CS-583A

(Deep learning)

Spring 2022

Instructor:	Tian Han
Meeting Times:	6:30-9:00 PM Thursday, Edwin A. Stevens 222 or Canvas zoom
Contact Info:	than6@stevens.edu
Office Hours:	11:00AM-12:00PM, 1:00PM-2:00PM Wednesday, Online zoom via Canvas
Prerequisite(s):	CS 556 Math foundation, MA232 linear algebra, CS 515 Python programming
Credit:	3
TA/CA:	Yu Yu (yyu50@stevens.edu), Tianhao Zhu (tzhu12@stevens.edu)

COURSE DESCRIPTION

Deep learning (DL) is a family of the most powerful and popular machine learning (ML) methods and has wide real-world applications such as face recognition, machine translation, self-driving car, recommender system, playing the Go game, etc. This course is designed for students either with or without ML background. The course will cover fundamental ML, computer vision, and natural language problems and DL tools for solving the problems. The students will be able to use DL methods for solving real-world ML problems. The homework includes implementation and programming using the Python language and popular DL frameworks such as TensorFlow, Keras and Pytorch. Knowledge and skills in Python programming and linear algebra are strictly required. Probability theory, statistics, and numerical analysis are highly recommended. Knowledge in machine learning and artificial intelligence is helpful but unnecessary.

STUDENT LEARNING OUTCOMES

- Understanding the fundamental machine learning problems.
- Modeling real-world problems using basic linear algebra and optimization tools.
- Applying numerical algorithms for solving mathematical models.
- Applying convolutional neural networks for solving image and vision problems.
- Applying recurrent neural networks for solving natural language problems.
- Being able to implement neural networks using programming languages and deep learning frameworks.

Tentative Course Schedule

Weeks	Topic(s)	Readings	Assignments
1	Introduction, ML basics, Linear Regression		
2	Polynomial Regression, Classification (logistic regression)		
3	Classification (SVM), Regularization		
4	Classification (softmax classifier, KNN), scientific computing		
5	Neural Network (MLP)		**HW#1 Due**
6	Convolutional neural network (CNNs)		
7	More on CNNs, architecture		
8	**MIDTERM**		
10	Data processing, simple RNN		**HW#2 (CNN) Due**
11	RNNs: LSTM, machine translation		
12	Attention and self-attention. Transformer		
13	Autoencoder, VAE		**HW#3 (RNN) Due**
14	Generative Adversarial Net. Reinforcement Learning		
15	Deep RL		**HW#4 due**
16	FINAL		

COURSE MATERIALS:

The following textbooks are highly recommended.

Textbook(s):

- Francois Chollet. Deep learning with Python. Manning Publications Co., 2017. (Available online.)
- I. Goodfellow et al., *Deep Learning*, MIT, 2016

GRADING PROCEDURES

Homework: 55% (10%, 15%, 15%, 15%)

Midterm: 20%

Final: 25%

Grading Policy:

- Submit file through Canvas
- You are encouraged to work and discuss in a group, but you have to write down your OWN answers and codes.
- You have in total of **4 late days** (excluding weekends) for the entire class, after 4 late days, NO credit will be given for the late submission.

Undergraduate Honor System

Enrollment into the undergraduate class of Stevens Institute of Technology signifies a student's commitment to the Honor System. Accordingly, the provisions of the Stevens Honor System apply to all undergraduate students in coursework and Honor Board proceedings. It is the responsibility of each student to become acquainted with and to uphold the ideals set forth in the Honor System Constitution. More information about the Honor System including the constitution, bylaws, investigative procedures, and the penalty matrix can be found online at http://web.stevens.edu/honor/

The following pledge shall be written in full and signed by every student on all submitted work (including, but not limited to, homework, projects, lab reports, code, quizzes and exams) that is assigned by the course instructor. No work shall be graded unless the pledge is written in full and signed.

"*I pledge my honor that I have abided by the Stevens Honor System*."

Reporting Honor System Violations
Students who believe a violation of the Honor System has been committed should report it within ten business days of the suspected violation. Students have the option to remain anonymous and can report violations online at www.stevens.edu/honor.

Graduate Student Code of Academic Integrity
All Stevens graduate students promise to be fully truthful and avoid dishonesty, fraud, misrepresentation, and deceit of any type in relation to their academic work. A student's submission of work for academic credit indicates that the work is the student's own. All outside assistance must be acknowledged. Any student who violates this code or who knowingly assists another student in violating this code shall be subject to discipline.

All graduate students are bound to the Graduate Student Code of Academic Integrity by enrollment in graduate coursework at Stevens. It is the responsibility of each graduate student to understand and adhere to the Graduate Student Code of Academic Integrity. More information including types of violations, the process for handling perceived violations, and types of sanctions can be found at www.stevens.edu/provost/graduate-academics.

