TEXAS A&M UNIVERSITY
SAN ANTONIO

CSCI 5341:800, **Machine Learning and Deep Learning**, Fall 2025, CRN: 13033
Department of Computational Engineering and Mathematical Sciences
College of Arts and Sciences
Course Syllabus

Class Modality:		**On-Campus**
Class Meeting Time and Place:		T 4:00 PM – 6:45 PM, STEM 269
Class Duration:		08/24 - 12/11
Instructor:		Dr. Gongbo "Tony" Liang, Office: STEM 211G Tel: 210-784-2373 E-Mail: gliang@tamusa.edu Student emails will receive a reply within two business days.
Course Website:		https://tamusa.blackboard.com/
Office Hours:	M/W T	10:45 AM – 12:30 AM, 1:30 PM – 4:00 PM, and by appointment.
	Please email your instructor to set up an appointment if you wish to meet outside of the scheduled hours.	

Catalog Course Description: This course examines the concepts, principles, and applications of machine learning (ML), the major driving force of current AI development. This course provides fundamental knowledge of ML and hands-on experiences to develop ML models in real-world scenarios. The topics of this course include supervised learning, unsupervised learning, classification, and regression. This course will introduce a wide range of ML algorithms, such as K-Nearest Neighbor, K-Means Clustering, Logistic Regression, Principal Component Analysis, and Neural Networks.

Prerequisites: A grade of B or better in CSCI 2436 and MATH 2314 or equivalent, or by the program coordinator's approval.

Learning Outcomes: The objective of this course is to introduce the theoretical and applied principles and techniques for the latest advancement of machine learning and deep learning, specifically:

1. Gain a historical perspective of ML and its foundations.
2. Become familiar with basic principles of ML toward data representation, problem-solving, model training, and performance evaluation.
3. Investigate various machine learning and deep learning (DL) techniques.
4. Able to implement ML/DL solutions from scratch.

Career-Ready Preparation: This course is specifically designed to prepare students for career readiness with course materials adopted from industry leaders, such as Nvidia and Google. After completing this course, students will:

1. Gain insight into the industry's use of the latest ML/DL techniques through invited guest speaker(s) from the industry.
2. Learn the state-of-the-art ML/DL software and methods for various application domains, such as computer vision, natural language processing, spatial-temporal analysis, generative AI, etc.
3. Use the real-world resource (e.g., cutting-edge supercomputers and GPU clusters) to solve real-world problems.
4. Enhance career-related research skills to prepare students for R&D (Research and Development) and Research Scientist roles.
5. Develop career-related soft skills, such as interpersonal, teamwork, presentation, professional writing, etc.

Recommended Textbook:

- Müller, Andreas C., and S. Guido. *Introduction to machine learning with Python: a guide for data scientists*. O'Reilly Media, Inc., 2016. [ISBN: 978-1449369415]
- Raschka, Sebastian, and Liu, Yuxi, and Mirjalili Vahid. *Machine Learning with PyTorch and Scikit-Learn*. Packt Publishing, 2022. [ISBI: 978-1801819312]
- Xiao, Perry. *Artificial Intelligence Programming with Python: From Zero to Hero*. John Wiley & Sons, Inc., 2023. [ISBN: 978-1119820864]
- *Deep Learning*, MIT Press by I. Goodfellow, Y. Bengio, and A. Courville. ISBN: 9780262035613. Free Access online: https://www.deeplearningbook.org

Required Materials:

- **Blackboard:** Connect to http://tamusa.blackboard.com. Students will have lecture notes, solutions to problems, multimedia materials, and other supplementary materials in Blackboard. All class communications will be through Blackboard; students should monitor this daily.
- **Computer Hardware:** To participate in this class, students need access to a computer with an internet connection and be able to use Google Colab.
- **Time Expectation for Coursework:** Students are expected to spend 5-10 hours per week on the course. Based on the background, some students may require more time. Time spent may be longer when assignments/exams are due.

(Tentative) Fall 2025 Class Schedule: The provisions and information outlined in the schedule below are intended to be informational and not contractual in nature. The instructor reserves the right to amend, alter, change, delete, or modify the provisions of the schedule.

