

CS270 Digital Image Processing

Lecture 1-1 : Course introduction

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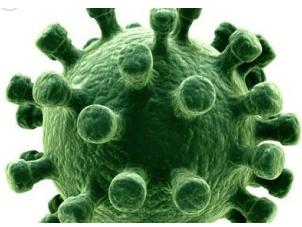
Course piazza link : <https://piazza.com/class/k6rrogf7juqk7>



Outline

- Teaching Guide
- Evaluation
- Course introduction



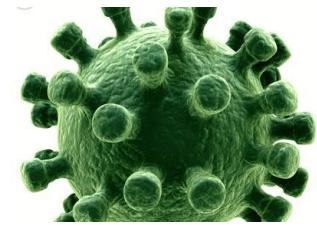


A special semester

- **录制课程教学视频授课。**每次课（按课表时间）的录制视频、教材章节、讲义PPT、参考资料以及其他辅助慕课资源等课程相关资料，（提前3天）通过校教学互动平台发布（BlackBoard和Piazza） Course piazza link : <https://piazza.com/class/k6rrogf7juqk7>
- **课堂互动方式：**遵循课表时间师生同时在线，进行课程讲解指导、答疑、讨论、作业布置、习题课和小测验等。
- **本课程拟采用的互动方式是：**Zoom云视频会议软件，请提前下载并安装客户端。视频会议的ID和密码会在每节课之前的前一个晚上发布在教学互动平台和Piazza的通知版块，请关注相关信息。
- **按课表时间，首次课时间：3月3日上午8:15。**



Teaching schedule



- **Topic I: Digital image fundamental.**

Week 1: Introduction, color, human visual system and perception.

Week 2: Image sensoring and image foundation

Week 3: Intensity transform and Geometry.

- **Topic II: Frequency domain processing.**

Week 4: Spatial filter and 2D DFT.

Week 5: Unitary transform and wavelet.

Week 6: Watermark and image blending.

Week 7: Lossy compression and image restoration.

- **Topic III: Image segmentation.**

Week 8: Edge detection and edge linking.

Week 9: Thresholding and image segmentation.

Week 10: Snake contour and morphology.

Week 11: Region representation and objective detection.

- **Topic IV: Computer vision basics.**

Week 12: Image in-painting and out-painting.

Week 13: Image retargeting and digital image forensics.

Week 14&15: Project.

Week 16: Project presentation.



Evaluation

- **Case 1: back to school time between March to May:**
- Homework assignment ($10\% \times 3 = 30\%$): 3 times of homework for the first three topics, the objective is to familiarize students with the material and exercise the processing skill that learned in the class.
- Quiz (20%): 1-2 times of quizzes. Quizzes will be held in-class.
- Final Project (50%): the topic and descriptions of the final projects will be released in the mid-semester (the 10th week), students can also propose their own topic as the final project. The proposal should be submitted and approved by the instructor before the 12th week. The 14th and 15th week will be left for project, and the last week will be left for the presentation of the projects.



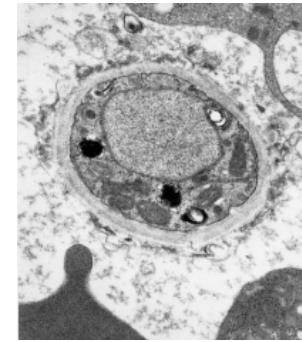
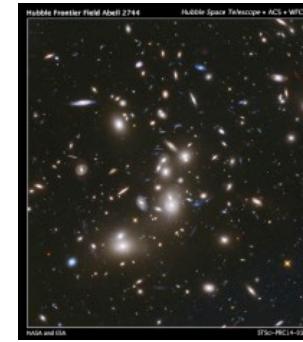
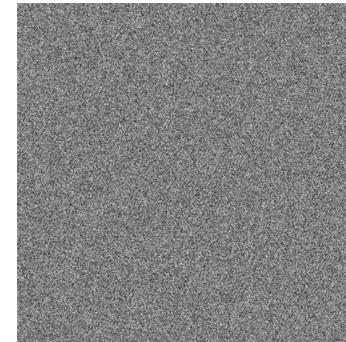
Evaluation

- **Case 2: back to school time later than May:**
- Homework assignment ($15\% + 15\% + 35\% + 35\% = 100\%$): 4 times of homework for each of the topics, and the lecture content of topic IV will be extended. There will be at least one more week of lecture for Topic IV. The students will be asked to submit PPT slides that including oral presentation of their homework for topic III and IV. The grade of homework (especially for topic III and IV) will depend on the performance of your image processing task and the quality of the presentation in PPT slides.



