2006 Autumn semester Pattern Information Processing

Course guide

Instructor

Akira Asano (right)

Professor, Information Engineering

Office

C718, 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 five 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 requried 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 on and after Session 3 is not currently fixed. The day and period will be fixed by the students' preference.

Session 1. (Oct. 6) Introduction

Topic 1. Sampling and digital processing of images

Session 2. (Oct. 13) (1) Spatial frequency and Fourier transformation

Session 3. ( ) (2) Sampling theorem and discrete Fourier transformation

Topic 2. Image compression by orthogonal transformation

Session 4. ( ) (1) Principal component analysis and Karhunen-Loéve transformation

Session 5. ( ) (2) Orthogonal and unitary transformations of matrices

Session 6. ( ) (3) Discrete Fourier transformation and discrete cosine transformation

Topic 3. Mathematical morphology

Session 7. ( ) (1) Opening and set operations on images
Session 8. ( ) (2) Granulometry and skeleton
Session 9. ( ) (3) Filter theorem / morphology and ordered set

Topic 4. Pattern recognition

Session 10. ( ) (1) Discriminant analysis
Session 11. ( ) (2) Neural networks and learning algorithm
Session 12. ( ) (3) Support vector machine and kernel method

Topic 5. Computed Tomography – Image reconstruction from projection

Session 13. ( ) (1) Discriminant analysis
Session 14. ( ) (2) Neural networks and learning algorithm

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://kuva.mis.hiroshima-u.ac.jp/~asano/Kougi/06a/PIP/

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