Medical Image Processing for Diagnostic Applications

Teaser – Course Introduction

Online Course – Unit 1

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Topics

Course Guidelines

Introduction
- Motivation for Medical Image Processing
- Topics of Medical Image Processing for Diagnostic Applications

Summary
- Take Home Messages
- Further Readings

Medical Image Processing for Diagnostic Applications

Guidelines of the course:

- Be unique in its contents.
- Challenge, but do not overload students.
- Have tons of fun in learning and experimenting.
- Provide access to cutting edge research.

Medical Image Processing for Diagnostic Applications

Guidelines of the course:

- Introduce students to international, interdisciplinary, and industry collaborations.
- Learn that the really hard problems are real world problems.
- Find the right balance between algorithms, mathematics, physics and clinical applications.
- Do not only introduce theory and methods, but demonstrate the practical impact.
- Require students to read and to work through original research papers.

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Motivation for Medical Image Processing

- A view into the human body is made possible by “spies” like:
  - standard cameras,
  - sound waves,
  - radiation attenuation,
  - magnetism.
- Medical image processing is a perfect (and sometimes difficult) combination of
  - physics,
  - mathematics,
  - computer science, and
  - engineering,

  strongly tied to medicine and medical applications.

Motivation for Medical Image Processing

- All medical imaging approaches and systems require knowledge of physics for signal generation and detection.
- All modalities generate signals. Signal processing and analysis is a requirement what all of them share to a large extent.

Note:
The lectures on “Medical Image Processing for Diagnostic Applications” focus on the algorithmic aspects of the signal processing and analysis. The physics of medical imaging is not part of this course.

Topics of Medical Image Processing for Diagnostic Applications

Medical Image Processing for Diagnostic Applications is mostly about methods and algorithms that are required for *diagnostic medical imaging*.

In detail we will discuss the following topics that are the pillars of the whole course:

1. Different modalities in medical imaging
2. Acquisition specific image enhancement and pre-processing
3. Multiple view image acquisition and reconstruction
4. Image registration and fusion

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Take Home Messages

- This course is interdisciplinary and an excellent choice to learn about medical imaging.
- You will learn a lot and you will have tons of fun.

Further Readings

An introduction to the physics for medical imaging is given by the following books:

1. David J. Dowsett, Patrick A. Kenny, and R. Eugene Johnston. *The Physics of Diagnostic Imaging*. 2nd ed. London: Hodder Arnold, Apr. 2006. DOI: 10.1201/b13462-1
2. Arnulf Opelt, ed. *Imaging Systems for Medical Diagnostics: Fundamentals, Technical Solutions and Applications for Systems Applying Ionizing Radiation, Nuclear Magnetic Resonance and Ultrasound*. 2nd ed. Erlangen: Publicis, 2005

The mathematical details of medical imaging are described in:

Charles L. Epstein. *Mathematics of Medical Imaging*. Upper Saddle River, N.J.: Pearson Education/Prentice Hall, 2003