
CSE-5368-002 Neural Networks

Fall 2024

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Instructor Information

Instructor Name

Farhad Kamangar

Office Location

524 ERB

[View Campus Map](#)

Office Phone Number

817-272-3605

Email Address

kamangar@cse.uta.edu

Faculty Profile

<https://mentis.uta.edu/explore/profile/farhad-kamangar>

Office Hours

Tuesdays & Thursdays 5:00-6:30 PM

Communication Guidelines

My preferred communication method is email

Course Information

Section Information

CSE-5368-002

Course Delivery Method

This course is designated ON-CAMPUS, which means Majority On Campus. The majority of course instruction, exams and projects delivered on-campus or at designated instructional sites, in-person.

For a full definition of the course modalities, please visit the [Course Modalities page](#).

Time and Place of Class Meetings

SEIR 194, Tuesdays and Thursdays 7:00-8:20 PM

Time Zone

This course operates on Central Time. All times listed for class meeting times, exams, and assignment deadlines are in Central Time.

Description of Course Content

CSE 5368. NEURAL NETWORKS (3-0) Theoretical principles of neurocomputing. Learning algorithms, information capacity, and mapping properties of feedforward and recurrent networks. Different neural network models will be implemented and their practical applications discussed.

Prerequisites

- CSE 5301 and calculus II, knowledge of a high level programming language, or consent of instructor.
- Be advised that this course is intended for graduate students in computer science and engineering. It is assumed that all students are comfortable with math (calculus, linear algebra, vectors, and matrices) and are proficient in high level programming languages, particularly Python.
- This class is heavy on math and programming. Please be prepared.

Student Learning Outcomes

This course focuses both on the theoretical and practical aspects of neural networks. It covers major paradigms and concepts in neural networks, including but not limited to performance surfaces, optimization, multi-layer neural networks, backpropagation, convolutional neural networks, autoencoders, generative models, large language models, and transformers.

Upon successful completion of this course students will be able to:

- Understand the concepts, and representation of the common neural network models and the essential deep learning models and algorithms.
- Understand the mathematical foundations of deep learning and the concepts of the performance surfaces and different methods for optimizations.
- Analyze and reason about the performance of neural networks and implement neural network models for specific applications.
- Develop the skills to implement neural networks from scratch.
- Acquire proficiency in utilizing popular machine learning and neural network libraries such as Tensorflow, Keras, and Pytorch for real-world applications.
- Do research and implement their own ideas and apply them to real world problems.

Textbooks and Other Course Materials

Required Textbooks and Materials

Neural Network Design (2nd Edition), Martin T. Hagan, Howard B. Demuth, Mark H. Beale, Orlando De Jesus, ISBN-10: 0-9717321-1-6, ISBN-13: 978-0-9717321-1-7

Recommended Course Materials

The textbooks and other materials listed below are optional but recommended.

- [Deep Learning](#) (Free online)
- [Neural Networks and Deep Learning](#) (Free online book)
- [Deep Learning Tutorial](#) (Free online)
- [Neural Networks and Learning Machines](#) (3rd edition)
- Deep Learning Step by Step with Python: A Very Gentle Introduction to Deep Neural Networks for Practical Data Science, N D Lewis, 2016, ISBN-10: 1535410264, ISBN-13: 978-1535410267
- Make Your Own Neural Network, Tariq Rashid, 2016, ISBN-10: 1530826608, ISBN-13: 978-1530826605
- Artificial Intelligence for Humans, Volume 3: Deep Learning and Neural Networks, Jeff Heaton, 2015, ISBN-10: 1505714346, ISBN-13: 978-1505714340

Course Schedule and Important Dates

- First day of classes: Aug. 19, 2024
- Census day: Sept. 4, 2024
- Exam 1: Oct. 10, 2024. 7:00-8:30 PM.
- Last day to drop classes: Oct. 25, 2024
- Thanksgiving Holidays: Nov. 27-29, 2024
- Exam 2: Dec, 3, 2024 7:00-8:30 PM.
- Last day of classes: Dec. 3, 2024

Descriptions of major assignments and examinations

This course includes face-to-face lectures, programming assignments, in-class quizzes and two exams.