What is Digital Image?

- What is an image ?

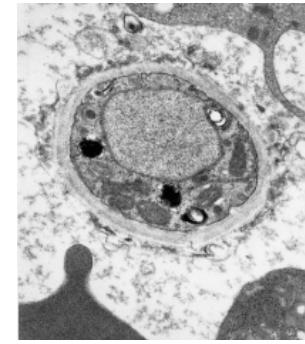
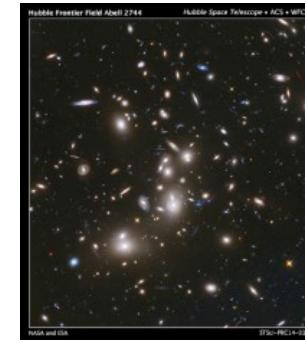
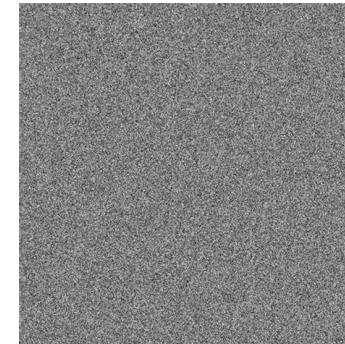


- ___?___ image.
- Digital image.



What is Digital Image?

- What is an image ?

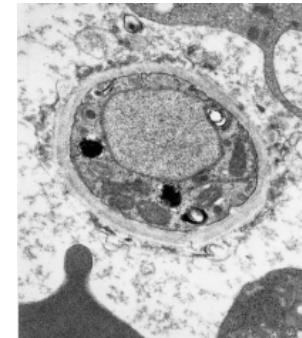
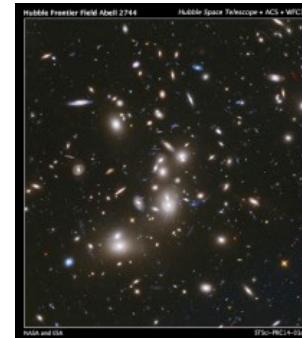
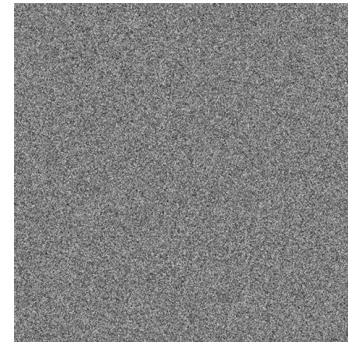


- Analog image.
- Digital image.

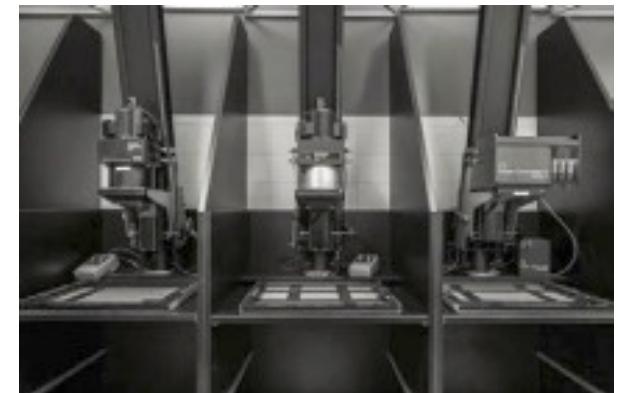
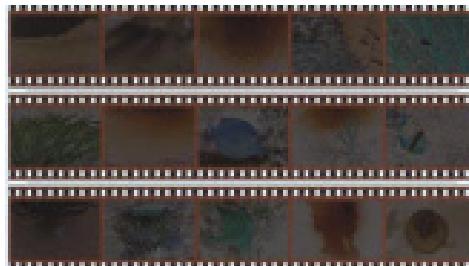


What is Digital Image?

