EE 604
Digital Image Processing

IIT KANPUR
Indian Institute of Technology, Kanpur

Tanaya Guha
Aug - Nov 2017

Lecture outline

- **Course overview**
- **Guidelines and course policies**
- **Introduction to Image Processing**

EE604 Team

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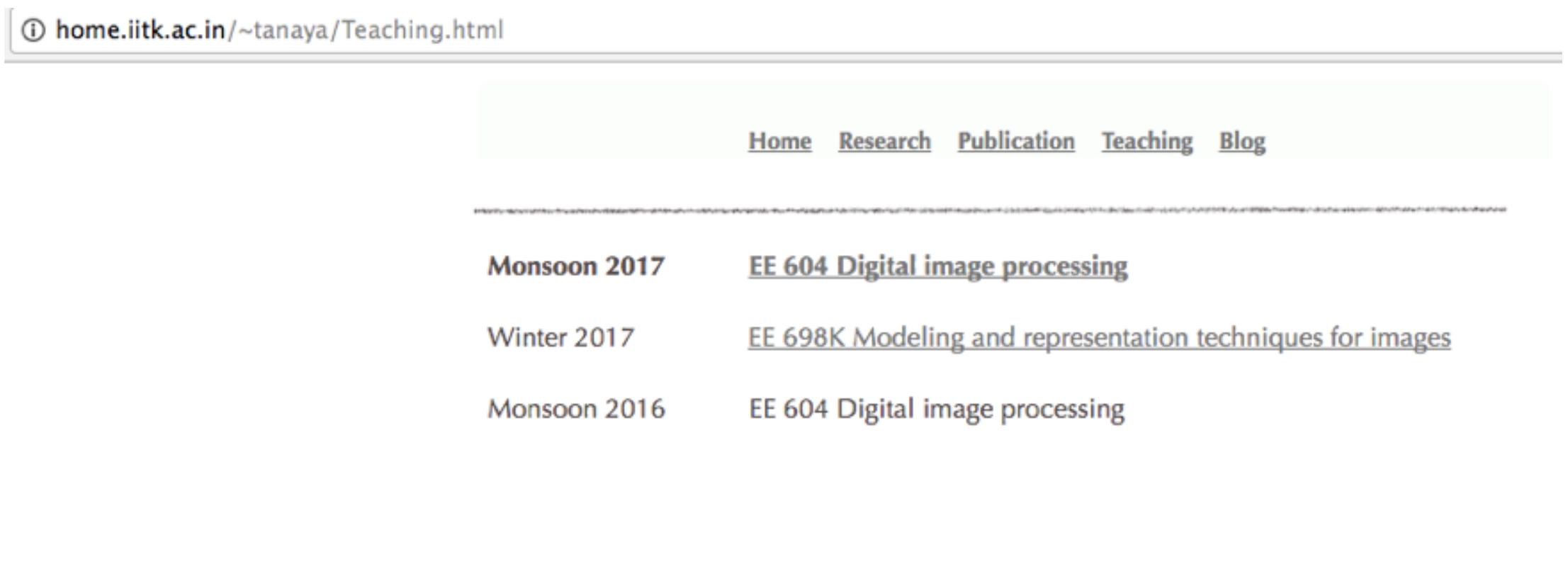
Logistics

- **Lectures:** Wed, Fri, 3:30 - 4:45pm at L13
- **Instructor office hour:** by appointment
- **Course webpage:** http://home.iitk.ac.in/~tanaya/ee604



Course objective

- **Learn** the basics of image formation, processing and analysis
- **Understand** the wide applicability of image processing methods
- **Develop** an insight towards which method to use when
- **Apply** learned techniques to build a real-world system

Content

- **Image fundamentals:** perception, sampling, quantization
- **Image enhancement:** time and frequency domain filtering
- **Image restoration:** noise models, denoising algorithms
- **Image compression:** DCT, Huffman coding, JPEG compression
- **Morphological image processing: s**et-theoretic filters
- **Image segmentation:** thresholding, watershed, graph-based segmentation
- **Image representations & descriptions**

Prerequisites

- **Hard prerequisites**

  Programming

  Signals and systems

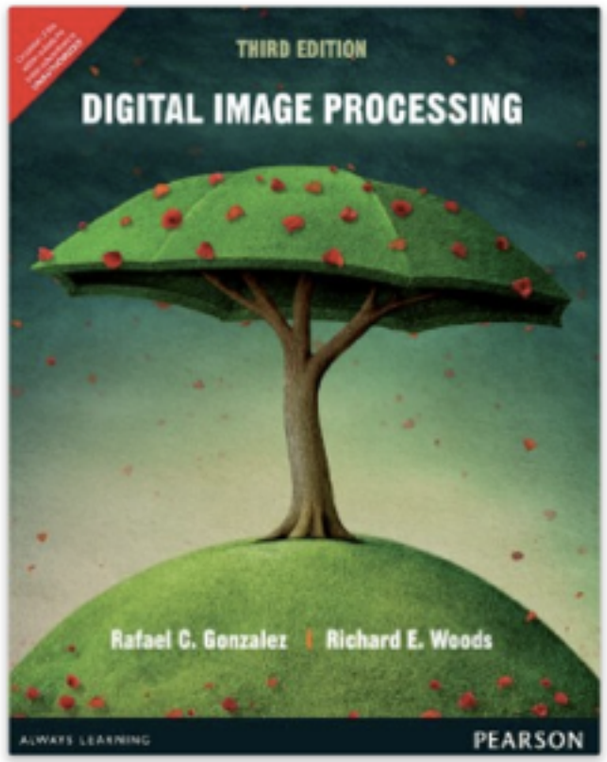
  Linear algebra, Probability.