- The lowest quiz score will be dropped.
- Quizzes and exams will include both theoretical and programming questions.
- Quizzes and exams will be comprehensive, covering material from pre-readings, textbook chapters, and class lectures.
- Quizzes may be administered at any time during a class period and will only be given to students who are present at the time of the quiz.
- Only non-programmable calculators are allowed during quizzes and exams, unless explicitly specified otherwise. The use of all other electronic devices, including laptops, cellphones, smartwatches, and tablets, is prohibited.

Assignments

- All assignments will be given well in advance of the due date and are due by 11:59 PM on the specified date.
- A 24-hour grace period is available after the due date with no penalty. The grace period is intended to accommodate unforeseen events such as network or server issues. No late assignments will be accepted after the grace period and the grade for the missed assignment will be zero.
- Assignments must be submitted electronically via Canvas.

- The programming language for this class is Python, and all lecture examples and demos will also use Python.
- Each assignment must be self-contained (unless explicitly stated otherwise), including all required components. The teaching assistant will only grade the files submitted—no additional or supplemental files will be used.
- Programs that do not run will receive no credit (no partial credit for non-running programs). Programs that partially meet requirements may receive partial credit but must still run without errors.
- It is each student's responsibility to thoroughly test their program before submission to ensure it runs without errors. After submitting an assignment, it's advisable to download and test the submitted file to confirm the correct version was submitted.
- All assignments are graded as submitted. Once the submission deadline has passed, no changes or modifications can be made to the submitted files.
- Assignments may be submitted multiple times before the deadline.

Expectations for Out-of-Class Study

Beyond the time required to attend each class meeting, students enrolled in this 3 credit-hour course should expect to spend at least an additional 12 hours per week of their own time in course-related activities, including reading required materials, completing assignments, preparing for exams, etc.

Technology Requirements

Canvas will be an important resource throughout the semester, so you will need to be proficient in the use of Canvas to perform well. Your assignments, grades, and other multimedia files will be posted through Canvas. Make sure you have access to Canvas. Canvas support is available 24/7 by calling 1-855-597-3401 or by clicking on the “?” icon on your Canvas Dashboard.

Microsoft Teams will be used for online questions during the office hours. Note that the face-to-face questions will be given precedence. Microsoft Teams is available to all employees and students at The University of Texas at Arlington. [Download Teams](#) to your device. Your computer must have a webcam, internet access, a word processor, and a microphone. Visit the [UTA Libraries Technology page](#) for a list of items that can be checked out or used at the library.

Recording of Classroom and Online Lectures

Faculty maintain the academic right to determine whether students are permitted to record classroom and online lectures. Recordings of classroom lectures, if permitted by the instructor or pursuant to an ADA accommodation, may only be used for academic purposes related to the specific course. They may not be used for commercial purposes or shared with non-course participants except in connection with a legal proceeding.

As the instructor of this course, I elect to allow recording of classroom or online lectures.

Grading Information

Grades will be calculated based on the following percentages:

Assignments	10%
Quizzes	30%
Exam 1	30%
Exam 2	30%

Letter Grades Thresholds	
87%–100%	A
75%–87%	B
65%–75%	C
55%–65%	D
0%–55%	F

- **Grading Policy:** Grades will not be curved and will be strictly determined based on the criteria outlined in the table above. Research shows that curve grading can demotivate students from studying effectively. Additionally, since curves are typically applied at the end of a semester, they create uncertainty, leading to increased stress and leaving students unsure of their standing in the course or what is required to achieve a specific grade.
- **Tracking Performance:** All grades and assignments will be posted on Canvas. Students are expected to monitor their progress throughout the semester and seek guidance from the instructor if their performance falls below satisfactory levels.
- **Important:** Grades will be determined solely by the grading criteria listed above. Students should not request or expect any additional factors to be considered when calculating the course grade. For example, factors such as needing a higher grade to improve GPA, remain in a program, qualify for a job offer, or graduate will not be considered.

Make-Up Exams & Late Work Policy

There will be no make-up quizzes or exams. Exceptions will only be made if you have an approved written medical or university excuse for missing a quiz or exam. In such cases, the average of your other quizzes or exams will replace the grade of the missed quiz or exam. No EXCEPTIONS.

