AD 698 Applied Generative AI Business Analytics

Syllabus

1 Course Sections

Section	Title	Instructor	Day	Time
A1	Generative Artificial Intelligence for Business Analytics	Nakul Padalkar	Mon	14:30:00
O1	Generative Artificial Intelligence for Business Analytics	Nakul Padalkar	Tue	7:00PM

2 Course Content and Objectives

2.1 Course Description

This course is designed for **analytics developers and advanced business students** seeking to build **practical, production-ready applications** using **Generative AI (GenAI)**. Emphasizing hands-on learning, students will explore key techniques such as **prompt engineering, in-context learning (ICL), retrieval-augmented generation (RAG), AI agents, and responsible AI design**.

Students will work with **open-source tools and APIs** including **LangChain**, **LlamaIndex**, and **embedding models**, while learning to implement GenAI systems across the **entire development lifecycle** — from prompt design and knowledge retrieval to fine-tuning and deployment.

The course will emphasize **practical development** over theoretical model internals and will cover topics such as:

- Model optimization strategies (e.g., quantization, adapter-based tuning)
- Inference pipelines and GenAI app deployment
- Evaluation and benchmarking of model performance
- Responsible and explainable GenAI usage in enterprise settings

Students will complete **five applied assignments** and a **capstone project**, culminating in the **deployment of a custom GenAI-powered analytics application**.

This course bridges the gap between **business analytics fluency** and **technical AI development**, equipping students to build **domain-specific LLM applications** that solve real-world problems.

3 Course Learning Objectives

By the end of this course, students will be able to:

- **Design and implement prompt workflows** to extract relevant, accurate, and useful outputs from large language models using in-context learning (ICL) strategies.
- **Build retrieval-augmented generation (RAG) systems** that combine language models with structured and unstructured knowledge bases.
- **Develop autonomous AI agents** that can reason, retrieve, and execute tasks across business workflows using frameworks such as LangChain and AutoGen.
- **Fine-tune and customize foundation models** (e.g., LLaMA, Mistral) using parameter-efficient techniques like LoRA and QLoRA to adapt to business-specific domains.
- **Evaluate and audit generative models** for quality, risk, bias, and alignment using both manual and automated tools (e.g., OpenAI Evals, GPT-judge, Trulens).
- **Deploy GenAI applications** using lightweight serverless pipelines (e.g., Streamlit, FastAPI, GitHub Actions) and optimize for cost and performance.
- **Critically assess ethical and governance implications** of deploying GenAI in enterprise settings, including risks of hallucination, misinformation, and data leakage.
- **Collaborate using modern software development workflows**, including version control (Git/GitHub), cloud-based inference, and reproducible notebooks.

4 Course Resources

There is **no required textbook** for this course. All core readings, technical documentation, and video tutorials will be provided on the course site (Canvas or Quarto site).

Recommended (not required):

- *Designing LLM Applications with LangChain* (docs.langchain.com)
- *OpenAI Cookbook* (cookbook.openai.com)
- *The Hitchhiker's Guide to LLMOps* (arize.com)

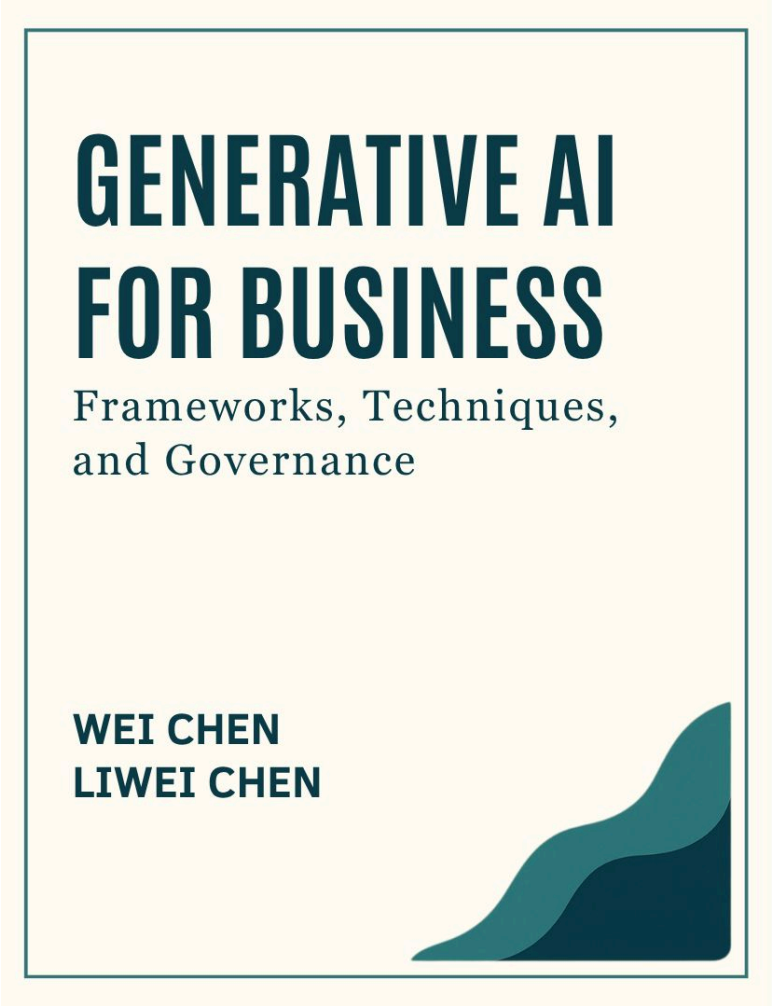
- *Generative AI with Python and Hugging Face Transformers* (available via BU Library or Hugging Face Hub)

