



ISE 599 Special Topics:
Introduction to Deep Learning
Summer 2023, MW 9-11:30 a.m.
Location: KAP 145

Instructor: Cesar Acosta
Office: GER 216
Office Hours: TBD
Contact Info: acostame@usc.edu

Teaching Assistant: Abid Hassan
Office: TBD
Office Hours: TBD
Contact Info: TBD

IT Help:
Hours of Service:
Contact Info:

Course Description

This course introduces Deep Learning (DL) fundamentals and applications. Students will learn the elements of neural networks (NN), the methods used to optimize their performance, the most common NN architectures, and applications of DL models to analytics and AI. These applications range from regression, classification, decision making, image classification, and image identification. Students will learn how to implement these applications using python library Keras.

Learning Objectives and Outcomes

At the end of the course the students will know

- the fundamental principles of NN models
- the elements of a neural network model
- the most common types of NN architectures and what type of problems each is suitable for
- how to build and implement NN models for prediction and classification business data analytics problems
- how to build and implement NN models for artificial intelligence applications

Prerequisite(s): None

Recommended Preparation: Undergraduate courses as follows

- It is strongly recommended to have python programming experience
- Calculus to the level of MATH 229 or equivalent
- Statistics to the level of ISE 225 or equivalent

Course Notes

The course material is available on Blackboard.

Technological Proficiency and Hardware/Software Required

Required software: Python programming language is used throughout the course. Jupyter Notebook is used as the main interface for documenting the scripts and results.

Textbook (required)

- Chollet F., *Deep Learning with Python*, 2nd Ed., Manning, 2021, ISBN 978-16172996864

Supplementary Materials (for reference only)

- Goodfellow I. et al., *Deep Learning*, MIT Press, 2017, ISBN 978-0262035613
- VanderPlas, *Python Data Science Handbook*, O'Reilly, 2017
- Kutner et al., *Applied linear Statistical Models*, 5th Ed., 2005, ISBN 007-112221-4
- Other references as suggested during the introduction.

Description and Assessment of Assignments

All assignments and examinations are on-line. Unless otherwise noted the assignments are individual. All homework assignments are released and distributed one-week in advanced. Dates are shown in the Course schedule on page 4. Submit on to Blackboard by the due date. No late homework will be accepted.

Grading Policy

Assignment	Points	% of Grade
Homework	100 each (6+ homework assignments)	30
Midterm	100	30
Final	100	40
TOTAL		100

Grading Scale (Course final grades will be determined using the following scale)

A	94-100	B-	80-82.9	D+	67-69
A-	90-93.9	C+	77-79	D	63-66.9
B+	87-89	C	73-76.9	D-	60-62.9
B	83-86.9	C-	70-72.9	F	59.9 and below

Assignment Submission Policy

Assignments should be typewritten and clean. Email submissions and late submissions are not allowed. No make-up exams are considered.

Timeline and Rules for submission

Assignments must be submitted on the due date. Solutions will be released soon after the homework due date.