- What is an image ?

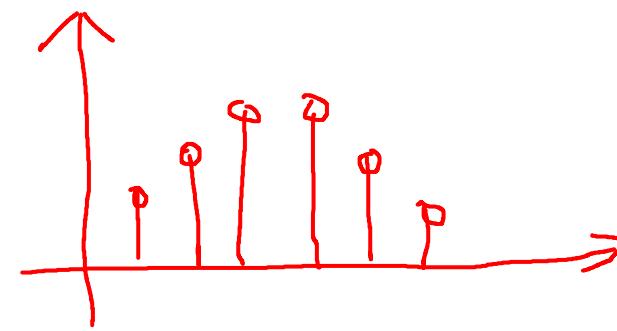
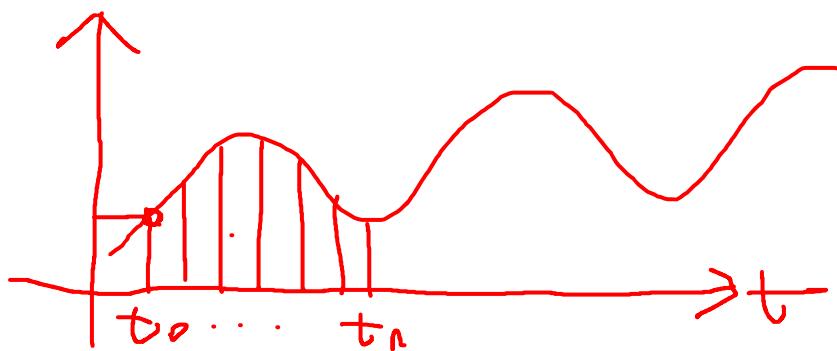
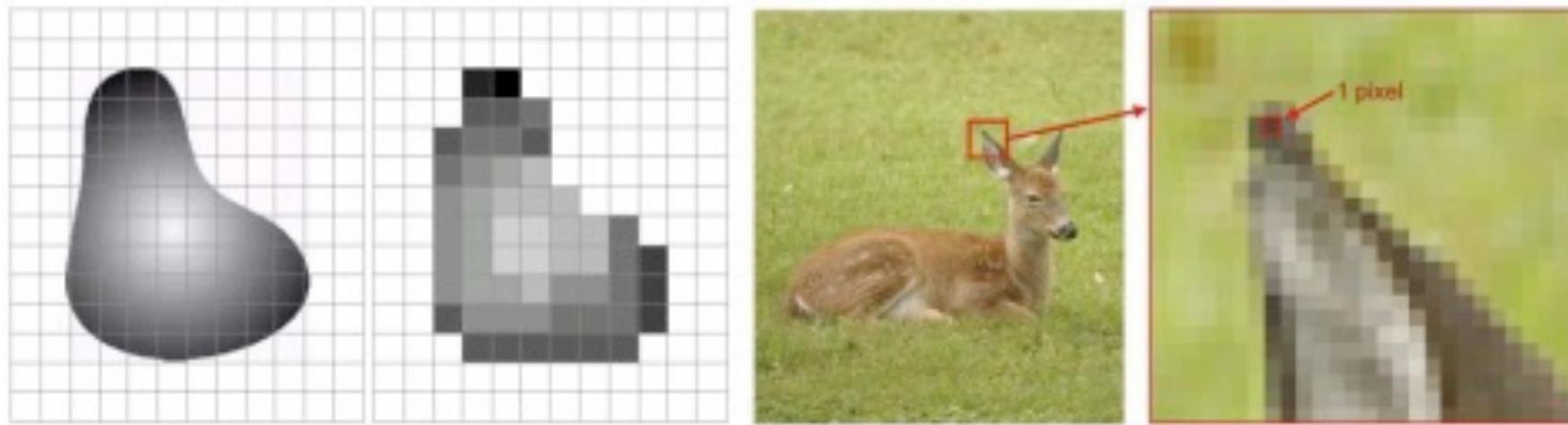


- Analog image.
- Digital image.