Week	Date	Chapter and Topic	Comments
Week 1	Aug 24 – 29	**Introduction:** Syllabus, Introduction to AI/ML/DL, Python and Google Colab Review **Machine Learning Basis:** Data Representation, Feature Visualization	**Assignment I -- Self-proctored test on prerequisites** (Due: 11:59pm, 08/31 | 100 pts)

		Asynchronous Prerequisites Review: - **Linear Algebra:** vectors, matrices and matrix operations, dot product, distance/similarity measures (Euclidean, Manhattan, Cosine Similarity) - **Probability:** Basic Probability (Sample space, Types of events, Probability Rules), Joint, Conditional & Marginal probability, Probability Distributions	
Weeks 2-4	Aug 30 – Sep 19	**Pathway to Neural Networks:** Linear Regression, Gradient Descent, Cost Function, Logistic Regression **Neural Network:** Feedforward Neural Networks, Bias and Variance, Overfitting and Underfitting, PyTorch **Neural Network Practice:** Data Augmentation, Hyperparameter Tunning, Model Visualization	**Census Date** (Wed, Sep 10) Assignment 2 – Linear Regression from Scratch **Labor Day** - University Closed (Mon, Sep 7) **Census Date** (Wed, Sep 9) Assignment 3 – Multilayer Perceptron Model (MLP) Assignment 4 – Image Classification
Weeks 5-6	Sep 20 – Oct 03	**Computer Vision:** CNN & Pre-Training **Mid-Term Exam**	Term/Research Project Announcement
Week 7	Oct 04 –10	**Invited Talk**	Research Project Formation (10 pts)
Weeks 8-10	Oct 11 – 17	**Natural Language Processing:** RNN **Large Language Models:** Transformers, LLM Fine-tuning, LLM Embedings	Research Project Milestone I (10 pts)
Weeks 11-13	Nov 01 – 21	**Emerging Topics**: Vision-Language Model (VLM) Retrieval-Augmented Generation (RAG) Trustworthy AI Agentic AI	Research Project Milestone II (10 pts) Research Project Milestone III (10 pts)
Week 14	Nov 22 – 28	**Invited Talk**	**University's Study Day** - No Classes (Wed, Nov 25)
Week 15	Nov 29 – Dec 04	Research Project Showcase and Project Due	Research Project Showcase (60 pts) Research Project (100 pts) Research Paper (100 pts)
Final Exam Week			

Grading Policy: The final course grade will be based on your performance on the quizzes, exams, assignments, and class participation using the following weights:

Assignment (4)	400 pts
Mid-Term Exam	200 pts
Research Term Project	300 pts
Total	**900 pts**

This course requires a grade of **B (>=720 pts) as a minimum grade** for satisfactory completion of this course.

Examinations: There will be one mandatory mid-term exam and a mandatory research project. Being absent / non-submitted to an exam will result in a grade of zero for that exam and may result in a failing

grade in the course. The exams will be project-based exams. The exam materials will come from lecture notes, the text, and class discussions. Questions will emphasize understanding and applications of concepts and topics covered in class.

Assignments/ Research papers: There will be several assignments and projects (individual/team of two) during the course. Individual assignment statements and due dates will be posted through Blackboard. For all assignments and quiz problems, ALL intermediate work of the problem solution steps MUST be shown. *For the programming assignments/projects, a clear representation of the program code and logic, including comments, is necessary.* Considerable points will be taken off for not following these requirements. As a general rule, name the assignment/lab submissions as: *assignmentName_firstname_lastname*.

Makeup and Late Assignment/exam policy:

- As a general rule, make-ups or late submissions will **NOT** be offered or accepted for any missed exams. Late submissions or make-ups for exams may be accepted/administered only in extraordinary circumstances, such as an excused official university activity, a severe illness, or a dire emergency. However, you must provide comprehensive documentation either before or within a few days of the missed exam.
- All assignments, labs, and projects have a clearly indicated due date. Students will receive full credit only if they are turned in by that date. All assignments are due at 11:59 p.m. on that **date.**
- Late assignments (including labs, assignments, and projects) are penalized by 10% per school day. No assignment that is more than 3 days late may be accepted.

