

AI System Architecture and Large Language Model Applications

July 13 – July 17, 2026 | In-Person | Lead Instructor: David Martinez

Day 1: Monday, July 13

	TOPIC	DESCRIPTION	HIGHLIGHTS
8:45–10:10 am	D. Martinez - Introduction and Lecture 1: Course introduction, AI background, and functional building blocks overview	Course kicks-off. introduction to GenAI system architecture	AI building blocks used in the design of an LLM application
10:10–10:20 am	Break		
10:20–11:30 am	D. Martinez – Lecture 2: GenAI and the Evolution of LLMs	Short history of advances in GenAI focusing on LLMs	Motivation behind the importance of GenAI and LLMs in particular
11:30 am–12:15 pm	D. Martinez - Lecture 3: AI strategic vision and project roadmap	Formulate a strategic development plan that serves as the guiding blueprint for AI designers, developers, testers, and users/customers	Understand AI strategic development model (AISDM) used in developing and deploying AI capabilities
12:15–1:00 pm	Lunch Break		
1:00–2:10 pm	D. Martinez - Lecture 4: Data conditioning	First stage of the AI pipeline required to transform data into information; classes of data covered are structured and unstructured data	Learn different types of databases and data conditioning approaches
2:10–2:20 pm	Break		
2:20–3:40 pm	L. Mbarak and D. Hvizdalova – Agentic AI implementation techniques	Conceptualizing , designing and implementing Agentic AI	Introduction to the steps necessary to implement Agentic AI using open-source tools and class project expectations
3:40–5:00 pm	Team class project: Formulate one project per team	Teams discuss and select one Agentic AI application	Discuss in class selected Agentic AI application

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Day 2: Tuesday, July 14

	TOPIC	DESCRIPTION	HIGHLIGHTS
8:30–9:00 am	D. Martinez - Welcome to Day 2: Day 2 agenda and faculty Q&A	Day 2: What to expect	Discussion on team project guidelines and format
9:00–10:10 am	D. Martinez - Lecture 5: Traditional machine learning	Set the foundation design elements from traditional ML relevant to LLM design	Understand the key components used in the design of traditional ML that are also applied in the design of LLMs
10:10–10:20 am	Break		
10:20–11:30 am	D. Martinez – Lecture 6: LLM fundamentals	High level description of large language model architecture	Introduce participants to LLMs and key processing steps
11:30 am–12:15 pm	D. Martinez - Lecture 7: Deeper dive on decoder architecture and GPT	Details on a decoder-only architecture and performance metrics	Learn the details of a decoder-only architecture and techniques for assessing the LLMs performance
12:15–1:00 pm	Lunch Break		
1:00–2:10 pm	L. Mbarak and D. Hvizdalova – Basic, Intermediate and Advanced Agentic AI options	Introduction to three Agentic AI and candidate options for team class project (cont.)	Teams will have access to three candidate Agentic AI Jupyter notebooks to use in their application
2:10–2:20 pm	Break		
2:20–5:00 pm	Team project - Hands-on demonstration: Start implementing Agentic AI application	Gain familiarity with Agentic AI tools	Begin to formulate the key charts for their final class project presentation
	Note: All times are US Eastern Daylight Time. Schedule is subject to change.		

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Day 3: Wednesday, July 15

	TOPIC	DESCRIPTION	HIGHLIGHTS
8:30–9:00 am	D. Martinez - Welcome to Day 3: Day 3 agenda and faculty Q&A	Day 3: What to expect	Address any clarification on prior lectures or course project
9:00–10:10 am	D. Martinez - Lecture 8: Modern computing as enabling technology	Understand what makes GPUs and TPUs well-matched to executing machine learning algorithms	Computational engines enabling AI breakthroughs
10:10–10:20 am	Break		
10:20–11:30 am	D. Martinez - Lecture 9: Human-machine teaming	This building block of the system architecture transforms the output of the machine learning algorithms from knowledge into insight	Learn about trade-offs between roles best suited to a human vs. machines
11:30 am–12:15 pm	L. Mbarak and D. Hvizdalova – Basic, Intermediate and Advanced Agentic AI options (cont.)	Introduction to three Agentic AI and candidate options for team class project (cont.)	Teams will have access to three candidate Agentic AI Jupyter notebooks to use in their application
12:15–1:00 pm	Lunch Break		
1:00–2:10 pm	Team project - Hands-on demonstration: Continue developing Agentic AI they selected	Gain experience with developing and assessing all stages of the Agentic AI workflow	Apply Agentic AI open-source tools and techniques
2:10–2:20 pm	Break		
2:20–5:00 pm	Team project - Hands-on demonstration: Continue developing Agentic AI they selected	Create a 1 st draft of final presentation based on guidelines presented in class	Incorporate the Agentic AI system architecture building blocks in their team presentation

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Day 4: Thursday, July 16

	TOPIC	DESCRIPTION	HIGHLIGHTS
8:30–9:00 am	D. Martinez - Welcome to Day 4: Day 4 agenda and faculty Q&A	Day 3: What to expect	Address any clarification on prior lectures or course project
9:00–10:10 am	D. Martinez - Lecture 10: Guidelines for deploying LLM capabilities	Leverage 10 guidelines that incorporate people, processes, and technologies in the successful deployment of AI products and/or services	AI ecosystem environment from business needs to deployment plus perspectives and challenges with responsible AI (RAI)
10:10–10:20 am	Break		
10:20–11:30 am	D. Martinez - Lecture 11: LLMOps: transitioning from development into deployment	The foundational elements of LLMOps, techniques, and contemporary tools	Tips and techniques in transitioning from development into operations
11:30 am–12:15 pm	D. Martinez - Lecture 12: Responsible AI	Development and deployment of LLMs in a responsible manner	Adhere to a set of principles and discuss tools and techniques to deploy LLMs responsibly
12:15–1:00 pm	Lunch Break		
1:00–2:10 pm	D. Martinez - Lecture 13: Robust and secure LLMs	Address LLM vulnerabilities and discuss approaches to making systems robust	Learn about recognizing adversarial vulnerabilities (intentional and non-intentional) plus methods to address them
2:10–2:20 pm	Break		
2:20–5:00 pm	Team Project: Finalize implementations of Agentic AI application and presentation material	Finalize implementing the team Agentic AI application. Limit presentation to 7-8 charts	Finalize Agentic AI demonstration based on selected Agentic AI use case (use Jupyter notebook)
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Day 5: Friday, July 17

	TOPIC	DESCRIPTION	HIGHLIGHTS
8:30–9:00 am	D. Martinez - Welcome to Day 5: Day 5 agenda and faculty Q&A	Day 5: What to expect	Address any clarification on prior lectures or course project
9:00–10:10 am	D. Martinez and D. Hvizdalova - Lecture 14: Future outlook and impact on the workforce	Discuss trends and assess impact of the workforce	Reflect on potential uses of Agentic AI in your respective organizations
10:10–10:20 am	Break		
10:20–11:45 am (85 min.)	Team Presentations: Course projects	Teams present their course projects on the design and implementation of Agentic AI application	Duration: 18 minutes per team plus 2 minutes Q&A and feedback
11:45 am–12:30 pm	Lunch Break		
12:30–2:00 pm (90 min.)	Team Presentations (continuation): Course projects	Teams present their course projects on the design and implementation of Agentic AI application	Duration: 18 minutes per team plus 2 minutes Q&A and feedback
2:00–2:10 pm	Break		
2:10–3:00 pm	D. Martinez - Course Wrap-Up	Course completion is based on attending all 10 lectures and completing a presentation on team project	MIT Professional Education issues a certificate of completion to participants within 2 weeks
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