CSCE 5216- 002 Pattern Recognition

Course Instructor: Dr. Haili Wang  
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• Include CSCE 5216 in subject line  
• Always use your official UNT email address

Class Location/Time: NTDP B190 MoWe 1:00PM – 2:50PM  
Office Hours (In-Person): MoWe 3:00 PM-4:00 PM Office  
or by appointment

Office Location: NTDP E260E

TA’s Information: Siyuan Liu  
TA’s Email: SiyuanLiu@my.unt.edu

Communication Expectations: Students will be expected to regularly check their university email and the course canvas page for relevant updates or announcements. If there are personal concerns or questions, it is suggested that students discuss before or after class or during office hours, and at other times send the instructor an email. You can expect email responses within 24 hours M-F with possible delays over the weekend. Feedback on assignments and grades will be approximately one week after assignments are due.

For assistance with assignments or questions about grading of a particular assignment, you may also contact the TAs assigned to this directly via e-mail or their Zoom Meeting ID during their office hours. This information will be available on Canvas.

Grades will be posted on Canvas throughout the semester to provide an ongoing assessment of student progress, but typically about one week after the assignment was due. Grading disputes should first go to the TA that graded your assignment, but if a resolution cannot be reached between the student and the grader, then you should go to the instructor who will have the final say on the grade.

Course Description

Pattern recognition - the act of taking raw data and making decisions based on the categories of the pattern - has applied to such diverse areas as character recognition, data mining, medical diagnosis, image processing, computer vision, bioinformatics, speech recognition, fraud detection, and stock market prediction. This course will provide underlying of principles and various approaches of pattern recognition and decision making processes. The topics include diverse classifier designs, evaluation of classifiably, learning algorithms, and feature extraction and modeling. The goal of this course is to introduce students to the fundamental models of decision making to prepare them for applying the associated concepts to information processing.
Materials

Much of the material in the course is based on the book and lecture material of Chris Bishop

- Textbook information:

  Pattern Classification, 2nd Edition, by Richard O. Duda, Peter E. Hart, and David G. Stork

Supplementary material:

  Deep learning with Python, by Francois Chollet
  Deep learning, by Ian Goodfellow
  Building Probabilistic Graphical Models with Python, by Kiran R Karkera
  Introduction to support vector machines and other kernel-based learning methods, by Cristianini and Shawe-Taylor
  Brief Introduction to Graphical Models and Bayesian Networks, by Kevin Murphy.
Course Structure
Credit hours: 3
10 Weeks: May 22 – July 28, 2023

Tentative topics
- Introduction to Pattern Recognition, Feature Detection, Classification
- Probability Theory, Conditional Probability and Bayes Rules
- Decision Trees, Perceptron Algorithm
- Linear Model and Fisher Method
- Unsupervised Learning, Clustering, K-Means
- K-Nearest-Neighbor Classification
- Bayesian Networks
- Model Aggregation
- Feature Selection
- Gaussian Mixture Model
- Expectation Maximization Methods

Course Prerequisites
Programming experience (Python preferred). Introductory courses on data structures and algorithms. Linear algebra and probability theory preferred.

Course Objectives
By the end of this course, students will be able to:
1. Gain knowledge of various pattern recognition techniques and algorithms.
2. Develop an understanding of feature extraction and selection methods.
3. Develop skills to apply different classification algorithms for categorizing data into predefined classes or categories.
4. Understand and be able to perform data visualization and interpretation in pattern recognition.
5. Explore advanced topics in pattern recognition, such as ensemble methods, deep learning for pattern recognition, or multi-modal pattern recognition.
Teaching Philosophy

There are facts about Pattern Recognition that you will pick up in this class, but the best long-lasting benefits come from the implicit learning that will happen. You will understand a new approach to organizing information that is readily applicable to more than text processing. And work hard and creatively on the projects and assignments and your programming ability will improve. Though the title is Pattern Recognition, the skills and approaches from this class will help you well beyond this semester.

Technical Requirements & Skills

Minimum Technology Requirements

- Computers are required
  - You can choose to use your own laptop, or use the machines in the lab
  - In-class quizzes: These will be done individually on your computer in class. You will be expected to connect to the UNT wireless network
  - There will be in-class activities along with lecture that are not required, but will help in understanding and applying the material

- [Canvas Technical Requirements](https://clear.unt.edu/supportedtechnologies/canvas/requirem)

Computer Skills & Digital Literacy

- Using Canvas
- Download and install Anaconda Python version 3 and open a Jupyter notebook

Netiquette

Netiquette, or online etiquette, refers to the way students are expected to interact with each other and with their instructors online. Here are some general guidelines:

- Treat your instructor and classmates with respect in email or any other communication.
- Use clear and concise language.
- Remember that all college level communication should have correct spelling and grammar (this includes discussion boards).
- Be cautious when using humor or sarcasm as tone is sometimes lost in an email or discussion post and your message might be taken seriously or sound offensive.
- Be careful with personal information (both yours and other’s).
- Do not send confidential information via e-mail

Course Requirements

The following activities are graded, with anticipated point values shown. Note, point values shown are only approximate to give a sense of expected value and effort for each.