Course Requirements every student must fulfill to succeed in the course: Anyone violating these policies may be subject to disciplinary actions.

- Students should check the Course Calendar, Announcements, and Messages (e-mail) in Blackboard regularly.
- Students should keep current with all course assignments, quizzes, and examinations.
- If the course uses remote proctoring for exams, students must schedule their exams early in the semester.
- Students should ask questions and communicate with the instructor either in class or during office hours.
- If students wish to attend the virtual office hours via Zoom, please email the instructor to set up an appointment before attending the virtual office via Zoom.
- For all classwork, exams, quizzes, etc., if a student is completing it off-campus, then they are responsible for the availability of internet connectivity. Extensions will **not** be granted for lack of availability of internet connections.
- Students should remember that online and hybrid courses assume greater responsibility and independent learning skills by the student for their own learning outcomes.
- For online courses, students should keep current on class recordings if not attending the live class (either in person or online).
- For online asynchronous courses, there will be no online class sessions. All materials will be made available through Blackboard or through online links.
- For online synchronous courses, there will be online class sessions as indicated. Students are expected to attend the online session at the given time. If a student is unable to attend a session, the instructor will make the recording of the session available for the student to view. All materials will be made available through Blackboard or through online links.

Class attendance and Participation: A vital part of every student's education is regular attendance of class meetings (for face-to-face/hybrid classes/online synchronous classes) or regular review of class materials posted by the instructor for asynchronous classes. Any absences tend to lower the quality of a student's work, and frequent or persistent absences may result in a failing grade. Students are responsible for the materials covered in class. The course covers a lot of material, and most students find at least some parts of it difficult. Class participation is highly encouraged as it makes the class more interesting and enhances the learning experience. Students are strongly encouraged to ask questions, participate in class discussions and problem-solving, and visit/contact the instructor during office hours in case of questions or concerns. Virtual office hours are available to students, but please email your instructor to set up an appointment before attending the virtual office. Good attendance and participation will be rewarded when final grades are assigned.

The course is intensive and challenging. You are expected to master the materials presented in class. The structure of the class makes your individual study and preparation outside of class extremely important and may vary considerably based on student background. However, a **minimum** of two hours of work outside the class is expected for every one hour of class period per week. Reading the assigned chapter(s) and having some familiarity with them before class will be very useful for understanding lectures.

Key Dates for the Semester
The complete academic calendar is available online: https://www.tamusa.edu/academics/academic-calendar/index.html

IMPORTANT POLICIES AND RESOURCES

University Email Policy and Course Communications:

All correspondence between professors and students must occur via university email accounts. You must have your Jaguar email account ready and working. If it is not working, contact the help desk at helpdesk@tamusa.edu or at 210-784-HELP (4357). If you don't hear back within 48 hours, contact them again. They have many requests during the first part of the semester, so you may need to follow up with them.

Academic Accommodations for Individuals with Disabilities:

Texas A&M University-San Antonio is committed to providing all students with reasonable access to learning opportunities and accommodations in accordance with The Americans with Disabilities Act, as amended, and Section 504 of the Rehabilitation Act. If you experience barriers to your education due to a disability or think you may have a disability, Disability Support Services is located in the Central Academic Building, Suite 210. You can also contact us via phone at (210) 784-1335, visit us at the website or email us at **dss@tamusa.edu**. All students are encouraged to discuss their academic accommodation with Disability Support Services and their instructors as soon as possible.

Academic Learning Center:

All currently enrolled students at Texas A&M University-San Antonio can utilize the Academic Learning Center for subject-area tutoring. The Academic Learning Center provides free course-based tutoring to all currently enrolled students at Texas A&M University-San Antonio. Students wishing to work with a tutor can make appointments through the Brainfuse online tutoring platform. Brainfuse can be accessed in the *Tools* section of Blackboard. You can contact the Academic Learning Center by emailing tutoring@tamusa.edu, calling (210) 784-1307, or visiting the Central Academic Building, room 202. Online tutoring is also available for after hours and weekend assistance.

