CSE 5301
Data Analysis & Modeling Techniques

Spring 2017 - TuTh 3:30 - 4:50 - COBA 254

Instructor: Manfred Huber (huber@cse.uta.edu)

1 Course Description

Contents and Objecives:

with Computer Science moving into applications in the real world and involving large quantities of data, uncertainty and random variations become increasingly important aspects to be considered when designing algorithms, addressing large scale problems, modeling processes, or evaluating data. To do this, probabilistic methods for data analysis and modeling become essential tools within every branch of Computer Science.

This course briefly covers basic statistics and probability concepts and introduces techniques to model and analyze probabilistic data. This includes basic representation such as Bayesian networks as well as hypothesis testing techniques for data analysis and interpretation. Further, it introduces modeling and analysis techniques for sequential processes, including Markov models, regression analysis, and basic queueing models. All of these techniques will be discussed in the context of common Computer Science problems from a wide range of fields, including Computer Networks, Artificial Intelligence, Machine Learning, Computer Vision, Data Mining, Bioinformatics, etc. In addition, the course will discus selected advanced topics and applications such as capacity planning and bottleneck analysis, clustering and classification

Students successfully completing this course will have gained a solid understanding of probabilistic data modeling, interpretation, and analysis an thus have formed an important basis for more advanced courses in Computer Science as well as for the handling and analysis of data used in real-life applications and research.

Prerequisites:

All students are expected to have a background in basic probability, Calculus, and Algebra before attending this course. In particular, students should have passed the courses *Engineering Probability* (IE 3301), *Algorithms and Data Structures* (CSE 2320), *Calculus II* (Math 2425), and *Differential Equations & Linear Algebra* (Math 3319) or an equivalent. In case of questions, students should seek the consent of the instructor to attend the course.

Textbook:

There are a wide range of books on this topic, all of which cover many of topics covered in the course and can be used as references for the course. However, none of them covers everything in the course. As a consequence the course does not follow any one specific textbook. However, book recommendations will be made throughout the course and corresponding books will be made available in the Engineering Library Reserve.

Course Materials:

Additional course materials will be available electronically or through the reserve section in the Engineering Library. Also, changes, if any, will be announced by e-mail.

Programming:

Homework assignments in the course will contain programming components. The choice of programming language is left to the student. However, in some assignments simulation and data generation components might be provided which will be implemented in C or C++. These components will not be provided in additional languages and thus interfacing with C or C++ (which is possible in most programming languages) might be necessary when a different programming language is used. In all cases, the following limitation will apply to the programming language chosen: All programs must compile and run on university machines (either university servers or the machines in the open OIT laboratories) and instructions regarding how to compile and run the code must be provided with the program submission. In case of doubts regarding the use of a particular programming language or software package, contact the instructor prior to its use.

E-mail and WWW page:

There is a course web page at http://ranger.uta.edu/∼huber/cse5301 . All changes and supplementary course materials will be available from this site. In addition, necessary changes or important announcements will also be distributed by e-mail. In order to receive class-related messages you have to send an e-mail to the instructor (huber@cse.uta.edu).

Tentative Office Hours:

Office hours for the course will be held by the instructor in ERB 128 or ERB 522,
M 6:00 - 7:00, Tu 2:30 - 3:20, and Th 5:00-6:00pm. The first office hours will be held on Thursday, January 19. Times are subject to change and will be posted.

If for some reason you can not make it to any of these office hours, please inform the instructor.
e-mail: huber@cse.uta.edu

2 Course Work and Grading

Homework Assignments: There will be 6 assignments in this course, each covering approximately 4 class periods. Assignments will consist of written, theoretical components as well as short programming components in which particular solutions to problems are to be implemented. Assignments are due in or before class on the date indicated on the assignment with programming components to be submitted electronically. Solutions to the written parts of the assignments will be posted within a week of the due date (except if not possible due to special circumstances). Late assignments will not be accepted and extensions will only be granted in extreme situations. If you find yourself in such a situation and can not deliver a homework on time, immediately inform the instructor. Also, while working with other persons on non-graded example problems from the textbook is a good way to help you develop your understanding and insight into the techniques of problem solving, homework solutions must be your work only. Violations of this will not be tolerated and result in severe penalties for all parties involved.

