the CIS Department. All instructors regardless of the type of assignment will apply this Academic Dishonesty policy equally to all students. Abstracted from GSU's Student Handbook Student Code of Conduct "Policy on Academic Honesty and Procedures for Resolving Matters of Academic Honesty" `https://codeofconduct.gsu.edu/`.

As members of the academic community, students are expected to recognize and uphold standards of intellectual and academic integrity. The University assumes as a basic and minimum standard of conduct in academic matters that students be honest and that they submit for credit only the products of their own efforts. Both the ideals of scholarship and the need for fairness require that all dishonest work be rejected as a basis for academic credit. They also require that students refrain from any and all forms of dishonorable or unethical conduct related to their academic work.

Students are expected to discuss with faculty the expectations regarding course assignments and standards of conduct. Here are some examples and definitions that clarify the standards by which academic honesty and academically honorable conduct are judged at GSU.

11.1 Plagiarism

Plagiarism is presenting another person's work as one's own. Plagiarism includes any paraphrasing or summarizing of the works of another person without acknowledgment, including the submitting of another student's work as one's own. Plagiarism frequently involves a failure to acknowledge in the text, notes, or footnotes the quotation of the paragraphs, sentences, or even a few phrases written or spoken by someone else. The submission of research or completed papers or projects by someone else is plagiarism, as is the unacknowledged use of research sources gathered by someone else when that use is specifically forbidden by the faculty member. Failure to indicate the extent and nature of one's reliance on other sources is also a form of plagiarism. Any work, in whole or part, taken from the Internet or other computer-based resource without properly referencing the source (for example, the URL) is considered plagiarism. A complete reference is required in order that all parties may locate and view the original source. Finally, there may be forms of plagiarism that are unique to an individual discipline or course, examples of which should be provided in advance by the faculty member. The student is responsible for understanding the legitimate use of sources, the appropriate ways of acknowledging academic, scholarly, or creative indebtedness, and the consequences of violating this responsibility.

11.2 Cheating on Examinations

Cheating on examinations involves giving or receiving unauthorized help before, during, or after an examination. Examples of unauthorized help include the use of notes, texts, or "crib sheets" during an examination (unless specifically approved by the faculty member) or sharing information with another student during an examination (unless specifically approved by the faculty member). Other examples include intentionally allowing another student to view one's own examination and collaboration before or after an examination if such collaboration is specifically forbidden by the faculty member. The use of Generative AI tools during quizzes and exams is prohibited.

Unauthorized Collaboration. Submission for academic credit of a work product, or a part thereof, represented as its being one's own effort, which has been developed in substantial collaboration with another person or source or with a computer-based resource is a violation of academic honesty. It is also a violation of academic honesty knowingly to provide such assistance. Collaborative work specifically authorized by a faculty member is allowed.

11.3 Falsification.

It is a violation of academic honesty to misrepresent material or fabricate information in an academic exercise, assignment or proceeding (e.g., false, or misleading citation of sources, the falsification of the results of experiments or of computer data, false or misleading information in an academic context in order to gain an unfair advantage).

11.4 Multiple Submissions.

It is a violation of academic honesty to submit substantial portions of the same work for credit more than once without the explicit consent of the faculty member(s) to whom the material is submitted for additional credit. In cases in which there is a natural development of research or knowledge in a sequence of courses, use of prior work may be desirable, even required; however, the student is responsible for indicating in writing, as a part of such use, that the current work submitted for credit is cumulative in nature.