ELEG404/604

Imaging with Deep Learning

Spring 2023[WF 08:40 - 09:55]

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Course Description

Introduction to digital imaging including optics, sensors, sampling, filtering, and their mathematical modeling with 2 -dimensional Fourier analysis. The imaging pipeline of denoising, demosaicing, deblurring, and super-resolution are posed as an inverse optimization problem, as well as computational imaging systems including computer tomography, 3D LiDAR imaging, and spectral imaging. Traditional as well as Deep-learning algorithms are introduced to address the aforementioned computational inverse problems introduced including convolutional and deep neural networks.

Topics

- Light, optics, and pixels.
- Two dimensional Fourier analysis
- Sampling, aliasing, sensors, and noise
- 2D discrete Fourier transform
- Filtering, convolution, mosaicing
- Deep learning architectures
- Deep demosaicing, denoising, super-resolution
- 3D LiDAR and deep-learning
- Compressive sensing and reconstruction
- Hyperspectral imaging and reconstruction

Requirements

ELEG305 and basic programming skills in MatLab or Python

Materials

Class notes and other material will be provided.

Lecture slides available in

Course Site

Evaluation

Homework & computer assignments [20%].
2 Midterms [40%].
Final Exam [20%].
Project [20%].