

University of Waterloo
Department of Electrical and Computer Engineering
ECE 613: Image Processing and Visual Communications

Instructor

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Schedule

Follow announcements and instructions posted at LEARN: <https://learn.uwaterloo.ca>.

Course Description

This course covers the fundamental concepts and methods, as well as state-of-the-art theories and technologies, in the field of image processing and visual communications. Topics include fundamental digital image and video processing methods; image analysis and understanding; statistical and perceptual image modeling and processing; and compression, streaming, robustness, and scalability issues in visual communications.

Course Outline

1) Digital image and video processing

Intensity transformations for image enhancement; spatial domain linear filtering; frequency domain linear filtering; nonlinear image filtering; image sampling and interpolation; motion and digital video processing.

2) Image analysis and understanding

Edge detection; image segmentation; energy preserving and energy compaction; principle component analysis and independent component analysis; sparse representations; wavelet and multiresolution image analysis; non-linear image analysis.

3) Statistical and perceptual image modeling and processing

Spatial domain image statistics; Fourier domain statistical image models; wavelet domain statistical image models; Markov random field models; computational models of the human visual system; perceptual image quality assessment and processing; data-driven and learning-based image processing algorithms.

4) Visual communications: compression, quality, streaming, robustness and scalability

Video compression and standards; quality-of-service and quality-of-experience; adaptive video streaming; error resilient visual coding and communications; scalable image and video coding and communications.

Textbooks and References

No required textbook. Electronic copies of lectures and study materials will be provided. Additional references include recent research papers found through search engines and public reservoirs, such as Google Scholar, ieeexplore.ieee.org, www.webofknowledge.com, arxiv.org, researchgate.net