Special Provisions for Undergraduate Students in 500-level Courses
The general provisions of the Stevens Honor System do not apply fully to graduate courses, 500 level or otherwise. Any student who wishes to report an undergraduate for a violation in a 500-level course shall submit the report to the Honor Board following the protocol for undergraduate courses, and an investigation will be conducted following the same process for an appeal on false accusation described in Section 8.04 of the Bylaws of the Honor System. Any student who wishes to report a graduate student may submit the report to the Dean of Graduate Academics or to the Honor Board, who will refer the report to the Dean. The Honor Board Chairman will give the Dean of Graduate Academics weekly

updates on the progress of any casework relating to 500-level courses. For more information about the scope, penalties, and procedures pertaining to undergraduate students in 500-level courses, see Section 9 of the Bylaws of the Honor System document, located on the Honor Board website.

LEARNING ACCOMODATIONS

Stevens Institute of Technology is dedicated to providing appropriate accommodations to students with documented disabilities. The Office of Disability Services (ODS) works with undergraduate and graduate students with learning disabilities, attention deficit-hyperactivity disorders, physical disabilities, sensory impairments, psychiatric disorders, and other such disabilities in order to help students achieve their academic and personal potential. They facilitate equal access to the educational programs and opportunities offered at Stevens and coordinate reasonable accommodations for eligible students. These services are designed to encourage independence and self-advocacy with support from the ODS staff. The ODS staff will facilitate the provision of accommodations on a case-by-case basis.

Disability Services Confidentiality Policy

Student Disability Files are kept separate from academic files and are stored in a secure location within the Office of Disability Services. The Family Educational Rights Privacy Act (FERPA, 20 U.S.C. 1232g; 34CFR, Part 99) regulates disclosure of disability documentation and records maintained by Stevens Disability Services. According to this act, prior written consent by the student is required before our Disability Services office may release disability documentation or records to anyone. An exception is made in unusual circumstances, such as the case of health and safety emergencies.

For more information about Disability Services and the process to receive accommodations, visit https://www.stevens.edu/office-disability-services. If you have any questions please contact: Phillip Gehman, the Director of Disability Services Coordinator at Stevens Institute of Technology at pgehman@stevens.edu or by phone (201) 216-3748.

INCLUSIVITY

Name and Pronoun Usage

As this course includes group work and in-class discussion, it is vitally important for us to create an educational environment of inclusion and mutual respect. This includes the ability for all students to have their chosen gender pronoun(s) and chosen name affirmed. If the class roster does not align with your name and/or pronouns, please inform the instructor of the necessary changes.

Inclusion Statement

Stevens Institute of Technology believes that diversity and inclusiveness are essential to excellence in academic discourse and innovation. In this class, the perspective of people of all races, ethnicities, gender expressions and gender identities, religions, sexual orientations, disabilities, socioeconomic backgrounds, and nationalities will be respected and viewed as a resource and benefit throughout the semester. Suggestions to further diversify class materials and assignments are encouraged. If any course meetings conflict with your religious events, please do not hesitate to reach out to your instructor to make alternative arrangements.

You are expected to treat your instructor and all other participants in the course with courtesy and respect. Disrespectful conduct and harassing statements will not be tolerated and may result in disciplinary actions.

MENTAL HEALTH RESOURCES

Part of being successful in the classroom involves a focus on your whole self, including your mental health. While you are at Stevens, there are many resources to promote and support mental health. The Office of Counseling and Psychological Services (CAPS) offers free and confidential services to all enrolled students who are struggling to cope with personal issues (e.g., difficulty adjusting to college or trouble managing stress) or psychological difficulties (e.g., anxiety and depression). Appointments are strongly encouraged and can be made by phone (201-216-5177) or in-person (on the 7th floor of the Howe Center). CAPS is open from 9:00 am – 5:00 pm Mondays, Wednesdays, Thursdays and Fridays and from 9:00 am – 7:00 pm on Tuesdays during the Fall and Spring semesters.

EMERGENCY INFORMATION

In the event of an urgent or emergent concern about the safety of yourself or someone else in the Stevens community, please immediately call the Stevens Campus Police at 201-216-5105 or on their emergency line at 201-216-3911. These phone lines are staffed 24/7, year round. Other 24/7 resources for students dealing with mental health crises include the National Suicide Prevention Lifeline (1-800-273-8255) and the Crisis Text Line (text "Home" to 741-741). If you are concerned about the wellbeing of another Stevens student, and the matter is *not* urgent or time sensitive, please email the CARE Team at care@stevens.edu. A member of the CARE Team will respond to your concern as soon as possible.