Grades & Feedback Timeline

- **Re-grading Requests:** If you want to request a grade review or re-grading, you must do so within 72 hours of the grade being posted on Canvas. Submit your request in writing via email to the course instructor, clearly explaining why you believe the original grading was incorrect. Keep in mind that your entire submission may be regraded, which could result in an increase or decrease in your grade, depending on any errors identified during the review process.

Incomplete Grades

No incomplete shall be given in this course, except if you miss the last quiz or exam with a university approved letter.

No special make-up work will be accepted after the end of the semester. In the event of a documented major medical problem, with a university approved letter, a grade of Incomplete will be given pending the submission of complete work. However, make-up work “to improve one’s grade” will not be accepted.

Drops

Students may drop or swap (adding and dropping a class concurrently) classes through self-service in MyMav from the beginning of the registration period through the late registration period. After the late registration period, students must see their academic advisor to drop a class or withdraw. Undeclared students must see an advisor in the University Advising Center. Drops can continue through a point two-thirds of the way through the term or session. It is the student's responsibility to officially withdraw if they do not plan to attend after registering. **Students will not be automatically dropped for non-attendance.** Repayment of certain types of financial aid administered through the University may be required as the result of dropping classes or withdrawing. For more information, contact the Office of Financial Aid and Scholarships (<http://wweb.uta.edu/aao/fao/>).

Grade Grievances

Anyone feeling that a dispute exists after the grading of any assignment or exam may submit a written grievance. This grievance should identify the item in dispute and arguments supporting the student’s position. Grievances must be submitted in writing within 72 hours after the grades are posted. When a written grievance is received, the instructor and GTA reserve the right to re-grade the entire exam or assignment (not just the specific point in question).

Please note that grades will depend **EXCLUSIVELY** on standardized grading criteria that apply to all students. Students should not request nor expect any other factor to be considered in grading exams or assignments. For example, factors that will **NOT** be considered are:

Worked very hard for this assignment or exam; need of a better grade to improve GPA; to stay in the program; to qualify for a job offer; or to graduate.

Grade change requests that do not contain substantive content and ask for personal exceptions will result in a reduced grade for the student.

If the student finds the result unsatisfactory, then any appeal of a grade in this course must follow the procedures and deadlines for grade-related grievances as published in the current University Catalog.

[Undergraduate Grading Policies](#)

[Graduate Grading Policies](#)

[Student Complaints](#)

Any appeal of a grade in this course must follow the procedures and deadlines for grade-related grievances as published in the current [University Catalog Grades and Grading Policies](#).

General Policies

- **Your opinion matters.** All constructive suggestions will be carefully considered. I am open to considering any idea that contributes to enhancing the overall learning objectives of this course. Your suggestion should be applicable to all students in the class and focus on improving the learning experience of all students, rather than addressing individual preferences or circumstances. In order to maintain fairness and consistency, any appeal based on individual preferences or personal reasons will regrettably be disregarded. My aim is to create an inclusive and unbiased learning environment for all students. **Please DO NOT ask for any exception.**
- **Be there.** Multiple research studies indicate that the use of electronic devices in class can lead to a distracting learning environment. **You learn better when you are mentally present.** Cell phones, laptops, I-Pads, Kindles, and other electronic devices must be turned off during class (unless explicitly specified otherwise for particular in-class exercises).
- **DO NOT enter the classroom if you are late.** Your late arrival will disturb the continuity of the subject and may break other student's concentration.
- **Responsibility for Missed Material:** You are responsible for all material presented during classes from which you were absent.
- **Communication:** All announcements will be communicated via email. You are responsible for checking your email.

Email Guidelines

- **Subject Line:** Begin the subject line of your email with "CSE-5368". Follow this prefix with a concise description of the topic you're addressing. For example, "CSE-5368: Question about an old test."
- **Opening Line:** In the first line of your email, clearly state the main point or purpose of your message. This helps the recipient quickly understand the nature of your inquiry or request. For example, "I have a question about old test number 2 in Fall 2023". Follow this initial statement with any necessary details or justification in the subsequent paragraphs to provide context and support for your question or request.
- **Email Address:** Always use your official university email address.

- **Signature:** Conclude your email with your full name formatted as (Last, First). This practice helps to clearly identify who is sending the message and ensures proper attribution. For example, "Smith, John."