While tutoring hours may change based on tutor schedules and availability, the current tutoring hours for MATH in the ALC are as follows:

Appointments available MATH Walk in Tutoring – No appointment needed

	Appointments available	Walk in Tutoring – No appointment needed
MONDAY	8 am – 6 pm	9 am – 5 pm
TUESDAY	8 am – 6 pm	9 am – 5 pm
WEDNESDAY	8 am – 6 pm	9 am – 5 pm
THURSDAY	8 am – 6 pm	9 am – 5 pm
FRIDAY	8 am – 5 pm	11 am – 4 pm

Counseling/Mental Health Resources: As a college student, there may be times when personal stressors interfere with your academic performance and negatively impact your daily functioning. If you are experiencing emotional difficulties or mental health concerns, support is available to you through the Student Counseling Center (SCC). To schedule an appointment, visit our website, call 210-784-1331 or visit Madla 120 between the hours of 8:00 AM and 5:00 PM.

All mental health services provided by the SCC are free and confidential (as the law allows). The Student Counseling Center provides brief individual and group therapy, crisis intervention, consultation, case management, and prevention services. *Crisis support is available 24/7/365 by calling the SCC at 210-784-1331 or through the TELUS student support App.*

The TELUS Student Support App provides a variety of mental health resources to including 24/7/365 support for in the moment distress, crisis support, an anonymous peer-to-peer support network, mental health screenings, podcasts, and articles to improve your mental wellbeing.

Emergency Preparedness: JagE Alert is Texas A&M University-San Antonio's mass notification system. In the event of an emergency, such as inclement weather, students, staff and faculty, who are registered, will have the option to receive a text message, email with instructions and updates. To register or update your information visit: https://tamusa.bbcportal.com/. More information on emergency response may be found at: Emergency Operations Plan and the Emergency Action Plan. Download the SafeZone App (https://safezoneapp.com/) for emergencies or call (210) 784-1911. Non-Emergency (210) 784-1900.

Financial Aid and Verification of Attendance: According to the following federal regulation, 34 CFR 668.21: U.S. Department of Education (DoE) Title IV regulation, a student can only receive Title IV funds based on Title IV eligibility criteria which include class attendance. If Title IV funds are disbursed to ineligible students (including students who fail to begin attendance), the institution must return these funds to the U.S. DoE within 30 days of becoming aware that the student will not or has not begun attendance. Faculty will provide the Office of Financial Aid with an electronic notification if a student has not attended by the published Census Date (the first week of class). Any student receiving federal financial aid who does not attend prior to the published Census Date (the first week of class) will have their aid terminated and returned to the DoE. Please note that any student who stops attending at any time during the semester may also need to return a portion of their federal aid.

Jaguar Writing, Language, and Digital Composing Center (WLDCC): The WLDCC provides support to graduate and undergraduate students in all three colleges as well as faculty and staff. Writing tutors work with students to develop reading skills, prepare oral presentations, and plan, draft, and revise their written assignments. Our language tutors support students enrolled in Spanish courses and students composing in Spanish for any assignment. Our digital studio tutors support students working on digital projects such as eportfolios, class presentations, or other digital multimedia projects. The WLDCC offers face-to-face, synchronous online, and asynchronous digital appointments. Students can schedule appointments with the WLDCC in JagWire under the Student Services tab. Click on "Writing, Language, and Digital Composing Center" to make your appointment. Students wanting to work in realtime with a tutor can schedule an "Online Appointment." Students wishing to receive asynchronous, written feedback from a tutor can schedule an "eTutoring" appointment. More information about what services we offer, how to make an appointment, and how to access your appointment can be found on our website . The WLDCC can also be reached by emailing wldcc@tamusa.edu.

Meeting Basic Needs: Any student who has difficulty affording groceries or accessing sufficient food to eat every day or who lacks a safe and stable place to live, and believes this may affect their performance in the course, is urged to submit a CARE report for support. Furthermore, please notify the professor if you are

comfortable in doing so. This will enable them to direct you to available resources. A food pantry is available on campus; click here for hours and contact information.