Exams: The exams in the course are closed book. The midterm exam covers the content of the first half of the course. The final exam is cumulative and will cover all materials of the course with an emphasis on the second half of the course. As in the case of homework extensions, make-up exams will only be given in extreme situations. If for any such reason you can not attend an exam, inform the instructor as early as possible.

Grading Policy:

The final grade will be calculated using the following policy:

Homework Assignments	50 %
Midterm Exam	20 %
Final Exam	30 %

3 Class Schedule

CSE 5301 - Data Analysis & Modeling Techniques
Tentative Lecture and Assignment Schedule
Spring Semester 2017 - TuTh 3:30 - 4:50

Class	Date	Readings	Lecture Topics	Assignments
1	01/17		Course Details and Overview	
2	01/19		Basic Probabilty	
3	01/24			
4	01/26		Continuous random Variables	
5	01/31			
6	02/02		Data Analysis and Hypothesis Testing	
7	02/07			Homework 1 due
8	02/09			
9	02/14		Representations for Probabilistic Data	
10	02/16		Graphical Representations and Inference	
11	02/21			
12	02/23			Homework 2 due
13	02/28		Monte Carlo Methods	
14	03/02			
15	03/07			
16	03/09		Random Processes	
	03/14		*Spring Break - No Class*	
	03/16		*Spring Break - No Class*	
17	03/23		Markov Models	Homework 3 due
18	03/21		**Midterm Exam**	
19	03/28			
20	03/30		Hidden Markov Models	
21	04/04			
22	04/06			Homework 4 due
23	04/11		Queuing Systems	
24	04/13			
25	04/18		Regression and Parameter Estimation	
26	04/20			Homework 5 due
27	04/25		Randomness and Entropy	
28	04/27		Advanced Topics	
29	05/02			
30	05/04		Conclusions and Review	Homework 6 due
31	05/11		**Final Exam (2:00 - 4:30pm) - Covers all Course Material**	

This schedule is tentative and subject to change. Changes and additional detail will be posted on the course page.

4 University Policies and Services

Grade Grievances:

Any appeal of a grade in this course must follow the procedures and deadlines for grade-related grievances as published in the current undergraduate catalog.

Drop Policy:

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/).

Disability Accomodations:

UT Arlington is on record as being committed to both the spirit and letter of all federal equal opportunity legislation, including The Americans with Disabilities Act (ADA), The Americans with Disabilities Amendments Act (ADAAA), and Section 504 of the Rehabilitation Act. All instructors at UT Arlington are required by law to provide reasonable accommodations to students with disabilities, so as not to discriminate on the basis of disability. Students are responsible for providing the instructor with official notification in the form of a letter certified by the Office for Students with Disabilities (OSD). Only those students who have officially documented a need for an accommodation will have their request honored. Students experiencing a range of conditions (Physical, Learning, Chronic Health, Mental Health, and Sensory) that may cause diminished academic performance or other barriers to learning may seek services and/or accommodations by contacting:
The Office for Students with Disabilities, (OSD) www.uta.edu/disability or calling 817-272-3364. Information regarding diagnostic criteria and policies for obtaining disability-based academic accommodations can be found at www.uta.edu/disability.
Counseling and Psychological Services, (CAPS) www.uta.edu/caps/ or calling 817-272-3671 is also available to all students to help increase their understanding of personal issues, address mental and behavioral health problems and make positive changes in their lives.

Non-Discrimination Policy:

The University of Texas at Arlington does not discriminate on the basis of race, color, national origin, religion, age, gender, sexual orientation, disabilities, genetic information, and/or veteran status in its educational programs or activities it operates. For more information, visit uta.edu/eos.