- **Soft prerequisites**

  Digital Signal Processing

  Mathematical methods for signal processing

Primary reference



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Digital Image Processing Paperback – 2013

by Rafael C. Gonzalez (Author)

★★★★½ 20 customer reviews

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LIMITED QUANTITY

The order quantity for this product is limited to 2 units per customer

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Completely self-contained-and heavily illustrated-this introduction to basic concepts and methodologies for digital image processing is written at a level that truly is suitable for seniors and first-year graduate students in almost any technical discipline. The leading textbook in its field for more than twenty years, it continues its cutting-edge focus on contemporary developments inall mainstream areas of image processing-e.g., image fundamentals, image enhancement in the spatial and frequency domains,

Read more

Other references

- **Jain, Fundamentals of Digital Image Processing, Prentice Hall**

- **Research papers** (a few)

- **Class notes**

Evaluation

- 3 quizzes (3 x10%)
    - no midterm.
- 2 assignments (20% + 10%)
    - no course project.
- Final term (40%)

About the large assignment

- Build a **photo editing software**
    - with only 2 functionalities (out of a list of given functionalities)
    - E.g. auto-enhancement, auto-cropping, remove/add motion blur, etc.
    - should have a GUI

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- **General guidelines & course policies**
- Introduction to Image Processing

Guidelines and course policies

- The easiest way to reach the instructor is via email.
- Email regarding the course should start with [EE604] in the subject line.
- Assignments/reports (only PDFs please) should be submitted to ee604a@gmail.com. Hardcopies are neither needed nor accepted.
- Attending classes is not mandatory, but recommended.
- You'll be tested on your understanding. No need to memorize equations.

Guidelines and course policies

- It is expected that you will maintain academic honesty in every form.
- Please familiarize yourself with the general rules and laws of plagiarism.
- If plagiarism is detected, you'll be given zero mark for that piece of the work.

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Why study images?

- Images and videos are EVERYWHERE!

- Widespread applications in robotics, security, healthcare, entertainment, and many other fields.

- It's fun (think of Photoshop, Instagram)!

How it all started …

Robert Nathan
(photo from nasa.gov)

- 1920s - Bartlane cable picture system
- 1959-69 - NASA Jet Propulsion Lab
  - JPL's spacecraft was sending 'dark, noisy, distorted' images.
  - Nathan wrote first computer programs for image enhancement

Image processing (IP) =? Computer vision (CV)

- Loosely speaking
  - IP: Image -> Image
  - CV: Image -> high level information

  - IP: Wide range of image modalities
  - CV: mostly natural images

- In practice, we need both and do not differentiate!

