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
Class Duration:		08/25 - 12/12
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	8:45 AM – 11:00 AM, 2:30 PM – 4:00 PM, and by appointment. Please reserve your office using the link below: https://outlook.office365.com/owa/calendar/Gd2eae9aebbcd487c954bae3cc27e7168@tamusa.edu/bookings/ 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 C or better in CSCI 2436, or by the program coordinator's approval. TSI Restriction(s): Reading, Math, and Writing.

Student Learning Outcomes: The objective of this course is to introduce the basic principles, techniques, and applications of machine learning (ML), 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.

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 25	Aug 30	**Introduction:** Syllabus, Introduction to AI and ML, Python and Google Colab Review **Machine Learning Basis:** Data Representation, Feature Visualization	Assignment 1 – Hello World (Matplotlib)
Week 2	Aug 31	Sep 06	**Machine Learning Applications** K-Nearest Neighbor (Classification & Regression), Distance/Evaluation Metrics, sci-kit learn, Decision Tree, SVM, etc	Labor Day–No Class (Mon, Sep 1) Assignment 2 – KNN from Scratch
Week 3	Sep 07	Sep 13	**Pathway to Neural Networks:** Linear Regression, Gradient Descent, Cost Function, Logistic Regression	Census Date (Wed, Sep 10) Assignment 3 – Linear Regression from Scratch
Week 4	Sep 14	Sep 20	**Neural Network:** Feedforward Neural Networks, Bias and Variance, Overfitting and Underfitting, PyTorch	Assignment 4 – Multilayer Perceptron Model (MLP)
Week 5	Sep 21	Sep 27	**Neural Network Practice:** Data Augmentation, Hyperparameter Tunning, Model Visualization, PyTorch Lightning	Assignment 5 – Image Classification
Week 6	Sep 28	Oct 04	**Deep Learning: Computer Vision** Transfer Learning, Pre-Training	Mid-term Exam Release Term/Research Project

				Announcement (Research Project for Graduate Students)
Week 7	Oct 05	Oct 11	**Mid-Term Exam**	**Due by 11:59PM on Oct 10**
Week 8	Oct 12	Oct 18	Invited Speech from the Industry Term Project Idea Pitch	Research Project Formation (10 pts)
Week 9	Oct 19	Oct 25	**Deep Learning: NLP** Transformers & Multi-head Attention	Research Project Milestone I (10 pts)
Week 10	Oct 26	Nov 01	**Deep Learning: GNN** Basis of Graph Neural Networks	
Week 11	Nov 02	Nov 08	**Deep Learning: Energy-Based Learning** Energy-Based Generative Learning	Research Project Milestone II (10 pts)
Week 12	Nov 09	Nov 15	**Deep Learning: ViT** Vision Transformer	
Week 13	Nov 16	Nov 22	**Deep Learning: Meta-Learning** Learning to learn	Research Project Milestone III (10 pts)
Week 14	Nov 23	Nov 29	**Deep Learning: SimCLR** Self-Supervised Contrastive Learning	
Week 15	Nov 30	Dec 05	Research Project Showcase and Project Due	Research Project Showcase (60 pts) Research Project (100 pts) Research Paper (100 pts) Study Day–No Class (Dec 05)
Final Exam Week (Dec 06-12)				

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 (5)	500 pts
Mid-Term Exam	100 pts
Research Term Project	200 pts
Research Paper	100 pts
Total	**1000 pts**

The final letter grades will be assigned as follows:

>=900 ⇒ A; 800-899 ⇒ B; 700-799 ⇒ C; 600-699 ⇒ D; <600 ⇒ F.

This course requires a grade of **B 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.

University Email Policy and Course Communications: All correspondence between professors and students must occur via tamusa email accounts. You must have your Jaguar email account ready and working. If it is not working, contact the help desk at 210-784-4357.

Academic Accommodations for Persons with Disabilities: The Americans with Disabilities Act Amendments Act (ADAAA) of 2008 and the Rehabilitation Act of 1973 are federal anti-discrimination statutes that provide comprehensive civil rights protection for persons with disabilities. Title II of the ADAAA and Section 504 of the Rehabilitation Act require that students with disabilities be guaranteed equal access to the learning environment through the provision of reasonable and appropriate accommodation of their disability. If you have a diagnosed disability that may require accommodation, please contact Disability Support Services (DSS) for the coordination of services. DSS is located at the Main Campus on the 2nd floor of the Central Academic Building in suite 210. The phone number for DSS is (210) 784-1335, and the email is dsupport@tamusa.edu.

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 is an appointment-based center where appointments are made through the Navigate platform. Students access Navigate through Jagwire in the Student Services tab. The Center is active on campus outreaching to students to highlight services offered. You can contact the Academic Learning Center by emailing tutoring@tamusa.tamus.edu or calling (210)-784-1332. Appointments can also be made through JagWire under the services tab.

Counseling Resources: As a college student, there may be a time when personal stressors interfere with your academic performance and/or negatively impact your daily functioning. If you or someone you know is experiencing life stressors, emotional difficulties, or mental health concerns at A&M-SA, please contact the Office of Student Counseling & Wellness Services (SC & WS) located in Modular C Room 166 (Rear entrance) or call 210-784-1331 between the hours of 8:00 AM and 5:00 PM. All mental health services provided by SC & WS are free, confidential (as the law allows), and are not part of a student's academic or university record. SC&WS provides brief individual, couples, and group therapy, crisis intervention, consultation, case management, and prevention services. For more information, please visit www.tamusa.edu/studentcounseling.