Title IX Policy:

The University of Texas at Arlington (University) is committed to maintaining a learning and working environment that is free from discrimination based on sex in accordance with Title IX of the Higher Education Amendments of 1972 (Title IX), which prohibits discrimination on the basis of sex in educational programs or activities; Title VII of the Civil Rights Act of 1964 (Title VII), which prohibits sex discrimination in employment; and the Campus Sexual Violence Elimination Act (SaVE Act). Sexual misconduct is a form of sex discrimination and will not be tolerated. For information regarding Title IX, visit www.uta.edu/titleIX or contact Ms. Jean Hood, Vice President and Title IX Coordinator at (817) 272-7091 or jmhood@uta.edu.

Academic Integrity:

Students enrolled all UT Arlington courses are expected to adhere to the UT Arlington Honor Code:
I pledge, on my honor, to uphold UT Arlingtons 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 universitys 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 students suspension or expulsion from the University. Additional information is available at https://www.uta.edu/conduct/.

Electronic Communication:

UT Arlington has adopted MavMail as its official means to communicate with students about important deadlines and events, as well as to transact university-related business regarding financial aid, tuition, grades, graduation, etc. All students are assigned a MavMail account and are responsible for checking the inbox regularly. There is no additional charge to students for using this account, which remains active even after graduation. Information about activating and using MavMail is available at http://www.uta.edu/oit/cs/email/mavmail.php.

Campus Carry:

Effective August 1, 2016, the Campus Carry law (Senate Bill 11) allows those licensed individuals to carry a concealed handgun in buildings on public university campuses, except in locations the University establishes as prohibited. Under the new law, openly carrying handguns is not allowed on college campuses. For more information, visit http://www.uta.edu/news/info/campus-carry/

Student Feedback Survey:

At the end of each term, students enrolled in face-to-face and online classes categorized as lecture, seminar, or laboratory are directed to complete an online Student Feedback Survey (SFS). Instructions on how to access the SFS for this course will be sent directly to each student through MavMail approximately 10 days before the end of the term. Each students feedback via the SFS database is aggregated with that of other students enrolled in the course. Students anonymity will be protected to the extent that the law allows. UT Arlingtons effort to solicit, gather, tabulate, and publish student feedback is required by state law and aggregate results are posted online. Data from SFS is also used for faculty and program evaluations. For more information, visit http://www.uta.edu/sfs.

Final Review Week:

A period of five class days prior to the first day of final examinations in the long sessions shall be designated as Final Review Week. The purpose of this week is to allow students sufficient time to prepare for final examinations. During this week, there shall be no scheduled activities such as required field trips or performances; and no instructor shall assign any themes, research problems or exercises of similar scope that have a completion date during or following this week unless specified in the class syllabus. During Final Review Week, an instructor shall not give any examinations constituting 10% or more of the final grade, except makeup tests and laboratory examinations. In addition, no instructor shall give any portion of the final examination during Final Review Week. During this week, classes are held as scheduled. In addition, instructors are not required to limit content to topics that have been previously covered; they may introduce new concepts as appropriate.

Emergency Exit Procedures:

Should we experience an emergency event that requires us to vacate the building, students should exit the room and move toward the nearest exit, which is located to the right of the room exit and down the staircase at the end of the hallway. When exiting the building during an emergency, one should never take an elevator but should use the stairwells. Faculty members and instructional staff will assist students in selecting the safest route for evacuation and will make arrangements to assist individuals with disabilities.

Student Support Services:

UT Arlington provides a variety of resources and programs designed to help students develop academic skills, deal with personal situations, and better understand concepts and information related to their courses. Resources include tutoring, major-based learning centers, developmental education, advising and mentoring, personal counseling, and federally funded programs. For individualized referrals, students may visit the reception desk at University College (Ransom Hall), call the Maverick Resource Hotline at 817-272-6107, send a message to resources@uta.edu, or view the information at http://www.uta.edu/universitycollege/resources/index.php.