

issues, but the core work must be your own. Submitting AI-generated work as your own without proper understanding or attribution is academic misconduct and will be treated as such.

You must develop complete mastery of all course material independently of AI assistance. Your knowledge and skills will be evaluated in contexts where AI tools are not accessible, mirroring real-world scenarios where you must rely solely on your own expertise. This ensures you can perform effectively in any situation, with or without AI support. Violations of this policy will result in severe academic penalties. The goal is to prepare you to use AI effectively in your future work while ensuring you develop a strong, self-reliant foundation in the course material.

Course Outline

	Topics	Recommended Reading	Homework
Week 1 26 Aug	Machine Learning inventory. Configuring your Python environment.	[1] Ch. 1, 5.1–5.4, [2] Ch. 2–4, [4] Ch. 1.	HW 1 assigned.
(02 Sep)	No class, Labor Day.		HW 1 due.
Week 2 09 Sep	Getting started with Python. Numerical Python.	[4] Ch. 2–7, 12, 14–15.	HW 2 assigned.
Week 3 16 Sep	Estimation and MMSE.	[1] Ch. 2–3, [2] Ch. 6, 8.1–8.2, 10.1–10.2, 11.1–11.3.	HW 2 due. HW 3 assigned.
Week 4 23 Sep	Regression and maximum likelihood.	[1] Ch. 4, 5.5–5.6, [2] Ch. 8.3–8.6, 9.1–9.2, [4] Ch. 16.	HW 3 due.
Week 5 30 Sep	Logistic regression. Multilayer perceptron networks (MLPs).	[1] Ch. 5.6–5.11, 6.1–6.4.	HW 4 assigned.
Week 6 07 Oct	MLP backpropagation (scalar, vector/tensor).	[1] Ch. 6.5, [2] Ch. 5.	HW 4 due. HW 5 assigned.
Week 7 14 Oct	Quiz #1 (weeks 1-5).		HW 5 due. HW 6 assigned.
Week 8 21 Oct	PyTorch: Introduction.	[3] Ch. 1–3, 5–6.	HW 6 due.
Week 9 28 Oct	PyTorch: Building MLPs.	[1] Ch. 7.	HW 7 assigned.
Week 10 04 Nov	Convolutional Neural Networks (CNN). Project overview.	[1] Ch. 9, [3] Ch. 8.	HW 7 due. HW 8 assigned.
(11 Nov)	No class, Veterans Day.		HW 8 due.
Week 11 18 Nov	PyTorch: Optimizing training. Data engineering.	[1] Ch. 8, [3] Ch. 11–12.	Project proposal due (21 Nov).
Week 12 25 Nov	Auto-encoders and embedding. Recurrent neural networks (RNN).	[1] Ch. 10, 14.	
Week 13 02 Dec	Quiz #2 (weeks 6-12).		
Friday 13 Dec	Project deliverables, due 12:00.		

Grading Procedure

Homework (50%). Homework is assigned every 1-2 weeks. Assignments include analytic and programming problems and encourage experimentation and curiosity. Your total homework score sums your best homework scores (as a percentage) after removing the two lowest scores (of minimum 50%). You may discuss homework problems with classmates but each student must submit their own original work. Cheating warrants an "F" on the assignment. Turning in substantively identical homework solutions counts as cheating.

Late homework is accepted with a 0.5% deduction per hour, up to 48-hours – **no exceptions**. Technical issues while submitting are not grounds for extension. No submissions will be accepted 48-hours after the due date. Graders score what is submitted and will not follow up if the file is incorrect, incomplete, or corrupt. It is your responsibility to ensure you submit the correct files and that they are accessible.

Quizzes (30%). Quizzes are non-cumulative and cover the most recent material (approximately 6-weeks). They test your ability to apply major principles, demonstrate conceptual understanding, and may require writing Python code. They occur during weeks 7 and 13 (tentative). You are expected to bring a scientific (non-graphing) calculator. You may use a single 8.5"x11" reference sheet (front and back OK). You may not use any additional resources.

Quizzes include multiple-choice and short answer questions. They may also include free-response or open-ended questions to demonstrate conceptual understanding. You are expected to write reasonably correct code as well as determine expected behavior of novel computer code. Grading primarily follows correct reasoning but may include deductions for major syntax errors, algorithmic inefficiency, or poor implementation.

Final project (20%). This course culminates with a final project in lieu of a final exam. Teams of two students apply deep-learning to problem selected from a set of instructor-defined options. Each option will include a *complete* starter dataset. Teams must experiment and document network architecture search, hyper-parameter optimization, and dataset augmentation. Students should treat the final project as a multi-week in-depth homework assignment and work to integrate concepts from the entire semester.

Course Grade

A if 90 - 100 points, **B** if 80 - 89 points, **C** if 70 - 79 points, **D** if 60 - 69 points, **F** if 0 - 59 points. ("+" and "-" at $\approx 1.5\%$ of grade boundary).