- In-class assignments/ in-class activities/ in-class quizzes: 20 pts
- Homework Assignments 20 pts
Grading

Grades are determined by a simple points system, with a total of at least 100 pts as the goal though more than 100 points are likely. The expected distribution of points is given above, with the exact scale determined by point values given for each assignment, quiz, or exam - this is subject to minor modification based on actual points given. Note, due to the nature of the course, exams and quizzes are a significant means of establishing your final grade, so please complete the assignments in a timely way and study appropriately prior to each quiz and exam.

**Grading Scale:** Points needed to get each grade: A=90.0, B=80.0, C=70.0, D=60.0. Don’t expect this scale to change. If class grades are low (I expect the vast majority of students will get A’s and B’s. (Note, *these grades are based on points and not percentages, so if 120 points are given, you only need 93/120 to get an A!*)

Course Evaluation

Student Perceptions of Teaching (SPOT) is the student evaluation system for UNT and allows students the ability to confidentially provide constructive feedback to their instructor and department to improve the quality of student experiences in the course.

Course Policies

Assignment Policy

Assignments are generally due within a week after they are assigned (e.g., Monday assignments are due the following Monday before class) unless otherwise specified and are to be turned in through Canvas. Assignments, project reports and presentation slides are to be turned in as PDF. Code is to be turned in with both Jupyter notebook and PDF form, along with any files necessary to run your assignment. Results should be presentable, with appropriate comments for someone to follow what you have done. Assignments are to be turned in individually, although students are encouraged to work together
extensively in all ways except direct copy/paste of individual work - do keep in mind that only applied to assignments, not quizzes or exams. It is important to keep up given the pace of new assignments. See the late policy below.

There will be no extra credit or special assignments for individuals in this class, however, extra opportunities for points given to the entire class will be considered toward the end of the course if scores are low.

If during an online quiz or exam there is a technical error which affects your ability to complete the assignment, you are immediately to let the quiz or exam proctor know and the instructor will discuss ways to allow you to resume the test without giving an unfair advantage. In the event of any unexpected server outage or any unusual technical difficulty which prevents students from completing a time sensitive assessment activity, the instructor will extend the time windows and provide an appropriate accommodation based on the situation. Students should immediately report any problems to the instructor.

**Examination Policy**

Quizzes will primarily be on the computer, and exams will primarily be on paper. If you would like to use a laptop, be sure to bring it every regular lecture days. Quizzes and exams are “openbook”, opennote, no electronic device allowed, and otherwise specified in advance. Quizzes and exams must be taken in the classroom unless special accommodations have been made through the Office of Disability Accommodation (ODA). Another other accommodations must be given by prior arrangement with the instructor, otherwise documentation proving an extenuating circumstance will have to be provided after the missed exam.

Time will be limited, and all work will be individual. You are strongly encouraged to attempt to solve the tasks iteratively and incrementally - write code that works first, but works poorly, and improve from there, rather than write perfect code top to bottom. Exams will focus on the most recent material but are expected to be cumulative in scope.

**Instructor Responsibilities and Feedback**

The instructor’s goals are not only to provide a series of organized facts and examine you, rather the ultimate goal is to help the students grow and learn using the content as a means to achieving that goal. To that end, you are encouraged to discuss any ways in which the course or the instructors experience may help you achieve your professional aspirations. You will be provided with clear instructors for all projects and assignments, grading rubrics, and course content to focus on learning and adapting the information rather than guess expectations.

The instructor will try to respond to all questions by email within 24 hours during business days Mon - Fri, and graded feedback will regularly come within one week of the assignment or exam due date.

**Late Work**

If assignments or project work are turned in after the due date, this places an undue burden on the instructor and the TA, especially when this policy is abused. This is heightened given the pace of this course. In general, Late submissions of the assignment will incur penalties as follows: **80% penalty if submitted within 24 hours, 50% penalty if submitted within 2 days, and submissions beyond 2 days will not be accepted.** Though you are encouraged to discuss with the instructor if there are extenuating circumstances, in which case a point reduction is at the discretion of the instructor.
Attendance Policy
You are expected to attend all lectures on time. There is no direct participation grading, but in-class activities, assignments, and in-class quizzes will be given occasionally during regular lecture time. Please email the instructor or TAs with a reasonable excuse if you cannot attend the class before the class starts. You are responsible for keeping up with the material covered in the class if you are not present. If a class is missed, you are expected to proactively reach out to classmates or the instructor about in-class announcements.

Syllabus Change Policy
Any substantial changes to the syllabus after the first week will be highlighted in red on the online platform. Approximate point values are expected to vary but will be fixed when the assignment or exam is given.

