EE 5351 Sections 001, and 002

Summer 2008 TuTh 6:00-7:50pm
Room: 112 NH

Instructor: K.R. Rao
Office: Room 530 NH
Office Hours: Monday, 11a.m. – 12 noon
Wednesday 2 p.m. – 3 p.m.
Phone: 817-272-3478
Mailbox: Electrical Engineering, Box 19016, UTA, Arlington TX 76019
Email: rao@uta.edu
Course WWW site: `http://www-ee.uta.edu/dip/Courses/ee5351.htm`
Required Textbook(s):

K. Sayood, "Introduction to data compression," III Edition, San Francisco, CA Morgan-Kaufmann Publishers, 2006.

Reference:

- V. Bhaskaran and K. Konstantinides, "Image video compression standards: algorithms and architecture," II Edition, Norwell, MA: Kluwer Academic Publishers, 1998.
- Several books related to digital video coding are on 3 hour reserve in SEL

Course description

The course covers the fundamentals, principles, concepts and techniques of data (video/audio) compression such as:

* Huffman coding
* Arithmetic coding
* Lempel-Ziv coding
* G3 and G4 Facsimile coding
* Scalar quantization
    - Differential pulse code modulation
    - Delta modulation
    - Mathematical preliminaries for lossy coding
    - Mathematical preliminaries for transforms, subbands and wavelets
* Subband coding
* Transform coding
* Hybrid (mixed) coding
* Brief introduction to ITU/ISO/IEC standards related to audio/video/image/data compression
* Vector quantization
    - Motion estimation and motion compensation
    - Wavelet- based compression
    - Analysis/synthesis schemes
    - Video compression
    - Course learning Goals/Objectives

The goals of the course are to familiarize the students with these techniques so that they have not only a thorough grasp but also the ability to implement them through computer projects (simulation) using standard test sequences.

Attendance and drop policy
Follow university guidelines

Tentative Lecture/Top Schedule (Course Content)

Introduction
- Compression Techniques……
  - Lossless Compression……
  - Lossy Compression……..
  - Measures of Performance……
- Modeling and Coding……..
- Coding……
  - Uniquely Decodable Codes……
  - Prefix Codes……..

Huffman Coding
- Overview……
- The Huffman Coding Agorithm……..
  - Minimum Variance Huffman Codes…….…….
- Golomb Codes……..
- Rice Codes…….……
  - CCSDS Recommendation for Lossless Compression…….……
- Tunstall Codes……..
- Application of Huffman Coding……
  - Lossless Image Compression……..
  - Text Compression……..
- Audio Compression……

Arithmetic Coding
- Overview…….
- Introduction…….
- Coding a Sequence…….
  - Generating a Tag…….
  - Deciphering a Tag…….……..
- Generating a Binary Code…….……..
  - Uniqueness and Efficiency of the Arithmetic Code……
  - Algorithm Implementation……..
  - Integer Implementation……
- Comparison of Huffman and Arithmetic coding…….
- Applications……
  - Bi-level Image Compression-The JBIG Standard…….

Speech Compression……..…
The Channel Vocoder……..
The Linear Predictive Coder (Government Standard LPC-10)……
Code Excited Linear Prediction (CELP)……..
Sinusoidal Coders…….
Image Compression……..
Fractal Compression…….

Video Compression

Overview……
Introduction……
Motion Compensation……
Video Signal Representation……..
Algorithms for Videoconferencing and Videophones……
ITU-T Recommendation H.261……..
Model-Based Coding……..
Asymmetric Application……..
The MPEG-1 Video Standard……..
The MPEG-2 Video Standard…….
MPEG-4……..
MPEG-7……..

Projects

Project 1. Huffman Coding
Project 2. Golomb Coding
Project 3. LZ-77 Algorithm
Project 4. Scalar Quantization
Project 5. Vector Quantization
Project 6. DPCM
Project 7. Subband Analysis/Synthesis
Project 8. JPEG-Baseline
Project 9. JPEG-lossless
Project10. JPEG-LS (LOCO)
Project11. CALIC
Project12. HINT

(More projects may be added.)

First Day of Classes: Tue., May 27, 2008
Last Date of drop: July 11, 2008
Last Day of Classes: Mon., Aug. 5, 2008

Test # 1: Thurs., June 19, 2008
Test # 2: Thurs., July 10, 2008
Final: Thurs., Aug. 7, 2008

GRADING:

PLAN A

Test 1	15%	A=90-100%
Test 2	15%	B=80-89%
Final	20%	C=70-79%
Design projects	50%	D=60-69%

PLAN B:

(For those who miss a test – not recommended)
Max of Test 1 and Test 2: 25%, Final: 25%, Design projects; 50%
Course grades are based on max. of Plan A and Plan B, whichever is higher.

Everyone must take the final.

1. No makeup. 2. No incomplete. Final exam papers will not be returned. The student, however, has the right to look at his/her exam paper and discuss it with the instructor. If the student has questions/clarifications regarding the returned tests, this needs to be taken care of within a week from the dates of returns. Final exam papers will be kept until the midsemester of the following long semester. (No telephone calls or inquiries regarding course grades, please.) Everyone must take the tests and final exam at the same time and at the same place. If you have any questions on your returned tests, please do so within a week. Per the DE policy, the distance education students are supposed to have a 24hr window to take their exams. This time frame is to accommodate working students and students located in different time zones. Contact: Engineering center for distance education (Room 242 Nedderman Hall): Donya 1-817-272-2352, email: drandolph@uta.edu

Student Evaluation of Teaching
Evaluation forms will be given to the students at the end of the semester.

Final Review Week

A period of five class days prior to the first day of final examinations will be designated as FINAL REVIEW WEEK. The purpose of this week is to allow UT Arlington students sufficient time to prepare for final exams. During this week, there will be no schedule or required activities such as field trips, seminars, 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 will not give any exams constituting 10% or more of the final grade, except make-up tests and laboratory examinations. In addition, no instructor will give any portion of the final exam during Final Review Week.

Americans with Disabilities Act:

The University of Texas at Arlington is on record as being committed to both the spirit and letter of federal equal opportunity legislation; reference Public Law 93112-The Rehabilitation Act of 1973 as amended. With the passage of new federal legislation entitled Americans with Disabilities Act - (ADA), pursuant to section 504 of The Rehabilitation Act, there is renewed focus on providing this population with the same opportunities enjoyed by all citizens.

As a faculty member, I am required by law to provide "reasonable accommodation" to students with disabilities, so as not to discriminate on the basis of that disability. Student responsibility primarily rests with informing faculty at the beginning of the semester and in providing authorized documentation through designated administrative channels.

If you require an accommodation based on disability, I would like to meet with you in the privacy of my office, during the first week of the semester, to make sure you are properly accommodated.

Academic Dishonesty

It is the philosophy of The University of Texas at Arlington that academic dishonesty is a completely unacceptable mode of conduct and will not be tolerated in any form. All persons involved in academic dishonesty will be disciplined in accordance with University regulations and procedures. Discipline may include suspension or expulsion from the University.

"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." (Regents' Rules and Regulations, Part One, Chapter VI, Section 3, Subsection 3.2, Subdivision 3.22).

ANY CHEATING WILL RESULT IN SEVERE PENALTIES.