BA865: Advanced Topics (Introduction to Neural Networks)
Spring 2025

Instructional Staff

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Office Hours: Fridays, 2 pm to 3 pm (3/21 through 4/25)

Course Description & Learning Goals

This course will introduce you to neural networks in the Python programming language. The course will begin with a brief review of relevant concepts in Python and mathematics, before covering theory and implementation of (Deep) Neural Networks to address prediction problems. Students will learn various architectures, including multimodal networks, Convolutional Neural Networks (CNNs), Recurrent Neural Networks (RNNs) and attention-based models, employing various types of data (images, text, audio). Implementation will be conducted using TensorFlow and Keras, and course material will be presented through a combination of lecture slides and Jupyter notebooks (e.g., Google Colab). By the end of this course, you should be able to demonstrate a conceptual understanding of the various concepts covered in the course, both in written and verbal form, e.g., explaining the difference between CNNs and RNNs, how backpropagation works, or when to apply a particular neural network architecture. You will also be able to implement various neural network architectures in Python, employing Keras and TensorFlow.

Course Meeting Times & Location

Tuesdays & Thursdays: 6:30pm – 9:15pm; HAR 222

Course assignments and announcements will be posted to the course Blackboard site. Assignments are to be submitted via Blackboard. An up-to-date course schedule can also be viewed on Blackboard: https://learn.bu.edu/ultra/courses/_173006_1/outline

Course Materials & Readings

Textbook: This course has one required text. We will closely follow the material in the latest release of François Chollet's Deep Learning with Python. The book is available in both digital and physical formats from the publisher, Manning (or from Amazon).

- Chollet, François. (2021). _Deep Learning with Python (2nd Edition)._ Manning Publications Co. **ISBN-13: 978-1617296864.** https://www.manning.com/books/deep-learning-with-python-second-edition. **_NOTE: ENSURE YOU PURCHASE THE 2ND EDITION, NOT THE 3RD, AS THE LATTER IS NOT YET A COMPLETE TEXT!)_**

- HBSP Course Pack Available @ https://hbsp.harvard.edu/import/1279471.

  - Wu, Andy, Matt Higgins, Miaomiao Zhang, Hang Jiang (2024). _AI Wars_ (Revised Feb 12, 2024). Harvard Business School Case #723434-PDF-ENG.

  - Aschenbrenner, Leopold (2024). _Situational Awareness: The Decade Ahead._

Grading Distribution & Scale

(1) Participation	15%
(2) Individual Assignments (x2)	30%
(3) Case Write-up	10%
(4) Quizzes	15%
(5) Group Project	30%
Total:	100%

Attendance & Participation (15%): Participation in this course will contribute 15% toward your final grade. I expect all students to attend each class and to participate in class discussions and exercises actively. I try to foster an informal, hands-on approach to learning. Much of what will be presented and discussed in class will be available only, or primarily, in class. To help assess participation, you will complete an online form toward the end of each class, wherein you will self-assess your engagement in that lecture, and where you will also have the opportunity (optionally) to indicate the name of another student who commented/raised a question that helped you to better understand the material. Your self-assessments and appearance in peer mentions will contribute to your participation grade.

Individual Assignments (30%): There are two homework assignments, individually, which will collectively be worth 30% of your final grade (15% each). You may discuss with other students, but you cannot / should not copy or share code with other students. The assignment is due by 11:59 pm on the date indicated in the course schedule. You must submit a Python notebook as a standalone file, including any Python module installation/load statements at the outset of your script, such that the script can be executed by me or the TA within a clean Google Colab environment, without error or modification.

Case Write-up (10%): We will cover one Harvard-style business case in this course: the AI Wars case. Your case write-up will address questions I pose based on the case material. The write-up will be worth 10% of your final grade in the course. You can obtain a copy of the HBSP course pack here: https://hbsp.harvard.edu/import/1279471.

