

Department of Electrical and Computer Engineering  
The Johns Hopkins University

# 520.443 Digital Multimedia Coding and Processing

*Spring 2007*

**Instructor** Prof. Trac D. Tran  
Address: 310 Barton Hall  
Phone: 410-516-7416  
Email: trac@jhu.edu  
Office Hour: Wed 10-12 or by appointment.

**Course Homepage** <http://thanglong.ece.jhu.edu/Course/443/>

**Lectures** Wednesday, 2:00 - 5:00, 123 Barton Hall.

## Course Description

An introduction to the coding and processing of digital multimedia. The course covers current techniques for processing, storage and delivery of media such as speech, audio, images, and video. This requires an in-depth understanding of digital signal processing for 1D signals, as well as the extensions to 2D and 3D cases. The emphasis will be on the theoretical basis as well as efficient implementations. Key components studied in details are digital filters, transforms, quantizers, bit allocators, entropy coders, motion estimation and compensation algorithms. Current and future audio/image/video compression standards and formats such as MP3, JPEG, JPEG2000, MPEG family, H.263, H.264... are frequently used as illustrations.

## Required Textbook

- K. Saywood, *Introduction to Data Compression, 3rd Edition*, Morgan Kaufmann, 2005. ISBN 012620862X.
- J. W. Woods, *Multidimensional Signal, Image, and Video Processing and Coding*, Academic Press, 2006. ISBN 0120885166.

## Recommended Textbook

- K. R. Rao and J. J. Hwang, *Techniques and Standards for Image Video and Audio Coding*, Prentice Hall, Upper Saddle River, NJ. ISBN 0133099075.
- A. Murat Tekalp, *Digital Video Processing*, Prentice Hall, Upper Saddle River, NJ. ISBN 0131900757.

- Barry G. Haskell, Atul Puri, and Arun N. Netravali, *Digital Video : An Introduction to MPEG-2*, Chapman & Hall, New York, NY. ISBN 0412084112.
- Vasudev Bhaskaran and Konstantinos Konstantinides, *Image and Video Compression Standards Algorithms and Architectures*, Kluwer Academic Publishers, Boston, MA. ISBN 0792399528.
- Arun N. Netravali and Barry G. Haskell, *Digital Pictures: Representation, Compression, and Standards*, 2nd Edition, Plenum Publishing Corporation, New York, NY. ISBN 030644917X.
- Joan L. Mitchell (Editor), William B. Pennebaker (Editor), Chad E. Fogg, and Didier J. LeGall, *MPEG Video: Compression Standard*, Chapman & Hall, New York, NY. ISBN 0412087715.
- William B. Pennebaker and Joan L. Mitchell, *JPEG: Still Image Data Compression Standard*, Van Nostrand Reinhold, New York, NY. ISBN 0442012721.
- N. S. Jayant and Peter Noll, *Digital Coding of Waveforms: Principles and Applications to Speech and Video*, Prentice Hall, Englewood Cliffs, NJ. ISBN 0132119137.
- Yao Wang, Jörn Ostermann, and Ya-Qin Zhang, *Video Processing and Communications*, Prentice Hall, Englewood Cliffs, NJ, 2002. ISBN 0130175471.

## Prerequisites

- 520.435 Digital Signal Processing.
- C/C++ and Matlab.
- Basic knowledge in linear algebra and probability.

## Programming

- This course emphasizes hand-on learning with a lot of computer assignments and projects. There will not be any exam!
- The use of Matlab and C/C++ is encouraged.

## Homework

- There will be around 6 problem sets and computer assignments.
- Assignments handed in late will not be accepted unless consent is obtained from the instructor prior to the due date.

## **Final Project**

- Students are expected to work independently or in teams on a related topic of choice.
- The topic can be your own or chosen/modified from a list of suggestions to be provided by the instructor.
- A final project report and an oral demonstration/presentation are required from each team.

## **Grading**

- Homework and Class Participation: 50%
- Final project: 50%