醫用超音波專題

Instructor: 李百祺（電機二館 309 室, E-mail: paichi@cc.ee.ntu.edu.tw）
Time: 週三 2:10pm-5:00pm
Place: 電二 502 室
Objective: Introduce advanced research topics in the field of medical ultrasound. Efforts will be focused on topics that have clinical significance, engineering challenges and fundamental understanding in underlying physics.

Textbook: Class notes and journal papers.
Prerequisites: 醫用超音波原理, 醫學影像系統, 醫用超音波成像 (以上任一門均可) 或授課老師同意。

Schedule:

2/20: Orientation/How to read and search patents.
2/27: Current status of medical ultrasonic imaging. (Choose project topic)
3/6: Adaptive imaging I. (Describe full dataset)
3/13: Adaptive imaging II. (hand out HW#1)
3/20: Digital beamformation I. (HW#1 due)
3/27: Digital beamformation II. (hand out HW#2)
4/3: Spring break
4/10: Report: project proposal.
4/17: Nonlinear imaging I. (HW#2 due)
4/24: Nonlinear imaging II.
5/1: Nonlinear imaging III (hand out HW#3)
5/8: Report: progress report.
5/15: Blood flow estimation I. (HW#3 due)
5/22: Blood flow estimation II.
5/29: Blood flow estimation III. (hand out HW#4)
6/5: The future. (HW#4 due)
6/12: Report: final project.

Grading:

40% homework
15% proposal
15% progress report
30% final report

Project topics:

The project topic should be selected from the following list. You need to have professor's consent if you want to choose a different topic. Note that the project is designed to explore the similarities and differences among different imaging situations.

- Correlation/covariance in ultrasonic imaging.
- Sampling in ultrasonic imaging.
- Ultrasonic imaging parameters.
- Applications of ultrasonic imaging.
- Ultrasonic imaging formats.
- Speckle in medical ultrasound.
- Ultrasonic flow estimation.

Report/Project format:

- Topics will be assigned to each team at the beginning of the semester and each team will have two students. There are totally three reports. Each report includes an oral presentation and a written document. The first report is to describe the preliminary study of the project, including paper/book survey and the proposed approach. The second report is a progress report that should describe your progress and any modifications from your original proposal. The final report concludes the whole study. You must perform computer simulations and/or laboratory experiments to support your conclusions.
- The oral presentation is 20 minutes long followed by a 5 minutes discussion (subject to change). The written report should be submitted to the professor and an abstract should be given to all students before the presentation.
- Oral presentation will be graded by both the students and the professor. Written reports are graded by the professor only.

Bibliography:

Books:

1. Gordon S. Kino, “Acoustic Waves : Devices, Imaging and Analog Signal Processing”, Prentice-Hall, 1987.
2. K. Kirk Shung and Gary A. Thieme, “Ultrasonic Scattering in Biological Tissues, CRC Press.”, 1993.
3. K. Kirk Shung, Michael B. Smith and Benjamin Tsui, “Principles of Medical Imaging”, Academic Press, 1992.
4. Marvin C. Ziskin and Peter A. Lewin, “Ultrasonic Exposimetry “, CRC Press, 1993.
5. Hewlett Packard Journal, Oct. Dec. 83, June 86.
6. Albert Macovski, “Medical Imaging Systems”, Prentice-Hall, 1983.
7. B.D. Steinberg, “Principles of Aperture and Array System Design”, John Wiley and Sons, 1976.
8. D.H. Evans, W.N. McDicken, R. Skidmore, and J.P. Woodcock, “Doppler Ultrasound”, John Wiley and Sons, 1989.
9. J.W. Goodman, “Statistical Properties and Laser Speckle Patterns”, Laser Speckle and Related Phenomena, Springer-Verlag, 1975.
10. J.W. Goodman, “Introduction to Fourier Optics”, MaGraw-Hill, 1968.
11. J.A. Jensen, “Estimation of Blood Velocities Using Ultrasound”, Cambridge University Press, 1996.

Journals:

1. IEEE Transactions on Ultrasonics, Ferroelectrics, and Frequency Control.
2. IEEE Ultrasonics Symposium Proceedings.
3. Ultrasonic Imaging.
4. Ultrasound in Medicine and Biology.
5. Journal of Acoustical Society of America.