![USC Viterbi School of Engineering]

ITP-359 Applied Neural Networks
Units: 4
Term: Spring 2025
Time:

Location:

Instructor: Dr. Martin Prescher
Contact Info: prescher@usc.edu
Office Hours:
- In-Person:
- Virtual:
- Virtual Office hour time slots need to be booked using this link (a Zoom link will be sent upon booking):

  https://calendly.com/prescher-usc/prescher-office-hours-virtual-zoom

Learning Assistants:

IT Help: Viterbi IT
Hours of Service: Monday – Friday, 8:30 a.m. – 5:00 p.m.
Contact Info: DRB 205
(213) 740-0517 engrhelp@usc.edu

Course Description

Artificial Neural Networks are a mainstay of artificial intelligence. Learn how to model, train and apply NN to solve real-world problems using artificial intelligence. Explore the latest developments in making NN more accurate in a variety of scenarios from machine vision to recommendation systems.

Catalogue Description
Design, build and train artificial neural networks to solve real-world problems. Implement the latest advances in neural networks for machine vision.

Learning Objectives

After completing the course students will be able to:

- Describe the structure of artificial neural networks
- Construct multi-layer NN using leading frameworks
- Build and train NN to solve real-world problems
- Compare and apply various types of neural networks such as Convolutional and Recurrent NN

Prerequisite(s): ITP 259

Course Notes

Grading Type: Letter grade
Lecture slides, assignments, readings, announcements, and other class information will be posted on Blackboard.
Outside of class time, course discussion will take place on Piazza.

Technological Proficiency and Hardware/Software Covered

Platforms, packages, and tools that will be used for the class will be provided to students free of charge. The following software will be used in the class. Students should have access to a computer (ITP can provide loaner laptops is needed)
- Python packages – Keras, PyTorch, TensorFlow, scikit-learn - https://www.tensorflow.org/
- Google Colab - https://colab.research.google.com/
- Pycharm - https://www.jetbrains.com/pycharm/

Required Readings and Supplementary Materials

Readings will be assigned from the following sources. All books are available online through USC Safari Books. https://libraries.usc.edu/databases/safari-books
- Practical Convolutional Neural Networks, Mohit Sewak, Md. Rezaul Karim, Pradeep Pujari ("MS")
  o Publisher: O'Reilly Media, Inc.
  o Release Date: April 2018

- Neural networks and deep learning, Aurelien Geron ("AG")
  o Publisher: O'Reilly Media, Inc.
  o Release Date: March 2018

- Hands-on Neural Networks with TensorFlow 2.0, Paolo Galeone ("PG")
  o Publisher: Packt Publishing
  o Release Date: September 2019

Description and Assessment of Assignments, Grading Breakdown

The Course Schedule on Page 4 describes assignment description and due dates.
Final course grade will depend on the distribution of weighted scores in the class. ***No extra credit will be offered. Scores are not rounded up.***

Assignment	% of grade
Homework	**30**
Exam 1	**30**

Exam 2	**30**
Project	**10**
TOTAL	**100**

Homework will be assessed on timeliness, completeness, thoroughness, and conclusions drawn. Each component of the assessment will have points associated with it. This will vary for each assignment and will be listed in the homework instructions. Grader will provide feedback for each component of the assessment through Blackboard.

Homework instructions will be posted on Blackboard with a due date, objective, expectations, data files, resources, and deliverables. In most cases, the deliverable will be answers in a Word document along with source code and any other output files.

Assignment Submission Policy
Students are responsible for completing individual assignments by stated deadlines. Assignments must be turned in to Blackboard. Assignments turned in late will have 25% of the total points deducted from the graded score for each late day. You will have 3 "grace days" for the semester. i.e. no late penalty on HW for a cumulative 3 days. No grace days are available for Project.

Grading Timeline
Assignments Grading will typically be completed 7 days after the deadline for submission. Any variations will be announced in class or on blackboard. All grading discrepancies must be resolved within a week of grade release.
For grade disputes, contact your grader first. If resolution is not reached, contact the instructor.

