

EESC 7V85
Special topic in signal processing
Multimodal signal processing

The University of Texas at Dallas
Spring 2012

Tuesday & Thursday, 7:00-8:15 PM
Room ECSN 2.126

PROFESSOR CONTACT INFORMATION

Prof. Carlos Busso

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Room ECSN 4.220

Office hours: Tuesday 2:30-3:30pm
Friday 5:00-6:00pm

COURSE PREREQUISITES

The course requires knowledge on probability (ENGR 3341 or EESC 6349).

COURSE DESCRIPTION

This course covers the theory and applications in the field of multimodal signal processing. Robustness and performance of systems by considering cross-modal integration. Introduction to speech processing, natural language and dialog processing, image and video processing (face recognition, gestures and action recognition). Statistical algorithms and machine learning methods used for fusion/fission of multimodal content at feature, decision and model level. Common graphical models used in multimodal analysis including Dynamic Bayesian Network, Product HMM, Multistream HMM, coupled HMM, Factorial HMM, Input Output HMM and segmental models. The course presents applications on speech and conversational interfaces; non-verbal behaviors for embodied conversational agents; haptic interfaces; meeting analysis and intelligent meeting spaces; multimodal indexing, structuring and summarization; multimodal video analysis; audiovisual speech recognition; audiovisual attention modeling and salient event detection; searching multimedia content; multimodal interfaces; and, audiovisual emotion recognition.

STUDENT LEARNING OBJECTIVES/OUTCOMES

Students are expected to:

1. Demonstrate an understanding of the concepts and techniques in the area of multimodal signal processing.
2. Learn fundamental frameworks available for dealing with multiple modalities, with an emphasis on their inherent advantages and disadvantages.
3. Become familiar with common graphical models.
4. Apply and extend the ideas and techniques to new problems.

SUGGESTED TEXTBOOKS AND MATERIALS

- Textbooks:
- Multimodal Signal Processing: Theory and applications for human-computer interaction by Jean-Philippe Thiran, Ferran Marqués and Hervé Bourlard. Academic Press, ISBN: 978-0-12-374825-6
 - Bayesian Networks and Decision Graphs. Finn V. Jensen, Thomas D. Nielsen. Springer, edition 2, 9780387682815 (Suggested, online version in library)

Assignments & Content

ASSIGNMENTS

Project (35 points)

The students are expected to work individually or in groups (2) during the semester in a research problem in multimodal signal processing. The students will have to periodically report their progress.

- Brainstorm (0 points, 02/2/2012)
The groups will present (10 minute) different ideas and directions for their projects. They will receive feedbacks from the rest of the class.
- Project proposal (5 points, 2/16/2012)
The students will submit a formal written document with the motivation, related work, methodology, and expected results of their projects.
- Midterm presentation (10 points, 3/22/2012)
Each group will have a 10 minute presentation with the progress of the project, including initial results and expected results.
- Paper (10 points, 5/04/2012)
The groups will submit the final reports (4-6 page, 2 column, 10 points). The report should include abstract, introduction, related work, methodology, results, discussion and conclusions.
- Final presentation (10 points, 5/01/2012, 5/03/2012)
The project will conclude with a 15 minute presentation.

Reading assignment (20 points)

- Weekly summary of the assigned paper (10)
- 10 minute presentation (10)
The presentation should:
 - Motivate the problem
 - Describe the approach
 - Summarize the results
 - Highlight the limitations and futures directionsAfter the presentation, we will have a discussion about the paper.

Homework (20 points)

- 4 or 5 homework assignments. MATLAB will be used for all computer assignments.

Final exam (20 points)

Participation (5 points)

- Attendance (being physically present in class)
- Participation, which includes asking questions in class about readings, answering questions, offering suggestions, and you professional, positive attitude and demeanor.

COURSE CONTENT

1. Introduction to multimodal signal processing
2. Unimodal modalities
 - 2.1. Speech
 - 2.2. Facial expressions
 - 2.3. Gestures
 - 2.4. Natural Language
3. Statistical framework for multimodal fusion
 - 3.1. Introduction to probability and statistical learning
 - 3.2. Static methods
 - 3.3. Causal and Bayesian Networks
 - 3.4. Building Models
 - 3.5. Examples of Graphical models
4. Applications on multimodal signal processing
 - 4.1. Meeting analysis and intelligent meeting spaces
 - 4.2. Audiovisual speech recognition
 - 4.3. Multimodal interfaces
 - 4.4. Audiovisual emotion recognition

(Depending on the time and the students' interest, some of these applications will not be covered)

COURSE & INSTRUCTOR POLICIES

Course & Instructor Policies

Email

Emails are the preferred way to contact me. Please add < EESC 7V85 > in the subject of emails, so I can give priority to your emails. I only read eLearning mail periodically.