Tools & Platforms Used:

- Jupyter, VS Code, GitHub, Python (LangChain, LlamaIndex, OpenAI, Hugging Face)
- APIs: OpenAI, Cohere, Claude (Anthropic), Gemini (Google)
- Deployment tools: Streamlit, FastAPI, GitHub Actions
- Vector DBs: FAISS, ChromaDB
- Evaluation tools: GPT-Eval, Trulens, PromptLayer

All resources are available through GitHub Education and GitHub Classrooms. Students are required to create a GitHub account using their Boston University email address in the first week.

4.1 Recommended Textbook



5 Course Schedule

5.1 Class Schedule

Lecture	Title	Description	Online	On Campus
Lecture 0.1	Course Introduction & Generative AI Landscape	Overview of course objectives and use of GenAI in business contexts.	-	-
Lecture 0.2	Local Dev Setup: GitHub, Jupyter, VS Code	Setup instructions for local development using GitHub, Jupyter, and APIs.	-	-
Lecture 1.1	Prompt Engineering Fundamentals	Core prompting strategies including few-shot, CoT, and ReAct.	02-Sep	08-Sep
Lecture 1.2	Business Use Cases with Prompts	Applying prompt templates to generate emails, reports, SQL, and summaries.	02-Sep	15-Sep
Lecture 2.1	RAG Basics: Embeddings, Chunking, Indexing	Understanding vector databases and embedding models for RAG.	09-Sep	22-Sep
Lecture 2.2	RAG Query Pipelines with LangChain & LlamaIndex	Implementing retrieval-based Q&A systems using LangChain and LlamaIndex.	09-Sep	29-Sep
Lecture 3.1	Intro to Agents: ReAct, Tool Use	Introduction to AI agents and tool-use chains with LangChain.	16-Sep	06-Oct
Lecture 3.2	Multi-Agent Systems (AutoGen, CrewAI)	Designing multi-agent systems for business process automation.	16-Sep	20-Oct
Lecture 4.1	LoRA, QLoRA, PEFT Techniques	Overview of parameter-efficient tuning strategies for LLMs.	23-Sep	27-Oct
Lecture 4.2	Fine-Tuning Pipelines & Data Handling	Running LoRA/QLoRA fine-tunes and comparing to base models.	23-Sep	03-Nov
Lecture 5.1	Embeddings & Similarity Search	Using embedding models for semantic similarity and clustering.	30-Sep	10-Nov
Lecture 5.2	Memory & Context Management	Building memory modules to preserve	30-Sep	17-Nov

Lecture	Title	Description	Online	On Campus
		context in long tasks.		
Lecture 6.1	Model Evaluation & GPT-Eval	Evaluation methods for LLMs including hallucination and output quality.	07-Oct	24-Nov
Lecture 6.2	Responsible AI & Bias Detection	Auditing AI outputs for bias, fairness, and responsible use.	07-Oct	01-Dec
Lecture 7.1	Model Optimization Techniques	Techniques for reducing model size and optimizing inference speed.	-	08-Dec
Lecture 7.2	Deployment: GitHub Actions + Streamlit	Deploying GenAI applications using GitHub Actions and Streamlit.	-	-
Lecture 8.1	Capstone Project Presentations	nan	-	-
Lecture 8.2	Peer Feedback & Industry Outlook	nan	-	-

6 Boston University Library Information

As Boston University students, you have full access to various articles and resources within the BU Library. From any computer, you can gain access to anything at the library that is electronically formatted. These articles are downloadable without extra charges from the BU Library by following the steps. They are easily downloadable from BU Library, e-Journals (name & password protected). You may be asked to login with your BU login name and Kerberos password.

1. Go to BU Library main page http://www.bu.edu/library and from Library Location on the top right of the page, select Pardee Management Library.
2. From the Pardee Management Library main page, select eJournals under Related Links (right-hand side of page).
3. In the Advanced Search window, type “Harvard business review” or “MIT Sloan Management Review” or your preferred title of a journal and click Search.
4. Select the title of the journal Online Access Available.
5. On the page that opens, click on Business Source Complete (for HBR) or ProQuest (for MIT Sloan MR).

6. Login with your BU name and Kerberos account
7. Click on the icon PDF Full text.
8. Click on the Download icon (in Mozilla Firefox the location of the icon is on the top right of the main screen).
9. Save the file on your computer.

Please note that you are not to post attachments of the required or other readings in the water cooler or other areas of the course, as it is an infringement on copyright laws and department policy. All students have access to the library system and will need to develop research skills that include how to find articles through library systems and databases.