Additional Policies
No make-up exams (except for documented medical or family emergencies or religious observance) will be offered. If student will not be able to attend an exam due to an athletic game or other valid reason, then they must coordinate with the instructor before the exam is given. Student may arrange to take the exam before they leave, with an approved university personnel during the time they are gone, or within the week the exam is given. If students do not take an exam, they will receive a 0 for the exam.

If students need accommodations authorized by OSAS (*Office of Student Accessibility and Services*), notify the instructor at least two weeks before the exam. This will allow time for arrangements to be made.

Course Content Distribution and Synchronous Session Recordings Policies
USC has policies that prohibit recording and distribution of any synchronous and asynchronous course content outside of the learning environment.

Recording a university class without the express permission of the instructor and announcement to the class, or unless conducted pursuant to an Office of Student Accessibility Services (OSAS) accommodation. Recording can inhibit free discussion in the future, and thus infringe on the academic freedom of other students as well as the instructor. (Living our Unifying Values: The USC Student Handbook, page 13).

Distribution or use of notes, recordings, exams, or other intellectual property, based on university classes or lectures without the express permission of the instructor for purposes other than individual or group study. This includes but is not limited to providing materials for distribution by services publishing course materials. This restriction on unauthorized use also applies to all information, which had been distributed to students or in any way had been displayed for use in relationship to the class, whether obtained in class, via email, on the internet, or via any other media. ([Living our Unifying Values: The USC Student Handbook](), page 13).

Policy on the use of AI generators
In this course, I encourage you to use artificial intelligence (AI)-powered programs to help you with assignments that indicate the permitted use of AI. You should also be aware that AI text generation tools may present incorrect information, biased responses, and incomplete analyses; thus they are not yet prepared to produce text that meets the standards of this course. To adhere to our university values, you must cite any AI-generated material (e.g., text, images, etc.) included or referenced in your work and provide the prompts used to generate the content. Using an AI tool to generate content without proper attribution will be treated as plagiarism and reported to the Office of Academic Integrity. Please review the instructions in each assignment for more details on how and when to use AI Generators for your submissions.

Course Schedule: <u>Estimated </u>Weekly Breakdown

Exam 1 (Midterm): **Oct 16,** during class time
Exam 2 (final): **Dec 4,** during class time

Content schedule is subject to changes during the semester

Week	Dates	Topics/Daily Activities
01		Course introduction
		Review of neural networks
02		Review of loss functions, metrics, gradient descent, and back propagation
		Review of supervised ML
		Time series, Forecasting
03		Generative Models: Naïve Bayes and Hidden Markov Models
		Audio Processing
04		Unsupervised ML
		Encoder-decoder architecture, Autoencoders
		Autoencoders for denoising part I
05		Autoencoder for denoising part II
		Autoencoders for colorizing
06		Autoencoder for anomaly detection
		VAE – Variational Autoencoders
07		Review of Recurrent neural networks
		LSTM and GRU
08		Recap
		Midterm
09		Excursion: Model Persistence
		NLP
		Language Translation
10		Transformers
		Transformers and LLMs
		Guest Lecture
11		Generative models
		Generative adversarial networks GAN. Generative AI.
12		Diffusion models
		Diffusion models contd.
13		Reinforcement learning
		Reinforcement learning contd.
14		ML in Production - Tooling
		AI Projects
15		Review
		Exam 2
		Project due

Statement on Academic Conduct and Support Systems

Academic Integrity:
The University of Southern California is a learning community committed to developing successful scholars and researchers dedicated to the pursuit of knowledge and the dissemination of ideas. Academic misconduct, which includes any act of dishonesty in the production or submission of academic work, compromises the integrity of the person who commits the act and can impugn the perceived integrity of the entire university community. It stands in opposition to the university's mission to research, educate, and contribute productively to our community and the world.

All students are expected to submit assignments that represent their own original work, and that have been prepared specifically for the course or section for which they have been submitted. You may not submit work written by others or "recycle" work prepared for other courses without obtaining written permission from the instructor(s).