Image processing system

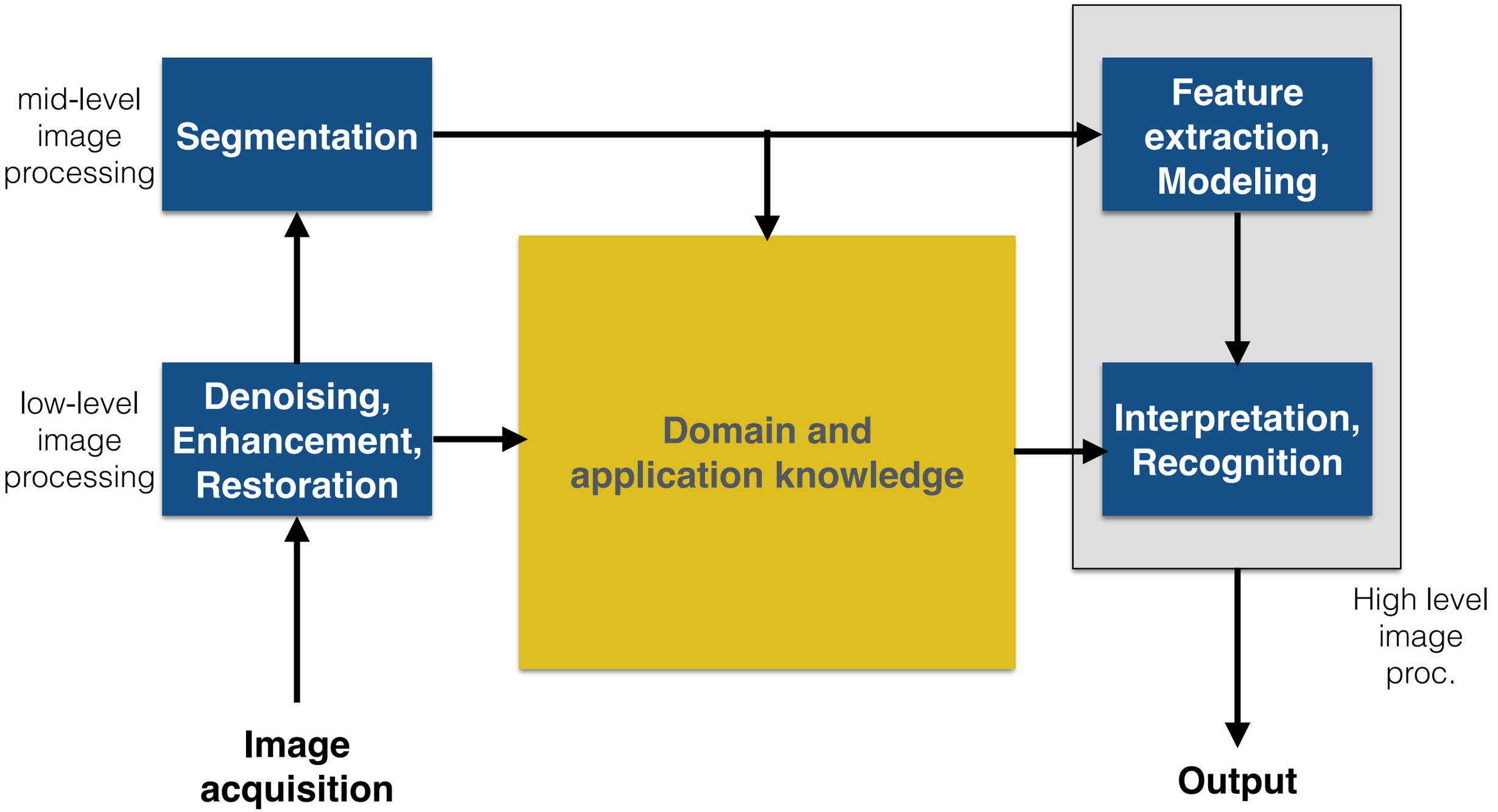


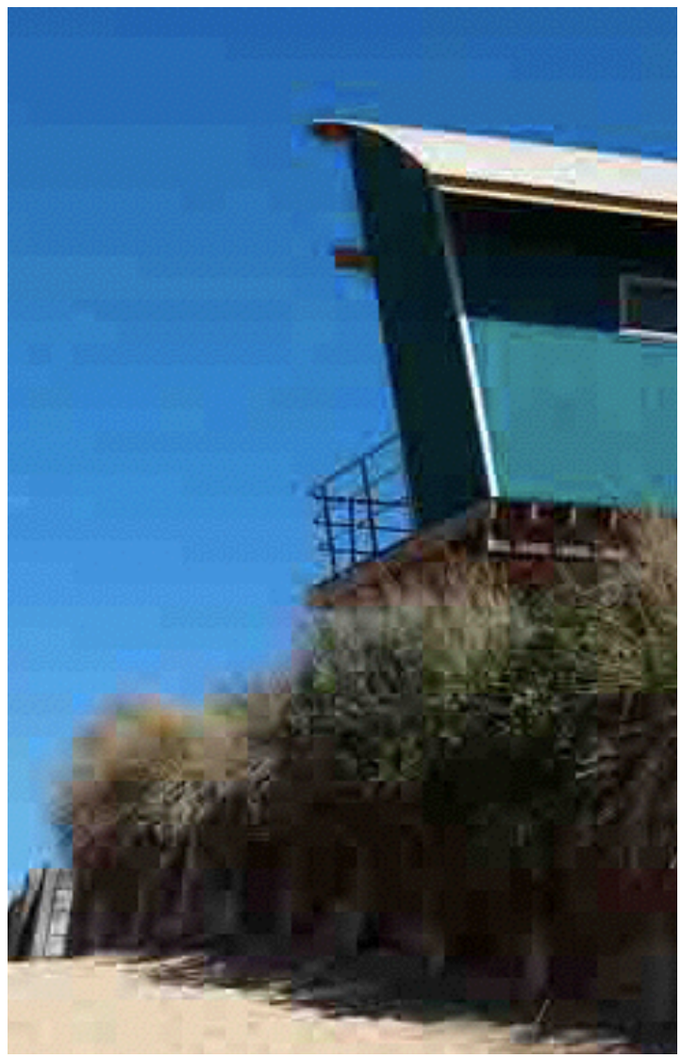
Image Modalities

Image Enhancement

source: mathworks

Image Compression

file size = 5MB



file size < 1MB

Image Inpainting

source: cs.utoronto.edu

source: code.google.com