Military Affairs: Veterans and active-duty military personnel are welcomed and encouraged to visit the Office of Military Affairs for any question involving federal or state VA Education Benefits. Visit the Patriots' Casa building, room 202, or to contact the Office of Military Affairs with any questions at military.va@tamusa.edu or (210)784-1397.

Religious Observances: Texas A&M University-San Antonio recognizes the wide variety of faiths represented among the campus community and protects the rights of students, faculty, and staff to observe religious holidays according to their tradition. Under the policy, students are provided an opportunity to make up any examination, study, or course work requirements that may be missed due to a religious observance provided they notify their instructors before the end of the second week of classes for regular session classes.

The Six-Drop Rule: Students are subject to the requirements of Senate Bill (SB) 1231 passed by the Texas Legislature in 2007. SB 1231 limits students to a maximum of six (6) non-punitive course drops (i.e., courses a student chooses to drop) during their undergraduate careers. A non-punitive drop does not affect the student's GPA. However, course drops that exceed the maximum allowed by SB 1231 will be treated as "F" grades and will impact the student's GPA.

Statement of Harassment and Discrimination: Texas A&M University-San Antonio is committed to the fundamental principles of academic freedom, equal opportunity, and human dignity. To fulfill its multiple missions as an institution of higher learning, A&M-San Antonio encourages a climate that values and nurtures collegiality and the uniqueness of the individual on our campus and within our state, nation, and world. All decisions and actions involving students and employees are to be based on applicable law and individual merit. Texas A&M University-San Antonio, in accordance with applicable federal and state law, prohibits discrimination, including harassment, on the basis of race, color, sex, religion, national origin, age, disability, genetic information, veteran status, sexual orientation, or pregnancy/parenting status. Individuals who believe they have experienced harassment or discrimination prohibited by this statement are encouraged to contact the University's Civil Rights Officer at 210-784-2061 or titleix@tamusa.edu.

Texas A&M University-San Antonio faculty are committed to providing a safe learning environment for all students and for the university as a whole. If you have experienced any form of sex discrimination or harassment, including sexual assault, sexual harassment, domestic or dating violence, or stalking based on sex, know that help and support are available. A&M-San Antonio's Title IX Coordinator can support those impacted by such conduct in navigating campus life, accessing health and counseling services, providing academic and housing accommodations, and more. The university strongly encourages all students to report any such incidents to the Title IX Coordinator. Please be aware that all A&M-San Antonio employees (other than those designated as confidential resources such as counselors and trained victim advocates) are required to report information about such discrimination and harassment to the university. This means that if you tell a faculty member about a situation of sexual harassment, sexual violence, or other related sex-based misconduct, the faculty member must share that information with the university's Title IX Coordinator (titleix@tamusa.edu, 210-784-2061, CAB 439K). If you wish to speak to a confidential employee who does not have this reporting requirement, you can contact the Student Counseling Center at (210) 784-1331 or visit them in Madla 120.

Pregnant/Parenting Students: Texas A&M-San Antonio does not require a pregnant or parenting student, solely because of that status or issues related to that status, to (1) take a leave of absence or withdraw from their degree or certificate program; (2) limit the student's studies; (3) participate in an alternative program;

(4) change the student's major, degree, or certificate program; or (5) refrain from joining or cease participating in any course, activity, or program at the University. The university will provide such reasonable accommodations to pregnant students as would be provided to a student with a temporary medical condition that are related to the health and safety of the student and the student's unborn child. These could include maintaining a safe distance from substances, areas, and activities known to be hazardous to pregnant individuals and their unborn child; excused absences because of illness or medical appointments; modified due dates for assignments; rescheduled tests/exams; taking a leave of absence; and being provided access to instructional materials and video recordings of lectures for excused absences, if these would be provided to any other student with an excused absence. Pregnant/parenting students are encouraged to contact the Title IX Coordinator with any questions or concerns related to their status (titleix@tamusa.edu; 210-784-2061; CAB 439K).

