ECON 6930
Introduction to Neural Networks
FALL 2024 SYLLABUS

<u>CLASS INFORMATION</u>

Time: T 6:00pm–9:15pm

Location: Cook Hall 236

Off. Hrs: TR 2:00pm–3:00pm & by appt.

Discord: discord.gg/SsrNPEeP2P

TA: openai.com/blog/chatgpt

<u>INSTRUCTOR CONTACT</u>

Instructor: Fei Tan

Department of Economics

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Homepage: github.com/econdojo

GENERAL INFORMATION

<u>COURSE DESCRIPTION</u>

Artificial intelligence should be made accessible to all. To this end, we provide a spelled-out introduction to neural networks and their applications for students from all disciplines, regardless of their background or area of study. Starting with the classical problem of image recognition, students will delve into the intricacies of modeling multilayer perceptrons, backpropagation algorithm for optimization, model training and evaluation, as well as extensions and variants of the basic architecture. By empowering students with hands-on modeling and programming skills, we aim to democratize AI technology and foster a community of 'AI ninjas' capable of harnessing its transformative potential for innovation, economic growth, and the betterment of humanity.

<u>PREREQUISITES</u>

Although the lectures will be self-contained, student are assumed to have completed ECON 3010 (Introduction to Econometrics) or an equivalent undergraduate course in statistics. Students are also expected to be familiar with basic operations in Python, an interpreted high-level general-purpose programming language.

<u>RESOURCES</u>

- cs231n.stanford.edu – CS231n: Deep Learning for Computer Vision, by Stanford University.

- github.com/karpathy/nn-zero-to-hero – Neural Networks: Zero to Hero, by Andrej Karpathy.

- github.com/karpathy/llm.c – LLM training in simple, raw C/CUDA, by Andrej Karpathy.

- github.com/econdojo/intro-nn – course webpage.

GRADING POLICY

PROBLEM SETS

There will be three required problem sets. Late submission is not graded and will be nullified. Each problem set is worth 20 points of the course grade; it will be submitted and evaluated on an individual basis. To prepare a submission, please type up your work in LaTeXand upload all source files (including Python programs) onto GitHub Classroom.

- LaTeXtypesetting: Overleaf, Texmaker, Vim, Visual Studio Code

- Python programming: Codespaces, Jupyter Notebook, PyCharm, Visual Studio Code

RESEARCH PROJECT

The project consists of a 10–15 pages term paper that makes judicious use of neural network models covered in this course to study a practical problem of your interest. The project accounts for 40 points of the course grade; it will be conducted in teams of 2 to 4 members and evaluated based on collective endeavor. Please follow the same submission requirement as the problem sets.

GRADING SCALE

There is no grading curve used other than the scale below. However, the instructor reserves the right to adjust the grading scale based on overall class performance at the end of the semester.

	Max Points	Grade	Points
Problem Set 1	20	A	100–91
Problem Set 2	20	A-	90–86
Problem Set 3	20	B+	85–81
Research Project	40	B	80–76
Total	100	B-	75–71
		C+	70–66
		C	65–61
		C-	60–56
		D	55–51
		F	50 or less

IMPORTANT MISCELLANEOUS

Please read the following information thoroughly and carefully. I would assume that you have fully understood these rules. Some modification of policies may become necessary during the semester. The instructor will make explicit announcements pertaining to any such changes.

1. In recognition that people learn in a variety of ways and that learning is influenced by multiple factors (e.g., prior experience, study skills, learning disability), resources to support student success are available on campus. The Student Success Center, a one-stop shop, which assists students with academic and career related services, is located in the Busch Student Center (Suite 331) and the School of Nursing (Suite 114). Students who think they might benefit from these resources can find out more about: [i.] course-level support (e.g. faculty member, departmental resources, etc.) by asking your course instructor; and [ii.] university-level support (e.g., tutoring services, university writing services, disability services, academic coaching, career services, and/or facets of curriculum planning) by visiting the Student Success Center.

