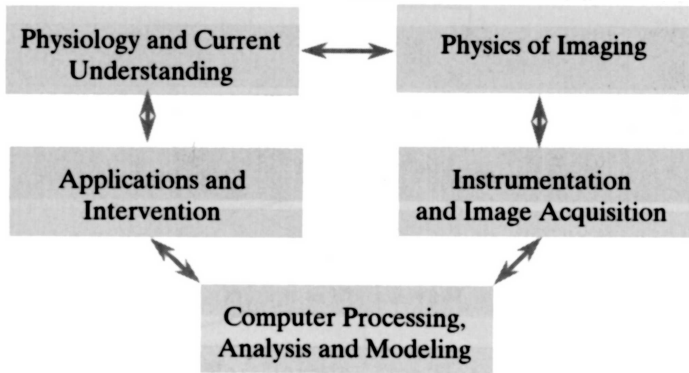


Medical Imaging – Introduction

Jan Kybic

September 29, 2005

Medical imaging: a collaborative paradigm



picture from Atam P. Dhawan: *Medical Imaging*

From physiology to information processing

(what we should learn)

- ▶ **Understanding Imaging Medium**
- ▶ Physics of Imaging
- ▶ Imaging Instrumentation
- ▶ Data Acquisition Methods
- ▶ Image Processing and Analysis

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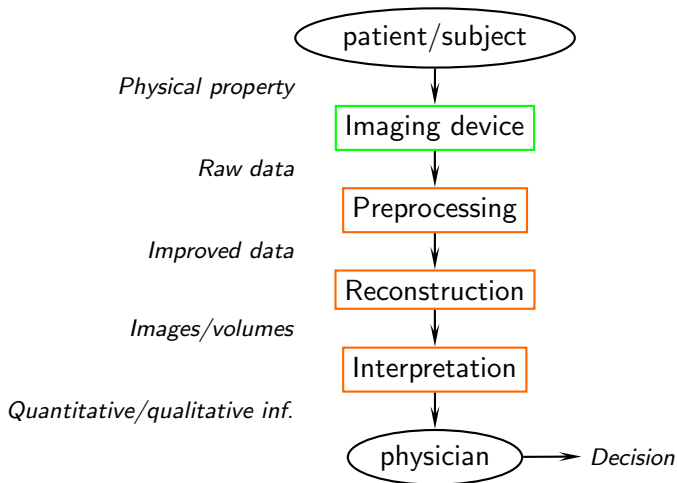
From physiology to information processing

(what we should learn)

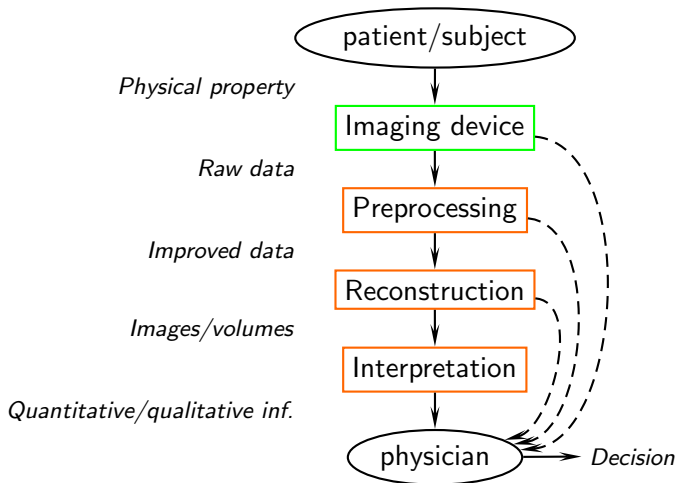
- ▶ Understanding Imaging Medium
- ▶ Physics of Imaging
- ▶ Imaging Instrumentation
- ▶ Data Acquisition Methods
- ▶ Image Processing and Analysis

Medical imaging pipeline

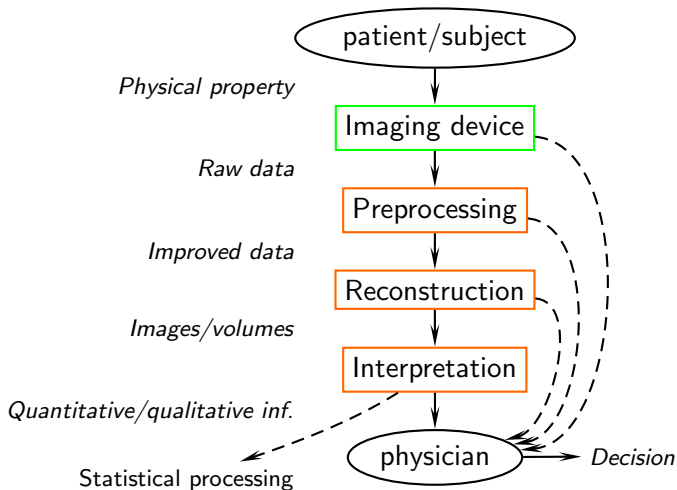
Medical imaging pipeline



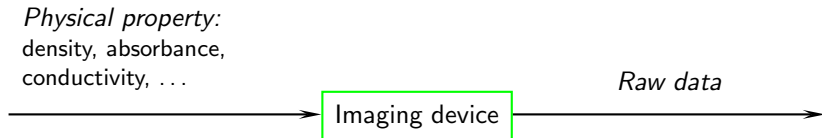
Medical imaging pipeline



Medical imaging pipeline



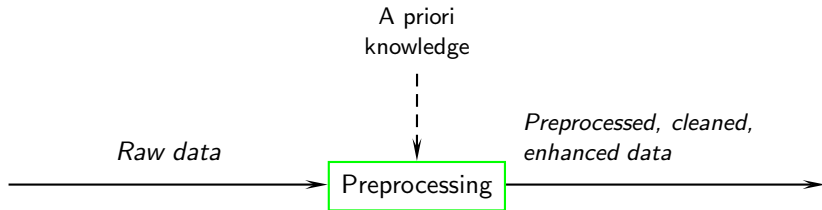
Imaging device



Examples:

- ▶ CT, X-rays, MRI, ultrasound, ...