Course Schedule: A Weekly Breakdown

	Date	Topics/Daily Activities	Deliverables	slides	files
1	June 28	Introduction. Quick review of Python and Jupyter Notebook (JN). Library numpy. Gradient Descent.	HW1 Python and numpy	overview.ppt python.ppt numpy.ppt python basics.pdf	intro.ipynb numpy.ipynb
2	July 3 (recorded)	Overfitting. Regularization. Cross-validation with hyperparameters tuning. Pandas review.		cv3.ppt RR.ppt hyperparams.ppt pandas.ppt pandas basics.pdf	Ch 5.2
3	July 5	Introduction to Neural Networks (NN). DL Architectures. The NN as a Nonlinear regression model.	HW1 due	nn.ppt	Kutner Ch. 13
4	July 10	Introduction Deep Learning (DL). The MLP. Feed forward and backward propagation.		dl.ppt	Ch 2.1, 2.5 mnist.ipynb
5	July 12	Deep Learning applications. NN for classification. Introduction to the Keras library	HW2	dla.ppt	Ch 4.1, 4.2 imdb.ipynb reuters.ipynb
6	July 17	Deep Learning applications. NN for Regression problems.		dla.ppt	Ch 4.3 boston.ipynb
7	July 19	Convolutional Neural Networks (CNN). Basic Components of a CNN. Architectures for CNN CNN applications. Image classification.	HW2 due Midterm release	cnn.ppt	Ch. 8 vision. ipynb Ch 9. image.ipynb
8	July 24	Deep learning for Time Series data. Forecasting application. Introduction to Recurrent NN.		lstm.ppt	Ch. 10 temperature. ipynb
9	July 26	Deep learning for text data. . Natural language processing. Pre-processing text data.		text.ppt	Ch. 11.2 nlp.ipynb
10	July 31	Processing a sentence as a sequence. Sequence Models.	Midterm due HW3	seq.ppt	Ch. 11.3 sequences.ipynb
11	Aug 2	Transformers. Transformer encoders. Sequence to sequence learning	HW3 due Final release.	transf.ppt	Ch. 11.4 transformer.ipynb
12	Aug 7	Generative Deep learning. Generative Adversarial Networks.		gdl.ppt	Ch. 12
13	Aug 9	FINAL EXAM			

Statement on Academic Conduct and Support Systems

Academic Conduct:

Plagiarism – presenting someone else’s ideas as your own, either verbatim or recast in your own words – is a serious academic offense with serious consequences. Please familiarize yourself with the discussion of plagiarism in SCampus in Part B, Section 11, “Behavior Violating University Standards” policy.usc.edu/scampus-part-b. Other forms of academic dishonesty are equally unacceptable. See additional information in SCampus and university policies on scientific misconduct, policy.usc.edu/scientific-misconduct.

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/departments/departments-public-safety/online-forms/contact-us>. 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/student-affairs/cwm/> provides 24/7 confidential support, and the sexual assault resource center webpage <http://sarc.usc.edu> describes reporting options and other resources.

Support Systems:

Student Health Counseling Services - (213) 740-7711 – 24/7 on call
engemannshc.usc.edu/counseling

Free and confidential mental health treatment for students, including short-term psychotherapy, group counseling, stress fitness workshops, and crisis intervention.

National Suicide Prevention Lifeline - 1 (800) 273-8255 – 24/7 on call
suicidepreventionlifeline.org

Free and confidential emotional support to people in suicidal crisis or emotional distress 24 hours a day, 7 days a week.

Relationship and Sexual Violence Prevention Services (RSVP) - (213) 740-4900 – 24/7 on call
engemannshc.usc.edu/rsvp

Free and confidential therapy services, workshops, and training for situations related to gender-based harm.

Office of Equity and Diversity (OED) | Title IX - (213) 740-5086
equity.usc.edu, titleix.usc.edu

Information about how to get help or help a survivor of harassment or discrimination, rights of protected classes, reporting options, and additional resources for students, faculty, staff, visitors, and applicants. The university prohibits discrimination or harassment based on the following protected characteristics: race, color, national origin, ancestry, religion, sex, gender, gender identity, gender expression, sexual orientation, age, physical disability, medical condition, mental disability, marital status, pregnancy, veteran status, genetic information, and any other characteristic which may be specified in applicable laws and governmental regulations.

Bias Assessment Response and Support - (213) 740-2421
studentaffairs.usc.edu/bias-assessment-response-support

Avenue to report incidents of bias, hate crimes, and microaggressions for appropriate investigation and response.

The Office of Disability Services and Programs - (213) 740-0776

dsp.usc.edu

Support and accommodations for students with disabilities. Services include assistance in providing readers/notetakers/interpreters, special accommodations for test taking needs, assistance with architectural barriers, assistive technology, and support for individual needs.

USC Support and Advocacy - (213) 821-4710

studentaffairs.usc.edu/ssu

Assists students and families in resolving complex personal, financial, and academic issues adversely affecting their success as a student.

Diversity at USC - (213) 740-2101

diversity.usc.edu

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

dps.usc.edu, emergency.usc.edu

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) 442-120 – 24/7 on call

dps.usc.edu

Non-emergency assistance or information.