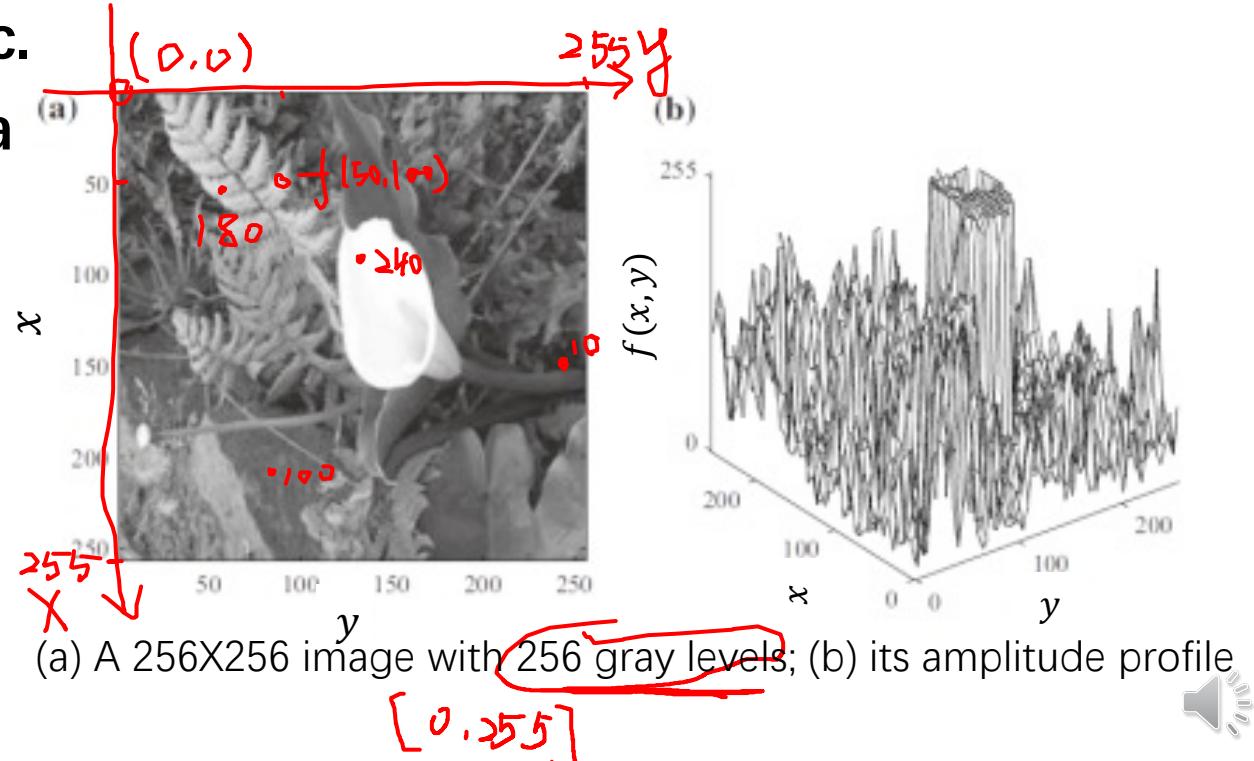
Analog vs. Digital Image

- Quantization.



Pixel / Voxel

- Digitization implies that a digital image is an approximation of a real scene.
- Digital image composed of a finite number of elements – Pixel.
- A pixel has a location and intensity information typically represent gray levels, colors, heights, opacities, etc.
- A visual representation in form of a function $f(x,y)$, where $f(50, 100)$
- f is related to the intensity or brightness (color) at point
- (x, y) are spatial coordinates
- x, y , and the amplitude of f are finite and discrete quantities