Quizzes (15%): We will conduct quizzes throughout the course. Quizzes are collectively worth 15% of your final grade. I will allocate 10 minutes for each quiz and 10 minutes to review correct answers.

Group Project (30%): The final project is worth 30% of your grade in the course. The project will evaluate your practical and conceptual understanding of the course material. You will work on this project in groups of no more than four students (your choice).

Pick a real-world topic that interests you and/or is relevant to your career, where *neural network-based predictions can be applied to add real value.* To make the methods most appropriate, the problem domain you identify and the dataset you work with should involve some form of unstructured data, i.e., text, audio, image, or video. You are expected to conduct in-depth research on the topic/problem to motivate and address the business problem. You will need to meet a few milestones along the way:

- Submit a 1-page proposal outlining your project topic (5% of your grade). You have the first three weeks of class to complete this deliverable.
- Attend a mid-point check-in with me to ensure you are on track (5% of your grade). Sign up for a 15-minute in-person meeting with me during a regular class session on April 3rd. When you are not meeting with me, you should be collaborating with your group members to make progress on the project.
- Submit your .ipynb notebook with commented code (5% of your grade), and with cell output present (so I do not have to run the code myself).
- Deliver a 15-minute presentation and submit a final deliverable summarizing everything you have learned/completed on the topic (15% of your grade). This deliverable can take the form of a [Medium](#) blog post, explaining your project motivation and background, data, your neural network architecture, and the performance of your model, employing in-line code samples or visuals along the way to clarify points. Alternatively, you can submit your presentation's PowerPoint or PDF slides, with heavy slide notes. The presentation part is weighted most heavily because the expectation is that you will provide the motivation and background on your business problem, explain your dataset, introduce your neural network and its architecture, and then explain your evaluation of your model's performance. All group members are expected to participate in the presentation unless the instructor approves, and your handling of questions will be particularly important.

Tip: Make this project useful to YOU. By the end of this assignment, you should have become a decent expert on the topic, and your report could take the form of a high-quality blog post, e.g., on Medium, which you can point to in job interviews!

Course Guidelines & Academic Policies

Online Submissions: All homework assignments require online submission via the course Blackboard page. Online submission provides several advantages to the course staff and students, including date/time stamps and confirmation/verification of your submission. If you are not familiar with the online submission process, please plan to make your first few submissions early, so that you can address any issues. For a variety of reasons, you should not email assignments to the instructor or TA unless specifically requested to do so.

Late Submission: 10% will be deducted from a deliverable grade for each midnight that passes following the deadline indicated in the course schedule until a deduction of 30% has been reached, beyond which a grade of 0 will be assigned.

Grading Appeals: If you disagree with an assignment score for a specific item, you should feel free to discuss it or get feedback from the teaching assistant or me. Note that any re-grading request *must* be raised within one week of the grade's initial posting. Late requests to review a grade will not be considered.

Academic Misconduct / Individual Work: The university's policies on academic integrity govern the class. These policies are available at: http://questromworld.bu.edu/acc/. Any clear evidence of an honor code violation on an assignment, project, or test will be brought to the Academic Conduct Committee. The Boston University Questrom School of Business defines academic misconduct as

"Conduct by which a student misrepresents his or her academic accomplishments or impedes other students' chances of being judged fairly for their academic work."

This includes, but is not limited to, cheating on assignments or examinations, plagiarizing, i.e., misrepresenting as one's own work any work done by another (here, I am counting ChatGPT or Bing), submitting the same project or substantially similar projects, to meet the requirements of more than one course without the approval and consent of the instructors concerned, or sabotaging another's work. Students found guilty of academic misconduct face penalties ranging from lowering of the course grade to suspension from the University.

Accommodations for Students with Special Needs: In keeping with university policy, any student with a disability who needs or thinks they need academic accommodations must call the Office of Disability Services at 353-3658 or stop by 19 Deerfield Street to arrange a confidential appointment with a Disability Services staff member. Accommodation letters must be delivered to me in a timely fashion (within two weeks of the date on the letter and not later than two weeks before any major examination). Please note that accommodations will not be made without an official letter of accommodation.