2. Students with a documented disability who wish to request academic accommodations must formally register their disability with the University. Once successfully registered, students also must notify their course instructor that they wish to use their approved accommodations in the course. Please contact the Center for Accessibility and Disability Resources (CADR) to schedule an appointment to discuss accommodation requests and eligibility requirements. Most students on the St. Louis campus will contact CADR, located in the Student Success Center and available by email at accessibility_disability@slu.edu or by phone at 314.977.3484. Once approved, information about a student's eligibility for academic accommodations will be shared with course instructors by email from CADR and within the instructor's official course roster. Students who do not have a documented disability but who think they may have one also are encouraged to contact to CADR. Confidentiality will be observed in all inquiries.

3. Academic integrity is honest, truthful and responsible conduct in all academic endeavors. The mission of Saint Louis University is "the pursuit of truth for the greater glory of God and for the service of humanity." Accordingly, all acts of falsehood demean and compromise the corporate endeavors of teaching, research, health care, and community service via which SLU embodies its mission. The University strives to prepare students for lives of personal and professional integrity, and therefore regards all breaches of academic integrity as matters of serious concern. Additionally, each SLU College, School, and Center has adopted its own academic integrity policies, available on their respective websites. It is the policy of Chaifetz School of Business that the "Giving and receiving of unauthorized assistance on any graded exercise constitutes academic dishonesty and may result in grade reductions and/or probation, suspension, or dismissal." All SLU students are expected to know and abide by these policies,

which detail definitions of violations, processes for reporting violations, sanctions, and appeals. Please direct questions about any facet of academic integrity to your faculty, the chair of the department of your academic program, or the Dean/Director of the College, School or Center in which your program is housed.

4. Saint Louis University and its faculty are committed to supporting our students and seeking an environment that is free of bias, discrimination, and harassment. If you have encountered any form of sexual misconduct (e.g. sexual assault, sexual harassment, stalking, domestic or dating violence), we encourage you to report this to the University. If you speak with a faculty member about an incident of misconduct, that faculty member must notify SLU's Title IX coordinator, Anna R. Kratky (DuBourg Hall, room 36; akratky@slu.edu; 314-977-3886) and share the basic fact of your experience with her. The Title IX coordinator will then be available to assist you in understanding all of your options and in connecting you with all possible resources on and off campus. If you wish to speak with a confidential source, you may contact the counselors at the University Counseling Center at 314-977-TALK.

5. **Valid Excuses:** many possible events may occur that would result in your inability to attend class, exams, or perform at a minimally acceptable level during an examination. The followings can be legitimate reasons to miss class or to be excused from a scheduled examination.

(a) Illness or injury: a note from a physician, physician's assistant, or a nurse-practitioner that says, among other things, "...unable to attend..." is required. If the note leaves any ambiguity on this point you will not be excused. Further, the note must be provided to the instructor within three days of the missed course event.

(b) Family emergencies: you must provide verifiable documentation of the emergency. Given the vast array of family emergencies the instructor will provide precise guidance as to what constitutes adequate documentation. With the exception of illness or *critical* emergencies, any absence must be excused in advance of the missed course event. In cases of critical emergencies, you must notify the instructor within three days of your absence.

(c) University-approved curricular and extra-curricular activities: verifiable documentation is required. The student should obtain from the unit or department sponsoring the activity a letter (or class absence form) indicating the anticipated absence(s). The letter must be presented to the instructor at least one week prior to the first absence.

(d) Religious holidays: the student should notify the instructor by the second week of the course of any potential conflicts.

TENTATIVE COURSE OUTLINE

Below is a tentative outline; the instructor reserves the right to change it whenever needed. My goal is to proceed at an optimal pace: slow enough that important concepts are thoroughly learned, yet fast enough that the course does not drag. It is a delicate balance.

Part I	**Preparation**
	Lecture 0: "Python Tutorial"
Feb. 20	Problem set 1 due
Part II	**Neural Networks**
	Lecture 1: "Linear Classifiers"
	Lecture 2: "Neural Networks"
	Lecture 3: "A Minimal Case Study"
Mar. 19	Problem set 2 due
Part III	**Applications**
	Lecture 4: "Language Modeling"
	Lecture 5: "Economic Forecasting"
	More applications to follow...
Apr. 21	Problem set 3 due
Apr. 21	Research project due