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

The impact of academic dishonesty is far-reaching and is considered a serious offense against the university. All incidences of academic misconduct will be reported to the Office of Academic Integrity and could result in outcomes such as failure on the assignment, failure in the course, suspension, or even expulsion from the university.

For more information about academic integrity see the student handbook or the Office of Academic Integrity's website, and university policies on Research and Scholarship Misconduct.

Please ask your instructor if you are unsure what constitutes unauthorized assistance on an exam or assignment, or what information requires citation and/or attribution.

Students and Disability Accommodations:

USC welcomes students with disabilities into all of the University's educational programs. The Office of Student Accessibility Services (OSAS) is responsible for the determination of appropriate accommodations for students who encounter disability-related barriers. Once a student has completed the OSAS process (registration, initial appointment, and submitted documentation) and accommodations are determined to be reasonable and appropriate, a Letter of Accommodation (LOA) will be available to generate for each course. The LOA must be given to each course instructor by the student and followed up with a discussion. This should be done as early in the semester as possible as accommodations are not retroactive. More information can be found at osas.usc.edu. You may contact OSAS at (213) 740-0776 or via email at osasfrontdesk@usc.edu.

Support Systems:

Counseling and Mental Health - *(213) 740-9355 – 24/7 on call*
Free and confidential mental health treatment for students, including short-term psychotherapy, group counseling, stress fitness workshops, and crisis intervention.

988 Suicide and Crisis Lifeline - *988 for both calls and text messages – 24/7 on call*
The 988 Suicide and Crisis Lifeline (formerly known as the National Suicide Prevention Lifeline) provides free and confidential emotional support to people in suicidal crisis or emotional distress 24 hours a day, 7 days a week, across the United States. The Lifeline is comprised of a national network of over 200 local crisis centers, combining custom local care and resources with national standards and best practices. The new, shorter phone number

makes it easier for people to remember and access mental health crisis services (though the previous 1 (800) 273-8255 number will continue to function indefinitely) and represents a continued commitment to those in crisis.

Relationship and Sexual Violence Prevention Services (RSVP) - *(213) 740-9355(WELL) – 24/7 on call*
Free and confidential therapy services, workshops, and training for situations related to gender- and power-based harm (including sexual assault, intimate partner violence, and stalking).

Office for Equity, Equal Opportunity, and Title IX (EEO-TIX) - *(213) 740-5086*
Information about how to get help or help someone affected by harassment or discrimination, rights of protected classes, reporting options, and additional resources for students, faculty, staff, visitors, and applicants.

Reporting Incidents of Bias or Harassment - *(213) 740-5086 or (213) 821-8298*
Avenue to report incidents of bias, hate crimes, and microaggressions to the Office for Equity, Equal Opportunity, and Title for appropriate investigation, supportive measures, and response.

The Office of Student Accessibility Services (OSAS) - *(213) 740-0776*
OSAS ensures equal access for students with disabilities through providing academic accommodations and auxiliary aids in accordance with federal laws and university policy.

USC Campus Support and Intervention - *(213) 740-0411*
Assists students and families in resolving complex personal, financial, and academic issues adversely affecting their success as a student.

Diversity, Equity and Inclusion - *(213) 740-2101*
Information on events, programs and training, the Provost's Diversity and Inclusion Council, Diversity Liaisons for each academic school, chronology, participation, and various resources for students.

USC Emergency - *UPC: (213) 740-4321, HSC: (323) 442-1000 – 24/7 on call*
Emergency assistance and avenue to report a crime. Latest updates regarding safety, including ways in which instruction will be continued if an officially declared emergency makes travel to campus infeasible.

USC Department of Public Safety - *UPC: (213) 740-6000, HSC: (323) 442-1200 – 24/7 on call*
Non-emergency assistance or information.

Office of the Ombuds - *(213) 821-9556 (UPC) / (323-442-0382 (HSC)*
A safe and confidential place to share your USC-related issues with a University Ombuds who will work with you to explore options or paths to manage your concern.

Occupational Therapy Faculty Practice - *(323) 442-2850 or* otfp@med.usc.edu
Confidential Lifestyle Redesign services for USC students to support health promoting habits and routines that enhance quality of life and academic performance.