Late Work

Homework may be turned in one class after it is due with a late penalty of 10%. Homework will not be accepted after the solutions are posted. Make-up exams or projects will not be given without advance notice to the instructor.

Extra Credit

I do not offer “extra credit” work or “special consideration” to allow students a chance to raise their grade. If a personal situation arises during the semester that may affect your classroom performance, please talk to me sooner rather than later. If you wait until the end of the semester, I won't be able to help you. I can work with you more easily if you speak to me when the situation arises. I cannot help you if I do not know you need help.

Classroom Citizenship

In keeping with this course's professional communication mandate, students are expected to use every opportunity in the course to practice communicating in a civil and professional manner. It is not allowed to exit the class during

the lectures to avoid distracting other students. If a student need to leave early, he/she must let the instructor know before the class.

Technology Requirements

The course is taught using eLearning. The student should develop the habit of checking both eLearning and their UTD email often for assignments and announcements. Reliable and frequent internet connectivity is indispensable – not having internet access will make your learning more difficult and will not serve as a valid excuse for shortcomings. Failure to check UTD or eLearning email, errors in forwarding email, and email bounced from over-quota mailboxes are not acceptable excuses for missing course email. Additionally, to protect your privacy rights, I will only send email through your official UTD email address or eLearning email. If you choose, you can redirect both of these addresses to external addresses.

Classroom and Equipment Use Policies

No laptops, cell phones, pagers, or other electronic messaging services may be used in the classrooms, unless the student (1) need a laptops for the presentation (2) have cleared it with me first and then only on an emergency basis.

Technical Support

If you experience any problems with your UTD account you may send an email to: assist@utdallas.edu or call the UTD Computer Helpdesk at 972-883-2911.

Field Trip Policies

Off-campus Instruction and Course Activities

Not applicable.

Student Conduct & Discipline

The University of Texas System and The University of Texas at Dallas have rules and regulations for the orderly and efficient conduct of their business. It is the responsibility of each student and each student organization to be knowledgeable about the rules and regulations which govern student conduct and activities. General information on student conduct and discipline is contained in the UTD printed publication, A to Z Guide, which is provided to all registered students each academic year.

The University of Texas at Dallas administers student discipline within the procedures of recognized and established due process. Procedures are defined and described in the Rules and Regulations, Series 50000, Board of Regents, The University of Texas System, and in Title V, Rules on Student Services and Activities of the university's Handbook of Operating Procedures. Copies of these rules and regulations are available to students in the Office of the Dean of Students, where staff members are available to assist students in interpreting the rules and regulations (SU 1.602, 972/883-6391) and online at <http://www.utdallas.edu/judicialaffairs/UTDJudicialAffairs-HOPV.html>

A student at the university neither loses the rights nor escapes the responsibilities of citizenship. He or she is expected to obey federal, state, and local laws as well as the Regents' Rules, university regulations, and administrative rules. Students are subject to discipline for violating the standards of conduct whether such conduct takes place on or off campus, or whether civil or criminal penalties are also imposed for such conduct.

Academic Integrity

The faculty expects from its students a high level of responsibility and academic honesty. Because the value of an academic degree depends upon the absolute integrity of the work done by the student for that degree, it is imperative that a student demonstrate a high standard of individual honor in his or her scholastic work.

Scholastic Dishonesty, any student who commits an act of scholastic dishonesty is subject to discipline. 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.

Plagiarism, especially from the web, from portions of papers for other classes, and from any other source is unacceptable and will be dealt with under the university's policy on plagiarism (see general catalog for details). This course will use the resources of turnitin.com, which searches the web for possible plagiarism and is over 90% effective.

