

EE 58H
Digital Video Processing

Instructor: Assist. Prof. Burak Acar

Course Description:

Introduction to video formation and visual perception. Fourier analysis of video signals. Video sampling and sampling rate conversion. Video modeling (Camera, illumination, object, Scene). Motion estimation. Video coding (Waveform based, content based) and overview of video compression standards. Video distribution over IP.

Prerequisite: EE 373 Signals and Systems

Webpage: www.vavlab.ee.boun.edu.tr -> courses & links

Grading:

Assignments: 4x17%

Final exam: 32%

Textbooks:

Video Processing and Communications, Y. Wang, J. Ostermann, Y.Q. Zhang, Prentice-Hall, 2002.

Digital Video Processing, M. Tekalp, Prentice-Hall, 1995

Course Outline:

1. Video Formation, Perception and Representation (Wang, CH1)
 - a. Color perception and specification
 - b. Video capture and display
 - c. Analog raster video
 - d. Analog video
 - e. Digital video
2. Fourier Analysis of Video Signals and HVS (Wang, CH2)
3. Video Sampling (Wang, CH3)
 - a. Lattice theory
 - b. Sampling over lattices
 - c. Sampling video signals
4. Video Sampling Rate Conversion (Wang, CH4)
5. 2D Motion Estimation (Wang, CH6)¹
 - a. Optical Flow
 - b. General Methodologies
 - c. Pixel based methods
 - d. Block matching
 - e. Deformable block matching
 - f. Mesh based methods
 - g. Global motion estimation

¹ Supplementary material: 2D Motion Estimation (Tekalp, Section II)

- h. Multiresolution motion estimation
- 6. Video Filtering (Tekalp, Section IV)
 - a. Motion compensated filtering
 - b. Noise filtering
 - c. Restoration
 - d. Superresolution
- 7. Foundations of Video Coding (Wang, CH8)
 - a. Basic notions
 - b. Information theory for source coding
 - c. Binary encoding
 - d. Scalar encoding
 - e. Vector quantization
- 8. Waveform Based Video Coding (Wang, CH9)
 - a. Block-based transform coding
 - b. Predictive coding
 - c. Video coding using temporal prediction and transform coding
- 9. (*Seminar by an invited speaker*) Video Compression Standards (Wang, CH13)
- 10. (*Seminar by an invited speaker*) Streaming Video over Internet and Wireless IP Networks (Wang, CH15)

Week	Sections	Notes
1	1	
2	2; 3 a	
3	3 b,c	
4	4	A1 (FT & Sampling)
5	5 a,b,c,d	
6	5 e,f,g,h	A2 (Sampling rate conversion)
7	6 a, b, c	
8	6 d; 7 a,b	A3 (Motion Estimation)
9	7 c, d, e	
10	8 a	A4 (Coding)
11		Spring Break
12	8 b,c	
13	9/10	
14	9/10 Exam	