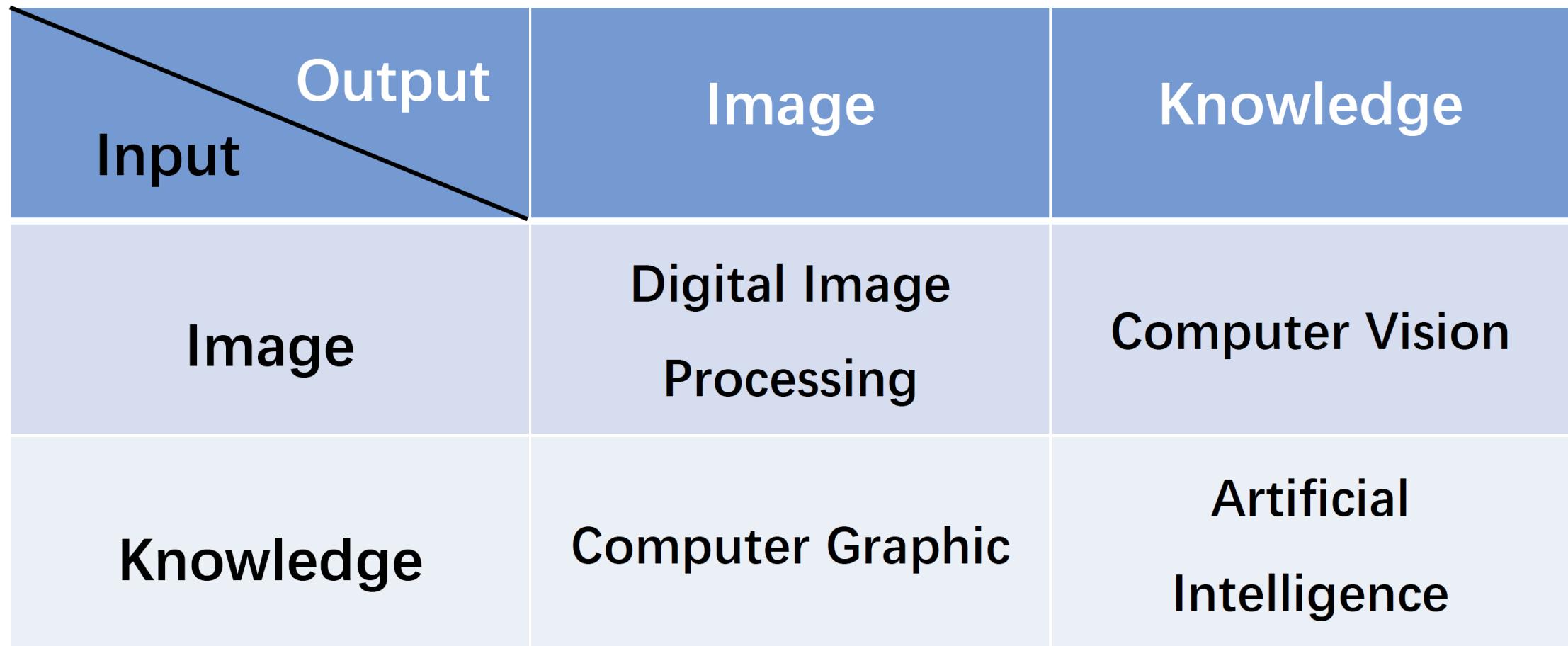
Digital image processing

$$f_1(x,y) = G[f(x,y)]$$

- Definition: Processing digital images by means of a digital computer.



Frequent question: relationship between Digital Image Processing and Computer Vision



Stage of DIP

Low level process

INPUT: Image

OUTPUT: Image

EXAMPLE:

Denoise

Contrast enhancement

Image sharpening

Mid level process

INPUT: Image

OUTPUT: Attributes

EXAMPLE:

Segmentation

Edge detection

Recognition

High level process

INPUT: Attributes

OUTPUT: Understanding

EXAMPLE:

Image analysis

Image understanding



There are no clear-cut boundaries
from image processing to computer vision



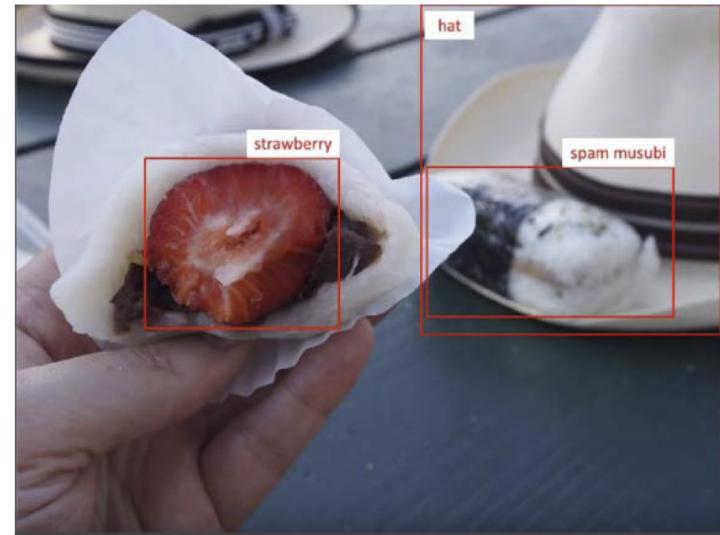


Low level



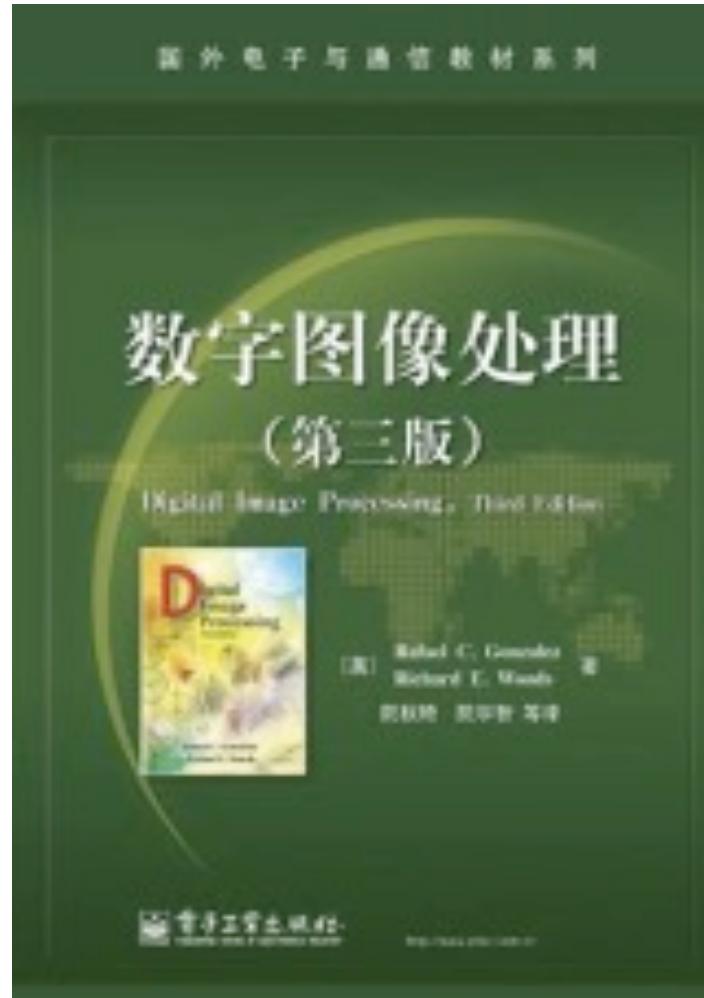
High level

Mid level



Reference book

- Digital Image Processing Rafael C. Gonzalez 978-0131687288



Fundamental Steps in DIP

- Image acquisition
- Image enhancement
- Image restoration
- Image reconstruction
- Image compression
- Image segmentation
- Image representation and description
- Object recognition



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Take home message

- 1. CS270- Digital image processing is the foundation of computer vision. If you have not at all idea about image processing this is the course you should start with.
- 2. The content will cover all the topics in the reference book and some basic but interesting methods of computer vision.
- 4. The simplest way to follow up this course is to complete your homework before each due date. The first ddl will be 2020-03-28. Homework will be released two weeks before due date.