7 Blackboard Course Website

To access your course website, go to http://learn.bu.edu/ and select AD688 Web Analytics for Business

7.1 Software Applications & Remote Access to Virtual Labs

In this course, students will be using AWS Academy and a massive dataset connected through Azure cloud. The instructions can be found in the Module 0 Lecture 1 video. As part of the tuition, all BU students can use these software applications free of charge. For directions to get free remote access to our BU MET Virtual Labs, please visit

https://www.bu.edu/metit/services/client-technology/virtual-lab/

7.2 Live Classroom in Zoom

Select Live Classroom from the left-hand navigator of the course website and follow the instructions.

8 Grading and Assessment

8.1 Grading Structure

On the course homepage, all of the material is presented by modules and each module covers two lectures. In the on-campus version of this course, each week we will have a live classroom session that will cover one lecture. In addition, students will work in teams in our virtual labs and will participate in group discussion boards. Please review the Course Calendar & Outline document to get the full schedule of this course.

9 Grading Breakdown

9.1 Certification Points:

1. AWS Academy Generative AI Foundations
2. Github + githubpages ePortfolio Creation

AWS Academy Generative AI Foundations is a self-paced course that will be completed in the first 10 weeks of the course. The final deliverable is completion badge from the AWS Academy. **Points are based on the AWS cloud module check grades translated to 100 points**.

9.2 Weekly Labs (On Campus Class Only):

The labs consist of Weekly Quizzes and Problem Solving Exercises. Each week, students will take part in a set of focused weekly in class exercise that concern the material covered during that week's content. Participation requirements include the jupyter or quarto notebook. These assignments will be done individually. The exercises are due by Day 6 at 11:59 PM.

9.3 Individual Assignments:

Assignments are associated with the modules and will be submitted in the "Assignments" section accessible from the left-hand course menu. All assignment dates are given in the course Study Guide.

9.4 Group Project:

The Term Project consists of one midterm check-in, a managerial report and a final presentation. These assignments strengthen your understanding of the core concepts introduced in this course and build on their knowledge acquired in the foundations of a business analytics course. The Term Project and some of the assignments require students to work with a conceptual website that you will build over the assignments.

1. Project Milestones through GitHub
    1. GitHub setup, team charter, repo planning
    2. Data + Corpus Engineering
    3. GenAI Pipeline + Insights Prototype
    4. Model Evaluation + Deployment Readiness
2. Managerial report - In the form of a GitHub Website
3. Presentation
4. Group Feedback

9.5 Grade Points

Class Activity	Count	Points	Max Points
AWS Academy Generative AI Foundations	1	100	100
Github+githubpages ePortfolio Creation	1	40	40
Labs*	10	20	200
Assignment	5	50	250
Managerial report with Application Demo	1	80	80
Git and git website setup	1	-	-
Api and data gathering	1	-	-
Data cleaning and EDA	1	-	-
Analytics, including full website	1	-	-
Group Project Presentation	1	40	40
Group Feedback	1	40	40
Total	-	-	750

***=On Campus Class Only**

10 Class Policies

10.1 Attendance & Absences

Class attendance is **mandatory**. Please inform your instructor if you know in advance that you will need to miss a class. More than two absences will influence your participation grade in this class.

Regularly engaging in discussions on course-related topics, any cases and readings (during the class and on the Discussion Board), asking questions that lead to better understanding of a concept by the class as a whole, clarifying concepts, readiness to help peers during the consultation sessions and between classes, and sharing professional experience about course-related topics constitute superior class participation and contribute to our collective learning.

10.2 Submission Format

All written contributions should follow the APA writing style, in particular, the requirements how to lay out a paper, as well as how to cite and reference correctly You can get an excellent guide to APA style here.

10.3 Assignment Completion & Due Dates & Late Work

Students should submit completed assignments on the Blackboard course website. All work requests from the instructor (quizzes,

assignments, contributions in the teamwork, etc.) have due dates. These are the last dates that stated material is due. This means that it is a good idea to set personal targets before then as your personal completion date to avoid difficulties. Dates are often viewed by students as the date to turn in an assignment. We view assignment due dates as the last date on which to turn in an assignment. With this warning, please note that we are not inclined to accept late work; if late work should be accepted it will be done only after considerable weighing of rationale, and with penalty.

10.4 Academic Conduct Code

Students are expected to adhere to the highest standards of honesty and integrity for this course. Cheating and plagiarism will not be tolerated in any Metropolitan College course. They will result in no credit for the assignment or examination and may lead to disciplinary actions. Please take the time to review the Student Academic Code of Conduct

This should not be understood as a discouragement for discussing the material or your particular approach to a problem with other students in the class. On the contrary – you should share your thoughts, questions and solutions. Naturally, if you choose to work in a group, you will be expected to come up with more than one and highly original solutions rather than the same mistakes.

10.5 Request for Accommodations

If you have a disability and will be requesting accommodations for this course, please inform the instructor early in the semester. Advance notice and appropriate documentation are required for accommodations.

11 References