University & Course Policies

UTA students are encouraged to review the below institutional policies and informational sections and reach out to the specific office with any questions. To view this institutional information, please visit the [Institutional Information](#) page which includes the following policies among others:

- Drop Policy
- Disability Accommodations
- Title IX Policy
- Academic Integrity
- Student Feedback Survey

Attendance

Attending class sessions is a critical predictor and indicator of student success. The University of Texas at Arlington does not recognize a single attendance policy but encourages faculty to establish class-specific policies on attendance. As the instructor of this section, At The University of Texas at Arlington, taking attendance is not required but attendance is a critical indicator in student success. Each faculty member is free to develop his or her own methods of evaluating students' academic performance, which includes establishing course-specific policies on attendance. As the instructor of this section, I will NOT take attendance. However, while UT Arlington does not require instructors to take attendance in their courses, the U.S. Department of Education requires that UT Arlington have a mechanism in place to verify Federal Student Aid recipients' attendance in courses. UT Arlington instructors are expected to report the last date of attendance when submitting students' final course grades; specifically, when a student earns a course grade of F, instructors must report the last date a student attended their class. For on-campus classes, last date of attendance can be based on attendance rosters or on academic engagements—a test, participation in a class project or presentation, or Canvas-based activity. Online or distance education courses require regular and substantive online interaction and participation. Students must participate in online course activities in Canvas to demonstrate attendance; logging into an online class is not sufficient by itself to demonstrate attendance. The last date of attendance is reported to the U.S. Department of Education for federal financial aid recipients.

Generative AI Use in This Course

The use of Generative AI (GenAI) in course assignments and assessments must align with the guidelines established by the instructor. Unauthorized use of GenAI could result in breaches of academic integrity. Instructors bear the responsibility of clearly delineating the permissible uses of GenAI in their courses, underscoring the importance of responsible and ethical application of these tools.

The [UTA Office of Community Standards](#) articulates the university's stance on [academic integrity and scholastic dishonesty](#). These standards extend to the use of GenAI. Unauthorized or unapproved use of GenAI in academic work falls within the scope of these policies and will be subject to the same disciplinary procedures.

Prohibition of GenAI Use: In this course, the focus is on the development of independent critical thinking and the mastery of subject-specific content. To ensure that all submitted work accurately reflects personal understanding and original thought, the use of Generative AI

(GenAI) tools in completing assignments or assessments is strictly prohibited. This policy supports our commitment to academic integrity and the direct measurement of each student's learning against the course's Student Learning Outcomes (SLOs). Any work found to be generated by AI will be subject to academic review.

This policy explicitly identifies the following actions as violations of academic honesty: having another individual or entity undertake any part of a graded assignment on behalf of the student, including but not limited to purchasing work from a company, hiring an individual or company to finalize an assignment or exam, and/or utilizing generative AI tools, such as ChatGPT

Academic Integrity:

All students enrolled in this course are expected to adhere to the UT Arlington Honor Code:

"I pledge, on my honor, to uphold UT Arlington's tradition of academic integrity, a tradition that values hard work and honest effort in the pursuit of academic excellence.

I promise that I will submit only work that I personally create or contribute to group collaborations, and I will appropriately reference any work from other sources. I will follow the highest standards of integrity and uphold the spirit of the Honor Code."

UT Arlington faculty members may employ the Honor Code in their courses by having students acknowledge the honor code as part of an examination or requiring students to incorporate the honor code into any work submitted. Per UT System *Regents' Rule* 50101, §2.2, suspected violations of university's standards for academic integrity (including the Honor Code) will be referred to the Office of Student Conduct. Violators will be disciplined in accordance with University policy, which may result in the student's suspension or expulsion from the University. Additional information is available at <https://www.uta.edu/conduct/>.

All students are expected to pursue their academic careers with honesty and integrity. "Scholastic dishonesty includes, but is not limited to, cheating, plagiarism, collusion, the submission for credit of any work or materials that are attributable in whole or in part to another person, taking an examination for another person, any act designed to give unfair advantage to a student or the attempt to commit such acts" (Regents' Rules and Regulations, Part One, Chapter VI, Section 3, Subsection 3.2, Subdivision 3.22.). Students found guilty of dishonesty in their academic pursuits are subject to penalties that may include suspension from the university.

