

Fall 2020

CS 659-851: Image Processing

Frank Shih

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CS659 - IMAGE PROCESSING AND ANALYSIS

Fall 2020

INSTRUCTOR: Dr. Frank Y. Shih
Office: Room 4205, GITC Building
Office hours: Thursday 11:00~12:20pm, 2:00-4:00pm
Also, you can see me by appointment or send me an e-mail.
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COURSE DESCRIPTION:

This course is an intensive study of the fundamentals of image processing, analysis and understanding. Topics to be covered include: a brief review of the necessary mathematical tools, human visual perception, sampling and quantization, image transformation, enhancement, restoration, compression, reconstruction, image geometric transformation, matching, segmentation, feature extraction, representation and description, recognition and interpretation, and so on.

COURSE OBJECTIVES

The objectives of this course are to:

1. Cover the fundamental theory and algorithms that are widely used in digital image processing
2. Expose students to current technologies and applications related to image processing
3. Develop hands-on experience in using computers to process images
4. Familiarize with MATLAB Image Processing Toolbox
5. Develop creative thinking on solving problems of the state-of-the-art in image processing

GRADING:

Homework (20%), Exam 1 (20%), Exam 2 (20%), Paper 1 (20%), Paper 2 (20%)

A. The course schedule (subject to change):

9/16, 11:00PM: Homework 1 Due (Lecture 1, 2, 3)
9/30, 11:00PM: Homework 2 Due (Lectures 4, 5, 6)
10/6, Exam 1, online 7~11pm
10/14, 11:00PM, Research Paper 1 Due
10/28, 11:00PM: Homework 3 Due (Lectures 7-9)
11/11, 11:00PM: Homework 4 Due (Lectures 10-13)
11/17, Exam 2, online 7~11pm
12/7, 11:00PM: Research Paper 2 Due

Note: Exam will be held on the day, 7~11 pm. It will be posted on Canvas at 7pm, and to be submitted to Moodle by 11pm. It is an open book exam.

B. Lecture-3rd Edition Book Correspondance

| | |
|------------|---------------------------------|
| Notes | Textbook1 |
| Lecture 1 | Ch 1 |
| Lecture 2 | Ch 2 |
| Lecture 3 | Ch 4, pp. 199-254 |
| Lecture 4 | Ch 3 |
| Lecture 5 | Ch 4, pp. 255-310 |
| Lecture 6 | Supplement |
| Lecture 7 | Ch 10 & Supplement |
| Lecture 8 | Ch 11 & Supplement |
| Lecture 9 | Ch 9 & Supplement |
| Lecture 10 | Ch 12, pp. 861-882 |
| Lecture 11 | Ch 12, pp. 882-902 |
| Lecture 12 | Ch 12, pp. 903-906 & Supplement |
| Lecture 13 | Supplement |

The following programming languages are allowed: Matlab, C++, and Java. However, Matlab is highly recommended since it offers lots of image-processing functions. It can be easily learned by reading any Matlab programming books. You can download the Matlab software from the NJIT website: <http://ist.njit.edu/software/download.php>.

There will be a total of 100 points. The grade assign is based on the following:

- A: 90 – 100 points
- B+: 80 – 89 points
- B: 70 – 79 points
- C+: 65 – 69 points
- C: 60 – 64 points
- D: 50 – 59 points
- F: 0 – 49 points

COURSE WEBSITE:

Submit the homework solution in Microsoft Word format to <http://njit2.mrooms.net/> before the above deadline. Absolutely, no late submission is accepted. Write the answers in your own words individually. Any plagiarism will cause a “FAIL” grade and report to Dean of Students. The course lecture and power-point files are available free of charge through NJIT website at <http://njit2.mrooms.net/>.

TEXTBOOKS:

1. R. Gonzalez and R. Woods, *Digital Image Processing*, Prentice Hall, third edition, 2008, ISBN 9780131687288. OR R. Gonzalez and R. Woods, *Digital Image Processing*, Pearson Publisher, fourth edition, 2018, ISBN 9780133356724.
2. F. Y. Shih (Editor), *Multimedia Security: Watermarking, Steganography, and Forensics*, CRC Press, Boca Raton, FL, 2013, ISBN: 978-1-4398-7331-1.

REFERENCE BOOKS:

1. A. McAndrew, *Introduction to Digital Image Processing with Matlab*, Thomson Course Technology, 2004.
2. F. Y. Shih, *Digital Watermarking and Steganography: Fundamentals and Techniques*, Taylor & Francis Group, CRC Press, Boca Raton, FL, ISBN 1-4200-4757-4, 2008.
3. F. Y. Shih, *Image Processing and Mathematical Morphology: Fundamentals and Applications*, Taylor & Francis Group, CRC Press, Boca Raton, FL, ISBN 1-4200-8943-9, 2009.
4. F. Y. Shih, *Image Processing and Pattern Recognition: Fundamentals and Techniques*, Wiley-IEEE Press, ISBN 0-470-40461-2, 2010.

COURSE CONTENT:

Digital Image Fundamentals
Image Transform
Image Enhancement
Image Matching
Mathematical Morphology
Image Segmentation
Image Representation
Pattern Recognition
Image Watermarking and Steganography

Academic Honor Code

The NJIT academic honor code (<http://www.njit.edu/academics/honorcode.php>) applies in full to this class. Note in particular that copying programs, in full or in part, is forbidden. You may discuss ideas and concepts with your fellow students, but you may NOT copy any code.