Texas A&M-San Antonio has also designated the Title IX Coordinator as the liaison officer for current or incoming students who are the parent or guardian of a child younger than 18 years of age. The Title IX Coordinator can provide students with information regarding support services and other resources.

Young Jaguars can support parenting students with daycare if students meet this criteria: (1) must be enrolled in classes at Texas A&M-San Antonio in the current semester, (2) must be Pell eligible or a single parent, (3) child(ren) must be aged 3 to 12-years-old, and (4) child(ren) must be enrolled in Pre-K-3 through 6th grade. Hours of operation is Monday-Thursday 3:30pm-9:00pm. For more information, please contact Young Jaguars at youngjaguars@tamusa.edu or call (210) 784-2636.

Students' Rights and Responsibilities:

The following statement of students' rights and responsibilities is intended to reflect the philosophical base upon which University Student Rules are built. This philosophy acknowledges the existence of both rights and responsibilities, which is inherent to an individual not only as a student at Texas A&M University-San Antonio but also as a citizen of this country.

Students' Rights

1. A student shall have the right to participate in a free exchange of ideas, and there shall be no University rule or administrative rule that in any way abridges the rights of freedom of speech, expression, petition and peaceful assembly as set forth in the U.S. Constitution.
2. Each student shall have the right to participate in all areas and activities of the University, free from any form of discrimination, including harassment, on the basis of race, color, national or ethnic origin, religion, sex, disability, age, and pregnancy/parenting or veteran status in accordance with applicable federal and state laws.
3. A student has the right to personal privacy except as otherwise provided by law, and this will be observed by students and University authorities alike.
4. Each student subject to disciplinary action arising from violations of university student rules shall be assured a fundamentally fair process.

Students' Responsibilities

1. A student has the responsibility to respect the rights and property of others, including other students, the faculty, and administration.

2. A student has the responsibility to be fully acquainted with the published University Student Rules found in the Student Handbook, Student Code of Conduct, on our website, and University Catalog, and to comply with them, as well as with federal, state, and local laws.
3. A student has the responsibility to recognize that student actions reflect upon the individuals involved and upon the entire University community.
4. A student has the responsibility to recognize the University's obligation to provide a safe environment for learning.
5. A student has the responsibility to check their university email for any updates or official university notifications.

We expect that students will behave in a manner that is dignified, respectful, and courteous to all people, regardless of sex, ethnic/racial origin, religious background, or disability. Conduct that infringes on the rights of another individual will not be tolerated.

Students are expected to exhibit a high level of honesty and integrity in their pursuit of higher education. Students engaging in an act that violates the standards of academic integrity will find themselves facing academic and/or disciplinary sanctions. Academic misconduct is any act, or attempt, which gives an unfair advantage to the student. Additionally, any behavior specifically prohibited by a faculty member in the course syllabus or class discussion may be considered as academic misconduct. For more information on academic misconduct policies and procedures please review the Student Code of Conduct or visit the resources available in the OSRR website

Important Fall 2026 Dates:

Dates	Event
August 20	Tuition & Fee Payments deadline
August 24	First day of class
September 7	Labor Day Holiday – No Classes / University Closed
September 9	Census Date – Students not paid in full or enrolled in a payment plan by 4:59 pm may be dropped for non-payment
October 5 – October 16	Midterm grading period
November 13	Last day to drop with an automatic "W"
November 25	Study Day – No classes
November 26-November 28	Thanksgiving Holiday – No Classes / University Closed
November 30	Last day to drop a course or withdraw from the University
December 4	Last day of classes
December 5 – December 11	Final exams
December 15	Commencement

The complete academic calendar is available online

Broader Use of Generative AI Permitted Within Guidelines

Use of artificial intelligence (AI) tools, including ChatGPT, is permitted in this course for students who wish to use them. To adhere to our scholarly values, students must cite any AI-generated material that informed their work (this includes in-text citations and/or use of quotations, and in your reference list). Using an AI tool to generate content without proper attribution qualifies as academic dishonesty and violates Texas A&M-San Antonio's standards of academic integrity.