Video Signal Processing (Multimedia Coding)

視訊信號處理 課號：290977, 293656, 299654; 開課單位：資工四，資工所，電資外生

Time: Thursday 9:10 – 12:00, 科研大樓 334

Instructor: 杭學鳴 (Hsueh-Ming Hang) hmhang@nctu.edu.tw

Objectives: Image and video processing and coding is used in our daily life such as digital camera, TV, MP3 audio, and internet music/video (mobile devices). This course introduces the basic theory and various techniques used in video signal compression. We introduce the commonly used techniques such as Huffman coding, arithmetic coding, subband/wavelet coding, motion-compensated DCT coding, etc. This course also covers briefly popular compression standards such as JPEG, MPEG, H.264, H.265, and the latest H.266. We now also introduce the most recent learning-based (neural net) image/video compression technology, which is a rapid growing topic. (The lectures are in English.)

Classnotes: 杭學鳴 https://mcube.nctu.edu.tw/wiki/core/pmwiki.php?n=Course.VSP2021

Textbook: 1. Class notes

2. K. Sayood, *Introduction to Data Compression*, 5th ed., Morgan Kaufman, 2017.

Recommended Readings:

1. J.-R. Ohm, *Multimedia Signal Coding and Transmission*, Springer, 2015.
2. D A. Murat Tekalp, *Digital Video Processing*, 2nd Ed, Pearson, 2015.
3. Salomon, and G. Motta, *Handbook of Data Compression*, 5th, Springer, 2010.
4. R.C. Gonzalez and R.E. Woods, *Digital Image Processing*, 4th, Pearson, 2018.

Grading: Computer Assignments: 45 % (2-3 assignments)
Final Examine: 20% (2 hours, closed book, two pages of (one-sided) A4 notes)
Final project (Report): 35% (written report + 20-min oral)

Background: Signals and Systems, Digital Signal Processing, Digital Image Proc.

Contents:

1. Representations of Digital Images (filtering and transform) (Weeks 1-2) (2w)
2. Quantization and Lossless Compression (Huffman, arithmetic, and dictionary) (Weeks 5-6) (2w)
3. Color and Human Visual System (Weeks 3-4) (1.5w)
4. Transform Image Coding (JPEG) (Weeks 7-8) (1.5w)
5. Wavelet transform and Coding (JPEG2000) (Week 9) (1w)
6. Motion Estimation (Week 10) (1w)
7. Video Coding (ITU/MPEG Video, H.264, H.265, H.266) (Weeks 11-12) (2w)
8. Final examine (Week 13)
9. Deep Learning and Image Processing (Weeks 14-15) (1.5w)
10. Deep-learning based image/video Coding (Weeks 16-17) (2w)
11. Term project report (Week 18)