

Course guide

Instructor

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Office

C703, Faculty of Integrated Arts and Sciences

Office hours

5. and 6. periods on Wednesdays

Subject

Digital image processing has been recently getting familiar to us in our daily life, for example images communication via the internet, the digital broadcasting, the third generation mobile phone, etc. However, usual textbooks about image processing often omit detailed explanation of the mathematical background of image processing for the sake of restriction of page length. This course will focus on four topics of digital image processing techniques with the mathematical background required for understanding these techniques.

Grading

At the end of each topic, a report will be requested. Students are required to read a paper concerning the topic, summarize it with your comment, and submit the report with a copy of the paper at the beginning of the next session. Students must write their reports *in English*. No examination is assigned.

Schedule

The schedule of Session 11 is not currently fixed, since Asano will have a special lecture at the same period of this class on Jan. 21. It is to be announced.

Session 1. (Oct. 1) Introduction

Topic 1. Sampling and digital processing of images

Session 2. (Oct. 15) (1) Spatial frequency and Fourier series

Session 3. (Oct. 22) (2) Fourier transformation and sampling theorem

Session 4. (Oct. 29) (3) Discrete Fourier transformation

Topic 2. Image compression by orthogonal transformation

Session 5. (Nov. 12) (1) Principal component analysis and Karhunen-Loève transformation

Session 6. (Nov. 19) (2) Orthogonal and unitary transformations of matrices

Session 7. (Nov. 26) (3) Discrete Fourier transformation and discrete cosine transformation

Topic 3. Mathematical morphology

Session 8. (Dec. 3) (1) Opening and set operations on images

Session 9. (Dec. 10) (2) Granulometry and skeleton

Session 10. (Dec. 17) (3) Filter theorem / morphology and ordered set

Topic 4. Computed Tomography – Image reconstruction from projection

Session 11. (TBA) (1) Radon transformation and projection theorem

Session 12. (Jan. 28) (2) Image reconstruction from projection

Session 13. (Feb. 4) (3) Recent topics

References

M. Petrou and P. Bosdogianni, *Image Processing The Fundamentals*, Wiley, ISBN0-471-99883-4

This book explains the fundamentals of image processing very simply with rich amount of examples, and is outstanding in its plain explanation. This book is also interesting in its style: all sections are written in the question-and-answer form.

A. K. Jain, *Fundamentals of Digital Image Processing*, Prentice Hall, ISBN0-13-336165-9

This book is not so simple as the above one, however, contains detailed explanations of background mathematics.

Other references will be introduced in the classes.

Handouts

No textbook is used. The handout for each session is uploaded on the web site shown below until its previous session (one week before the corresponding session) for your convenience of preparation. Please print and bring it to the class every week.

Web site

The web site of this course is

<http://laskin.mis.hiroshima-u.ac.jp/Kougi/07a/PIP/>

Asano's E-mail address is asano@mis.hiroshima-u.ac.jp.