In a crisis, please walk-in to the SC & WS services between 8:00 AM and 5:00 PM to be seen by a licensed clinician. After hours, please contact UPD at 911 or text "HOME" to 741-741 24/7/365 to connect with a trained crisis counselor. The National Suicide Prevention hotline also offers a 24/7/365 hotline at 1-800-273-8255.

Emergency Preparedness: JagE Alert is Texas A&M University-San Antonio's mass notification. 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, and/or phone call with instructions and updates. To register or update your information, visit https://tamusa.bbcportal.com/.
More information about Emergency Preparedness and the Emergency Response Guide can be found here: http://www.tamusa.edu/riskmanagement/index.html.

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 the first week of class. Any student receiving federal financial aid who does not attend 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 Center: The Jaguar Writing Center provides writing assistance to graduate and undergraduate students in all three colleges. Writing tutors work with students to develop reading skills, prepare oral presentations, and plan, draft, and revise their written assignments. Students can make individual or group appointments with a writing tutor. The Writing Center is located in the Central Academic Building, Suite 208. Appointments can also be made through JagWire under the services tab.

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 contact the Dean of Students (DOS@tamusa.edu) for support. Furthermore, please notify the professor if you are comfortable doing so. This will enable them to provide any resources they may possess.

Military Affairs: If possible, veterans and active-duty military personnel are welcomed and encouraged to communicate in advance in special circumstances (e.g., upcoming deployment, drill requirements, disability accommodations). You are also encouraged to visit the Patriots' Casa in-person room 202 or to contact the Office of Military Affairs with any questions at military@tamusa.edu or (210)784-1397.

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

Respect for Diversity: We understand that our students represent diverse backgrounds and perspectives. When we are equity-minded, we are aware of differences and inequalities and are willing to discuss them so we can act to resolve them. The University is committed to building cultural

competencies, or the attitudes, skills, and knowledge that enable individuals and organizations to acknowledge cultural differences and incorporate these differences in working with people from diverse cultures. Respecting and accepting people different than you is vital to your success in class, on campus, and as a future professional in the global community. While working together to build this community, we ask all members to:

- Share their unique experiences, values, and beliefs.
- Be open to the views of others.
- Honor the uniqueness of their colleagues.
- Value each other's opinions and communicate respectfully.
- Keep confidential discussions that the community has of a personal (or professional) nature.
- Use this opportunity together to discuss ways in which we can create an inclusive environment in this course and across the A&M-San Antonio community.

Drop Policy: You may drop the course with an automatic grade of W on or before the date listed in the academic calendar at www.tamusa.edu. The last date to drop a course or withdraw from the University is also indicated in the academic calendar on the university website (www.tamusa.edu). If you wish to drop the class, you must submit the necessary paperwork to the proper authority. Students dropping a course are subject to all conditions listed in the university catalog.

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, equality of 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, diversity, pluralism, and the uniqueness of the individual within our state, nation, and world. All decisions and actions involving students and employees should 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, national or ethnic origin, religion, sex, disability, age, sexual orientation, or veteran status. Individuals who believe they have experienced harassment or discrimination prohibited by this statement are encouraged to contact the appropriate offices within their respective units.

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, sexual orientation, 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 University officials.
2. A student has the responsibility to be fully acquainted with the published University Student Rules and to comply with them, as well as 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 maintain a level of behavior that is consistent in supporting the learning environment of the institution and to recognize the University's obligation to provide an environment for learning.

Violations of Academic Conduct (Section 14.5 Student Handbook): As a member in an academic community, students at Texas A&M University-San Antonio are expected to exhibit a high level of honesty and integrity in their pursuit of higher education, be mature, be self-directed and be able to manage their own affairs. Students who are unwilling to abide by these basic expectations will find themselves facing academic and/or disciplinary sanctions. Students are expected to share in the responsibility and authority with faculty and staff to challenge and make known acts that violate the Texas A&M University-San Antonio Code of Conduct. For more information please visit the Office of Student Rights &Responsibilities website http://bit.ly/TAMUSAStudentRR.

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. Academic misconduct includes, but is not limited to, cheating, plagiarism, multiple submissions, collusion, lying and bribery. For more information, refer to the Student Code of Conduct, Article III: Conduct Rules and Regulations. Texas A&M University-San Antonio faculty has the discretion to impose grade penalties as deemed necessary.

Faculty members are required to report such serious breaches of academic honesty to their chair, their dean and the Office of Student Rights and Responsibilities. In cases of academic misconduct, students may be subject not only to grade sanctions in courses but to disciplinary action. Grade sanctions may be imposed only by faculty members, but suspension or expulsion may be imposed only by the Vice President for Student Affairs. If a student wishes to appeal the decision of suspension or expulsion due to violations of academic misconduct, they must initiate their appeal as outlined within the Student Code

of Conduct. Extenuating circumstances may cause the University to deviate from the defined time frames.

All student term papers and other written assignments are subject to analysis by anti-plagiarism software. Posting of any class work given to student, solutions, or discussion, on publicly accessible forums or on social media is not permissible.

Considering the potential consequences of academic misconduct, it is obviously in students' best interests to avoid even the appearance of such behavior. If a student is unclear whether a specific act might constitute academic misconduct, please she/he should contact the instructor for an assessment of the situation.

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