Any suspicious activity of academic dishonesty will be reported to the Office of Student Conduct.

For any student found guilty of academic dishonesty the instructor reserves the right to impose any grading penalties, including failing the course regardless of any other aspects of student performance, in addition to any other penalties assessed by the Office of Student Conduct (suspension, expulsion, probation).

These and other applying UTA rules, will be strictly enforced. Any case of academic dishonesty will be treated in accordance with the UTA Handbook of Operating Procedures or the Judicial Affairs. If you do not understand this policy, it is your responsibility to obtain clarification or any additional information you may require. Students are not allowed to:

- Collaborate with others on the code they write or on assignment solutions.
- Copy any part of someone else's program, even with permission or modifications.
- Share or give their code, or any subset of it, to another student.
- Review another student's solution, including solutions from past semesters.
- Hire an individual or company to complete assignments or exams.
- Use generative AI tools, such as ChatGPT.

Student Conduct

Students are expected to maintain professionalism and civility in their language and behavior:

- During lectures.
- During office hours.
- In any oral, written, or electronic communication with the instructor and TAs.
- In assignment submissions.

For any student violating this policy, the instructor reserves the right to impose appropriate grading penalties, including a failing grade for the course, regardless of other aspects of student performance. Violations include using vulgar, insulting, disrespectful, or threatening language, making noise or talking during lectures, disrupting lectures, or otherwise making it difficult for other students to follow the lecture.

Academic & Wellness Resources

Academic Success Center

The Academic Success Center (ASC) includes a variety of resources and services to help you maximize your learning and succeed as a student at the University of Texas at Arlington. ASC services include supplemental instruction, peer-led team learning, tutoring, mentoring, and TRIO SSS. Academic Success Center services are provided at no additional cost to UTA students. For additional information visit: [Academic Success Center](https://www.uta.edu/student-success/course-assistance) (https://www.uta.edu/student-success/course-assistance). To request disability accommodations for tutoring, please complete this [tutoring request form](https://www.uta.edu/student-success/course-assistance/tutoring/request) (https://www.uta.edu/student-success/course-assistance/tutoring/request).

The English Writing Center (411LIBR)

The Writing Center offers **FREE** tutoring in 15-, 30-, 45-, and 60-minute face-to-face and online sessions to all UTA students on any phase of their UTA coursework. Register and make appointments online at the [Writing Center](https://uta.mywconline.com) (https://uta.mywconline.com). Classroom visits, workshops, and specialized services for graduate students and faculty are also available. Please see [Writing Center: OWL](http://www.uta.edu/owl) (http://www.uta.edu/owl) for detailed information on all our programs and services.

Academic Plaza

The Library's 2nd floor [Academic Plaza](http://library.uta.edu/academic-plaza) (http://library.uta.edu/academic-plaza) offers students a central hub of support services, including IDEAS Center, University Advising Services, Transfer UTA and various college/school advising hours. Services are available during the [library's hours](https://library.uta.edu/hours) (https://library.uta.edu/hours) of operation.

UTA CARE Team

UT Arlington is committed to the safety, success, and well-being of our students. To support our community, UTA has created a CARE Team, which is a dedicated group of campus professionals responsible for helping students who could benefit from academic, emotional, or psychological support, as well as those presenting risk to the health or safety of the community. If you know of someone experiencing challenges, appearing distressed, needing resources, or causing a significant disruption to the UTA community, please submit a [CARE Referral](#) by visiting the [Behavior Intervention Team](https://www.uta.edu/student-affairs/dos/behavior-it) (https://www.uta.edu/student-affairs/dos/behavior-it) page. You may also submit a referral for yourself if you would like additional support.

NOTE: If a person's behavior poses an immediate threat to you or someone else, contact UTA Police at 817-272-3303 or dial 911. If you or someone you know needs to speak with a crisis counselor, please reach out to the [MAVS TALK 24-hour Crisis Line](https://www.uta.edu/student-affairs/caps/crisis) (https://www.uta.edu/student-affairs/caps/crisis) at 817-272-8255 or the [National Suicide and Crisis Lifeline](https://988lifeline.org/) (https://988lifeline.org/) at 988.