UNT Policies

Academic Integrity Policy
Academic Integrity Standards and Consequences. According to UNT Policy 06.003, Student Academic Integrity, academic dishonesty occurs when students engage in behaviors including, but not limited to cheating, fabrication, facilitating academic dishonesty, forgery, plagiarism, and sabotage. A finding of academic dishonesty may result in a range of academic penalties or sanctions ranging from admonition to expulsion from the University.

ADA Policy
UNT makes reasonable academic accommodation for students with disabilities. Students seeking accommodation must first register with the Office of Disability Accommodation (ODA) to verify their eligibility. If a disability is verified, the ODA will provide a student with an accommodation letter to be delivered to faculty to begin a private discussion regarding one’s specific course needs. Students may request accommodations at any time, however, ODA notices of accommodation should be provided as early as possible in the semester to avoid any delay in implementation. Note that students must obtain a new letter of accommodation for every semester and must meet with each faculty member prior to implementation in each class. For additional information see the ODA website (https://disability.unt.edu/).

Emergency Notification & Procedures
UNT uses a system called Eagle Alert to quickly notify students with critical information in the event of an emergency (i.e., severe weather, campus closing, and health and public safety emergencies like chemical spills, fires, or violence). In the event of a university closure, please refer to Blackboard for contingency plans for covering course materials.

Retention of Student Records
Student records pertaining to this course are maintained in a secure location by the instructor of record. All records such as exams, answer sheets (with keys), and written papers submitted during the duration of the course are kept for at least one calendar year after course completion. Course work completed via the Blackboard online system, including grading information and comments, is also stored in a safe electronic environment for one year. Students have the right to view their individual record; however, information about student’s records will not be divulged to other individuals without proper written
consent. Students are encouraged to review the Public Information Policy and the Family Educational Rights and Privacy Act (FERPA) laws and the University’s policy. See UNT Policy 10.10, Records Management and Retention for additional information.

Acceptable Student Behavior
Student behavior that interferes with an instructor’s ability to conduct a class or other students’ opportunity to learn is unacceptable and disruptive and will not be tolerated in any instructional forum at UNT. Students engaging in unacceptable behavior will be directed to leave the classroom and the instructor may refer the student to the Dean of Students to consider whether the student’s conduct violated the Code of Student Conduct. The University’s expectations for student conduct apply to all instructional forums, including University and electronic classroom, labs, discussion groups, field trips, etc. Visit UNT’s Code of Student Conduct (https://deanofstudents.unt.edu/conduct) to learn more.

Access to Information - Eagle Connect
Students’ access point for business and academic services at UNT is located at: my.unt.edu. All official communication from the University will be delivered to a student’s Eagle Connect account. For more information, please visit the website that explains Eagle Connect and how to forward e-mail Eagle Connect (https://it.unt.edu/eagleconnect).

Student Evaluation Administration Dates
Student feedback is important and an essential part of participation in this course. The student evaluation of instruction is a requirement for all organized classes at UNT. The survey will be made available during weeks 13, 14 and 15 of the long semesters to provide students with an opportunity to evaluate how this course is taught. Students will receive an email from "UNT SPOT Course Evaluations via IASystem Notification" (no-reply@iasystem.org) with the survey link. Students should look for the email in their UNT email inbox. Simply click on the link and complete the survey. Once students complete the survey they will receive a confirmation email that the survey has been submitted. For additional information, please visit the SPOT website (http://spot.unt.edu/) or email spot@unt.edu.

Getting Help

Technical Assistance
UIT Help Desk (http://www.unt.edu/helpdesk/index.htm)
Email: helpdesk@unt.edu
Phone: 940-565-2324
In Person: Sage Hall, Room 130
Walk-In Availability: 8am-9pm
Telephone Availability:
  ● Sunday: noon-midnight
  ● Monday-Thursday: 8am-midnight
  ● Friday: 8am-8pm
  ● Saturday: 9am-5pm
Laptop Checkout: 8am-7pm
Student Support Services

- Registrar (https://registrar.unt.edu/registration)
- Financial Aid (https://financialaid.unt.edu/)
- Student Legal Services (https://studentaffairs.unt.edu/student-legal-services)
- Career Center (https://studentaffairs.unt.edu/career-center)
- Multicultural Center (https://edo.unt.edu/multicultural-center)
- Counseling and Testing Services (https://studentaffairs.unt.edu/counseling-and-testing-services)
- Student Affairs Care Team (https://studentaffairs.unt.edu/care)
- Student Health and Wellness Center (https://studentaffairs.unt.edu/student-health-and-wellness-center)
- Pride Alliance (https://edo.unt.edu/pridealliance)

Academic Support Services

- Academic Resource Center (https://clear.unt.edu/canvas/student-resources)
- Academic Success Center (https://success.unt.edu/asc)
- UNT Libraries (https://library.unt.edu/)
- Writing Lab (http://writingcenter.unt.edu/)
- MathLab (https://math.unt.edu/mathlab)