Mental Health and Wellness: Life at college can get complicated and it is easy to feel overwhelmed, lost, anxious, or depressed. If you find yourself struggling with your mental or physical health this semester, please feel free to approach me. I will try to be flexible and accommodating, within reason. But I am not a professional and there is no shame in getting help. Help for managing stress and your mental wellbeing can be found at Student Health Services. There you can find short term therapy, groups, and workshops, 24/7 on-call service (617-353-3569), referrals, and more resources. If you are feeling stressed and having trouble making choices around alcohol consumption the Collegiate Recovery Program may offer help.

Financial Insecurity: We learn as whole people. It can be challenging to do your best in school when you are worried about meeting basic needs like safe shelter, sleep, and nutrition. If financial insecurity is an obstacle to learning for you I urge you to contact Terrier Meal Share, Boston University Financial Assistance, or the Dean of Students Office.

Diversity and Inclusion Statement: In this course, I try to be thoughtful about how identity and culture impact the course content. I invite you to share your personal experiences and perspective related to the course content. If there are topics or conversations that you feel would benefit from incorporation of social context or a differing perspective, please let me know. I will explore resources and opportunities for us to engage a wide variety of perspectives in our classroom.

Classroom Conduct

- *Professionalism:* Students are expected to conduct themselves with respect and professionalism and can expect the same treatment from others. A part of the training in this program is learning what is expected in a workplace, and we try to enforce those standards throughout the program.

- *Punctuality:* Students are expected to arrive at the classes and scheduled meetings on time.

- *Name Tents:* Students are expected to keep the name tents in front of them during the class. This helps peers and faculty know them faster.

- *Cell Phones:* Students cannot use cell phones during class or quizzes unless specifically instructed. If you need to take an urgent call, leave the classroom, and return as soon as possible.

- *Activities Unrelated to Class:* Activities unrelated to the class are not allowed during the class. These include, but are not limited to, using social media, news sites, online video sites, gaming, email checking, and/or writing unless explicitly asked by the instructor for the purpose of the class.

- *Absence Policy:* If you need to miss a class, notify your instructor before the class.

A Complete Schedule Follows on the Next Page

COURSE SCHEDULE
(Subject to Revision Depending on Progress)

Week	Date	Topic	Assignments	Readings
1	T, March 18	**Course Intro & Setup**	--	Chapter 1
	Th, March 20	**The Math of NNs**	--	Chapter 2
2	T, March 25	**Keras and Other Frameworks**	--	Chapter 3
	Th, March 27	**Simple NNs & Model Tuning** (*Yuan Gao Guest Lecture*)	Assignment 1 Posted	Chapter 4
3	T, April 1	**Functional API & Image Data (CNNs)**	--	Chapters 7 and 8
	Th, April 3	Group Project Check-in	Proposal Due (Friday Apr 4, 11:59pm)	Chapters 5 and 6 (Optional)
4	T. April 8	**Advanced CNNs**	--	Chapter 9
	Th, April 10	**Textual Data (RNNs & Embeddings)**	Assignment 1 Due (Friday Apr 11, 11:59pm)	Chapters 10 and 11
5	T, April 15	**Intro to Generative AI**	Assignment 2 Posted	--
	Th, April 17	**Generative AI (Cont.)**	--	--
6	T, April 22	**Business Model & Work on Case Assignment**	--	Situational Awareness AI Wars Case
	Th, April 24	Work on Group Project or Assignment 2	Assignment 2 Due (Friday Apr 25, 11:59pm)	--
7	T, April 29	**Final Project Presentations I**	--	--
	Th, May 1	**Final Project Presentations II**	Project & Case Answers Due (Friday May 2, 11:59pm)	--