Student Services

Everything you need to make the most of your time as a student (and beyond) is all on campus. Below are a few resources to get you started.

- [Student Services Home](#)
- [Student Access and Resource \(SAR\) Center](#)
- [Military and Veteran Services](#)

- [Health Services](#)
- [Counseling and Psychological Services \(CAPS\)](#)
- [Activities and Organizations](#)
- [Recreation](#)

Librarian to Contact

Each academic unit has access to [Librarians by Academic Subject](https://libraries.uta.edu/research/librarians) (<https://libraries.uta.edu/research/librarians>) that can assist students with research projects, tutorials on plagiarism, and citation references, as well as support with databases and course reserves.

Safety Information & Resources

Face Covering Policy

Face coverings are not mandatory; all students and instructional staff are welcome to wear face coverings while they are on campus or in the classroom.

Emergency Exit Procedures

Should we experience an emergency event that requires evacuation of the building, students should exit the room and move toward the nearest exit, which is located at the south side of the SEIR building. When exiting the building during an emergency, do not take an elevator but use the stairwells instead. Faculty members and instructional staff will assist students in selecting the safest route for evacuation and will make arrangements to assist individuals with disabilities.

[Evacuation Route Maps \(Buildings\).](#)

[Emergency/Fire Evacuation Procedures.](#)

[Emergency Communication System](#)

MavAlert System

The MavAlert system sends information to cell phones or email accounts of subscribed users in case of an emergency. Anyone can subscribe to MavAlerts at [Emergency Communication System](https://www.uta.edu/uta/emergency.php) (<https://www.uta.edu/uta/emergency.php>).

Emergency Phone Numbers

In case of an on-campus emergency, call the UT Arlington Police Department at **817-272-3003** (non-campus phone), **2-3003** (campus phone). You may also dial 911. Non-emergency number 817-272-3381

Course Schedule

Course Schedule	
Introduction <hr/> <ul style="list-style-type: none">• Introduction to Python, Numpy, Matplotlib• Definitions• Historical background• Theoretical background• Matrix operations• Relationship to biological networks• Anatomy of a single neuron	Week 1
Neuron Model and Network Architectures <hr/> <ul style="list-style-type: none">• Artificial Neural Networks• Single neuron and single layer of neurons.• Inside an artificial neuron• Transfer functions• Multiple neurons• Topology of neural network architectures	Week 2
Regression (Linear & Logistic) Neural networks with hard-limit activation function <hr/> <ul style="list-style-type: none">• Definition• Learning rules• Convergence• Applications	Week 3
Computational Graphs Vector Spaces and Linear Transformations <hr/> <ul style="list-style-type: none">• Vectors• Linear transformations• Matrix operations• Eigenvalues and Eigenvectors• Orthogonalization and diagonalization	Week 4
Introduction to Open-Source Machine Learning Libraries <hr/> <ul style="list-style-type: none">• Tensorflow components and examples	Week 5

<ul style="list-style-type: none"> • Keras components and examples • Pytorch components and examples 	
<p>Performance Surface and Optimization</p> <hr/> <ul style="list-style-type: none"> • Tyler series • Directional Derivatives • Performance measure / Cost functions • Quadratic functions (Eigensystem, Hessian) • MSE, Softmax, ... • Steepest descent • Conjugate gradient 	Week 6
<p>Multi-Layer Networks</p> <hr/> <ul style="list-style-type: none"> • Backpropagation • Convolutional Neural Networks • Recurrent Neural Networks • Autoencoders • Transformers • Self-Organizing map • Radial Basis Functions (RBF) 	Week 7-10
<p>Applications of neural networks</p> <hr/> <ul style="list-style-type: none"> • Pattern recognition & computer vision • Practical Considerations • Generative Adversarial Networks (GAN) • LSTM • GRU • AlexNet, GoogleNet, and ResNet • Visualization • ChatGPT • Stable diffusion 	Week 11-..

CSE 5368 Neural Networks Course Overview				
	Mathematical Concepts	Neural Network Models	Programming & API	Applications & Case Studies
Prerequisite				
Review				
Covered in this course				

As the instructor for this course, I reserve the right to adjust this schedule in any way that serves the educational needs of the students enrolled in this course.
 –Farhad Kamangar