Brooklyn College
Department of Computer and Information Sciences

CISC 3635 [36] Multimedia Coding and Compression

3 hours lecture; 3 credits

Media types and their representation. Multimedia coding and compression. Lossless data compression. Lossy data compression. Compression standards: text, audio, image, fax, and video.

Course Outline:

1. Media Types and Their Representations (Week 1-2)
    a. Text
    b. Analog and Digital Audio
    c. Digitization of Sound
    d. Musical Instrument Digital Interface (MIDI)
    e. Audio Coding: Pulse Code Modulation (PCM)
    f. Graphics and Images Data Representation
    g. Image File Formats: GIF, JPEG, PNG, TIFF, BMP, etc.
    h. Color Science and Models
    i. Fax
    j. Video Concepts
    k. Video Signals: Component, Composite, S-Video
    l. Analog and Digital Video: NTSC, PAL, SECAM, HDTV

2. Lossless Compression Algorithms (Week 3-4)
    a. Basics of Information Theory
    b. Run-Length Coding
    c. Variable Length Coding: Huffman Coding
    d. Basic Fax Compression
    e. Dictionary Based Coding: LZW Compression
    f. Arithmetic Coding
    g. Lossless Image Compression

3. Lossy Compression Algorithms (Week 5-6)
    a. Distortion Measures
    b. Quantization
    c. Transform Coding
    d. Wavelet Based Coding
    e. Embedded Zerotree of Wavelet (EZW) Coefficients

4. Basic Audio Compression (Week 7-8)
    a. Differential Coders: DPCM, ADPCM, DM
    b. Vocoders
    c. Linear Predictive Coding (LPC)
    d. CELP
    e. Audio Standards: G.711, G.726, G.723, G.728. G.729, etc.

5. Image Compression Standards (Week 9)
   a. The JPEG Standard
   b. JPEG 2000
   c. JPEG-LS
   d. Bilevel Image Compression Standards: JBIG, JBIG2

6. Basic Video Compression (Week 10)
   a. Video Compression Based on Motion Compensation
   b. Search for Motion Vectors
   c. H.261 Standard
   d. H.263 Standard

7. MPEG Video Coding (Week 11-12)
   a. MPEG-1
   b. MPEG-2: Interlaced Video
   c. MPEG-4: Object Based Visual Coding
   d. H.264 Standard
   e. MPEG-7: Audiovisual Object Retrieval
   f. MPEG-21

8. MPEG Audio Compression (Week 13)
   a. Psychoacoustics
   b. MPEG Audio
   c. MP3
   d. MPEG-2 Advanced Audio Coding (AAC)
   e. MPEG-4 Audio

An additional week is devoted to examinations.

Bibliography:

1. Fundamentals of Multimedia
   by - M.S. Drew and Z. Li, Pearson Prentice-Hall, 2004 (Suggested Course Textbook)

2. Multimedia Communication Systems
   by – K.R. Rao, Z.S. Bojkovic, and D.A. Milovanovic, Prentice-Hall, 2002.

3. Multimedia Communications: Applications, Networks, Protocols, and Standards
   by – Fred Halsall, Addison-Wesley, 200