Copyright Notice

The copyright law of the United States (Title 17, United States Code) governs the making of photocopies or other reproductions of copyrighted materials, including music and software. Copying, displaying, reproducing, or distributing copyrighted works may infringe the copyright owner's rights and such infringement is subject to appropriate disciplinary action as well as criminal penalties provided by federal law. Usage of such material is only appropriate when that usage constitutes "fair use" under the Copyright Act. As a UT Dallas student, you are required to follow the institution's copyright policy (Policy Memorandum 84-I.3-46). For more information about the fair use exemption, see <http://www.utsystem.edu/ogc/intellectualproperty/copypol2.htm>

Email Use

The University of Texas at Dallas recognizes the value and efficiency of communication between faculty/staff and students through electronic mail. At the same time, email raises some issues concerning security and the identity of each individual in an email exchange. The university encourages all official student email correspondence be sent only to a student's U.T. Dallas email address and that faculty and staff consider email from students official only if it originates from a UTD student account. This allows the university to maintain a high degree of confidence in the identity of all individual corresponding and the security of the transmitted information. UTD furnishes each student with a free email account that is to be used in all communication with university personnel. The Department of Information Resources at U.T. Dallas provides a method for students to have their U.T. Dallas mail forwarded to other accounts.

Withdrawal from Class

The administration of this institution has set deadlines for withdrawal of any college-level courses. These dates and times are published in that semester's course catalog. Administration procedures must be followed. It is the student's responsibility to handle withdrawal requirements from any class. In other words, I cannot drop or withdraw any student. You must do the proper paperwork to ensure that you will not receive a final grade of "F" in a course if you choose not to attend the class once you are enrolled.

Student Grievance Procedures

Procedures for student grievances are found in Title V, Rules on Student Services and Activities, of the university's Handbook of Operating Procedures.

In attempting to resolve any student grievance regarding grades, evaluations, or other fulfillments of academic responsibility, it is the obligation of the student first to make a serious effort to resolve the matter with the instructor, supervisor, administrator, or committee with whom the grievance originates (hereafter called "the respondent"). Individual faculty members retain primary responsibility for assigning grades and evaluations. If the matter cannot be resolved at that level, the grievance must be submitted in writing to the respondent with a copy of the respondent's School Dean. If the matter is not resolved by the written response provided by the respondent, the student may submit a written appeal to the School Dean. If the grievance is not resolved by the School Dean's decision, the student may make a written appeal to the Dean of Graduate or Undergraduate Education, and the deal will appoint and convene an Academic Appeals Panel. The decision of the Academic Appeals Panel is final. The results of the academic appeals process will be distributed to all involved parties.

Copies of these rules and regulations are available to students in the Office of the Dean of Students, where staff members are available to assist students in interpreting the rules and regulations.

Incomplete Grade Policy

As per university policy, incomplete grades will be granted only for work unavoidably missed at the semester's end and only if 70% of the course work has been completed. An incomplete grade must be resolved within eight (8) weeks from the first day of the subsequent long semester. If the required work to complete the course and to remove the incomplete grade is not submitted by the specified deadline, the incomplete grade is changed automatically to a grade of F.

Disability Services

The goal of Disability Services is to provide students with disabilities equal educational opportunities. Disability Services provides students with a documented letter to present to the faculty members to verify that the student has a disability and needs accommodations. This letter should be presented to the instructor in each course at the beginning of the semester and accommodations needed should be discussed at that time. It is the student's responsibility to notify his or her professors of the need for accommodation. If accommodations are granted for testing accommodations, the student should remind the instructor five days before the exam of any testing accommodations that will be needed. Disability Services is located in Room 1.610 in the Student Union. Office hours are Monday – Thursday, 8:30 a.m. to 6:30 p.m., and Friday 8:30 a.m. to 5:00 p.m. You may reach Disability Services at (972) 883-2098.

Guidelines for documentation are located on the Disability Services website at <http://www.utdallas.edu/disability/documentation/index.html>

Religious Holy Days

The University of Texas at Dallas will excuse a student from class or other required activities for the travel to and observance of a religious holy day for a religion whose places of worship are exempt from property tax under Section 11.20, Tax Code, Texas Code Annotated.

The student is encouraged to notify the instructor or activity sponsor as soon as possible regarding the absence, preferably in advance of the assignment. The student, so excused, will be allowed to take the exam or complete the assignment within a reasonable time after the absence: a period equal to the length of the absence, up to a maximum of one week. A student who notifies the instructor and completes any missed exam or assignment may not be penalized for the absence. A student who fails to complete the exam or assignment within the prescribed period may receive a failing grade for that exam or assignment.

If a student or an instructor disagrees about the nature of the absence [i.e., for the purpose of observing a religious holy day] or if there is similar disagreement about whether the student has been given a reasonable time to complete any missed assignments or examinations, either the student or the instructor may request a ruling from the chief executive officer of the institution, or his or her designee. The chief executive officer or designee must take into account the legislative intent of TEC 51.911(b), and the student and instructor will abide by the decision of the chief executive officer or designee.

These descriptions and timelines are subject to change at the discretion of the Professor.