Cheating

Cheating is not tolerated on homework or exams. Penalty ranges from F on exam to F in course to recommended expulsion.

Final Project

Requirements. All projects must use PyTorch as the primary deep learning framework unless approved explicitly in writing by the instructor. Projects may use additional languages and frameworks for tooling and support. The instructor may provide additional requirements when introducing the final project assignment.

Scoring and Milestones.

Topic proposal	week 11	10%
Project report	final	35%
Model and source code		50%
Model card		5%

Project Deliverables.

Topic proposal: restate the selected problem and include a preliminary discussion about methods, techniques, or proposed variations/modifications/extensions to the problem handout. Proposals should be written in anticipation of fulfilling final report requirements. But the proposal is merely a guidepost and reasonable deviations in method, approach, and scope are expected.

Written report: a properly referenced written report that incorporates all source code as well as links to any external code sources. The project report should summarize the topic, provide relevant background (theoretical or applied), timeline and contributions, and document challenges and future extensions. It should provide discussion sufficient for an uninformed expert to understand the problem, model and training decisions, and implementation. Teams should provide quantifiable metrics to justify engineering tradeoffs.

The report must include the following additional elements

- (1) a mini “literature survey” of work already done in your problem domain. Understand network architectures used in similar models,
- (2) experimental results with various models (both ML and DL) and performance comparison. Use different architectures and hyperparameters,
- (3) evidence of good data handling and processing, *i.e.*, maintain separate test, train, and validation sets.

Source code: submitted as a GitHub repository archive file (zip). It must include README file(s) that describe the repository structure, execution instructions, and special technical requirements. It should not include any training data or model files.

Academic Accommodations

Any student requesting academic accommodations based on a disability is required to register with Disability Services and Programs (DSP) each semester. A letter of verification for approved accommodations can be obtained from DSP. Please be sure the letter is delivered to me as early in the semester as possible. DSP is located in STU 301 and is open 08:30 - 17:00, Monday through Friday. The phone number for DSP is (213) 740-0776.

Support Systems

A number of USC's schools provide support for students who need help with scholarly writing. Check with your advisor or program staff to find out more. Students whose primary language is not English should check with the *American Language Institute* <http://dornsife.usc.edu/ali>, which sponsors courses and workshops specifically for international graduate students. *The Office of Disability Services and Programs* http://sait.usc.edu/academicsupport/centerprograms/dsp/home_index.html provides certification for students with disabilities and helps arrange the relevant accommodations. If an officially declared emergency makes travel to campus infeasible, *USC Emergency Information* <http://emergency.usc.edu> will provide safety and other updates, including ways in which instruction will be continued by means of brightspace, teleconferencing, and other technology.

Discrimination, sexual assault, and harassment are not tolerated by the university. You are encouraged to report any incidents to the *Office of Equity and Diversity* <http://equity.usc.edu> or to the *Department of Public Safety* <http://capsnet.usc.edu/department/department-public-safety/online-forms/contactus>. This is important for the safety of the whole USC community. Another member of the university community - such as a friend, classmate, advisor, or faculty member - can help initiate the report, or can initiate the report on behalf of another person. *The Center for Women and Men* <http://www.usc.edu/studentaffairs/cwm/> provides 24/7 confidential support, and the sexual assault resource center webpage <http://sarc.usc.edu> describes reporting options and other resources.

Academic Conduct

The University of Southern California is foremost a learning community committed to fostering successful scholars and researchers dedicated to the pursuit of knowledge and the transmission of ideas. Academic misconduct is in contrast to the university's mission to educate students through a broad array of first-rank academic, professional, and extracurricular programs and includes any act of dishonesty in the submission of academic work (either in draft or final form).

This course will follow the expectations for academic integrity as stated in the *USC Student Handbook*. All students are expected to submit assignments that are original work and prepared specifically for the course/section in this academic term. You may not submit work written by others or "recycle" work prepared for other courses without obtaining written permission from the instructor(s). Students suspected of engaging in academic misconduct will be reported to the *Office of Academic Integrity*.

Other violations of academic misconduct include, but are not limited to, cheating, plagiarism, fabrication (e.g., falsifying data), knowingly assisting others in acts of academic dishonesty, and any act that gains or is intended to gain an unfair academic advantage.

Academic dishonesty has a far-reaching impact and is considered a serious offense against the university. Violations will result in a grade penalty, such as a failing grade on the assignment or in the course, and disciplinary action from the university itself, such as suspension or even expulsion.

For more information about academic integrity see the student handbook <https://policy.usc.edu/studenthandbook/>, or the Office of Academic Integrity's website <https://academicintegrity.usc.edu/>, and university policies on Research and Scholarship Misconduct <https://policy.usc.edu/research-and-scholarship-misconduct/>.