IT523: Digital Image Processing

1. Instructor: Aditya Tatu
2. Structure: 3-0-2-4
3. M.Tech Group-II.
4. Prerequisites: Signals and Systems (Convolution, Fourier transform)- Beginner level, Linear Algebra - Beginner/Moderate level, MATLAB/Python - Beginner level.
5. Foundation for: Computer Vision.
6. Abstract content: This course introduces students to the fundamental concepts associated with digital images and image processing techniques. A variety of algorithms dealing with typical problems like enhancement, restoration, segmentation etc. will be discussed in the course.
7. Content:
   - Image acquisition & Basics - Image formation model, Sampling & quantization issues, Digital Images - Pixel, Neighborhood, etc.
   - Image Enhancement: Noise removal, Contrast enhancement, adjust brightness, sharpening, re-sample etc.
   - Linear algebraic formulation of LSI (Linear-Shift Invariant) Image processing.
   - Image restoration.
   - Image Segmentation.
   - Morphological Processing: Nonlinear processing based on set-theoretic concepts.
   - Representation & Description.

The students will be given a set of tasks in every lab. Students are encouraged to attempt the tasks in small groups, and submit their attempts by the end of the lab. The course also has a project component in it for which students can either present a recent research paper, possibly with an implementation, or can come up with and implement a project related to the course.
8. Texts and References: Although we will stick to the first book listed below, we will often look at papers on specific topics.
   - Digital Image Processing, Gonzalez & Woods, 3rd ed. (Textbook)
   - Fundamentals of Digital Image Processing, Anil Jain
   - Digital Image Processing, Kenneth R. Castleman
9. Outcomes and Objectives: The objective of the course is to teach the students basic algorithms/approaches in image processing. At the end of the course the student should be able to understand issues involved in a general image processing setup and implement a few basic algorithms in image enhancement, restoration, segmentation etc.
10. Evaluation: One In-sem - 15%, End-sem - 25%, Lab assignments - 35%, Project - 15%, Lab exam - 10%