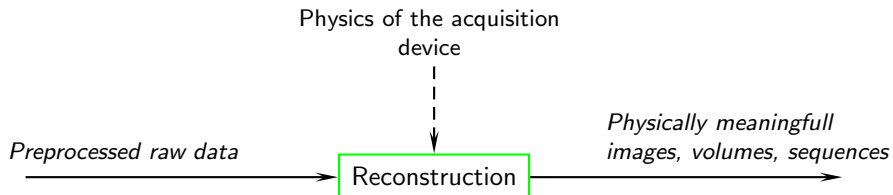
Preprocessing



Examples:

- ▶ Noise suppression, contrast enhancement, intensity equalization, outlier elimination, bias compensation, time/space filtering, . . .

Reconstruction

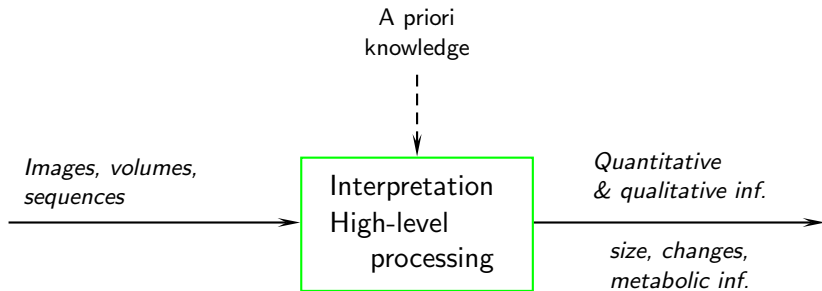


- ▶ Inverse problem

Examples:

- ▶ Tomographic reconstruction
- ▶ MRI, ultrasound ...

Interpretation



Examples:

- ▶ Registration, segmentation, classification, tracking,...

Modalities

Classification of medical modalities

- ▶ What information do we need?
 - ▶ anatomical, physiological, functional

Classification of medical modalities

- ▶ What information do we need?
 - ▶ anatomical, physiological, functional
- ▶ What is the energy source?
 - ▶ external, internal, combined

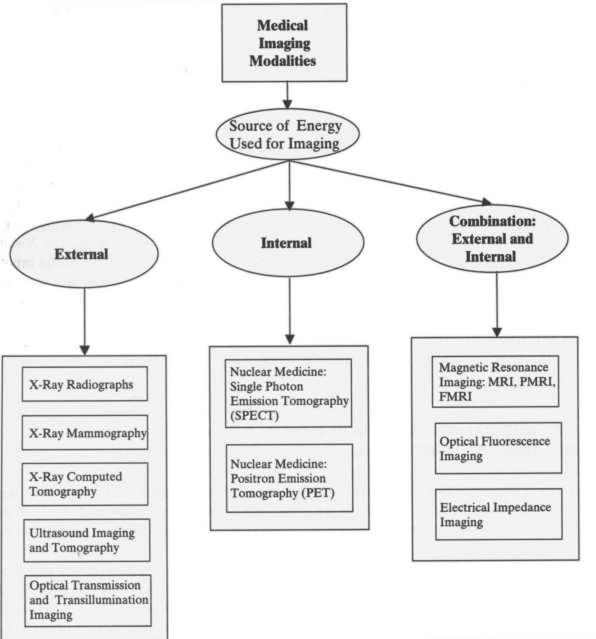
Classification of medical modalities

- ▶ What information do we need?
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- ▶ What is the energy source?
 - ▶ external, internal, combined
- ▶ How good is the image?
 - ▶ resolution, noise

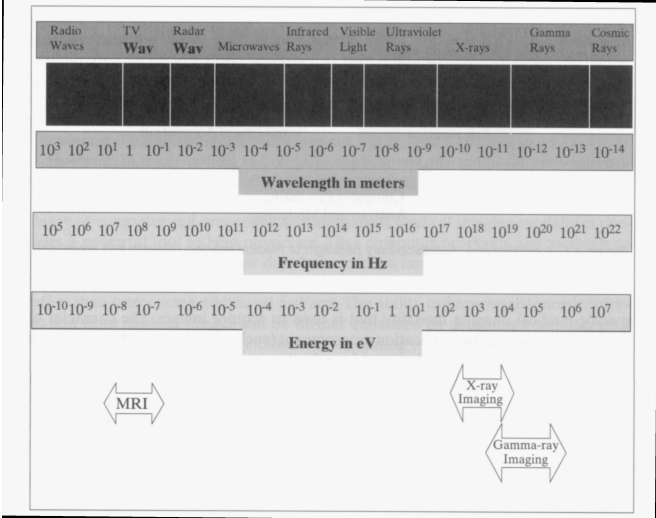
Classification of medical modalities

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- ▶ What is the energy source?
 - ▶ external, internal, combined
- ▶ How good is the image?
 - ▶ resolution, noise
- ▶ How much does it cost?

Energy source



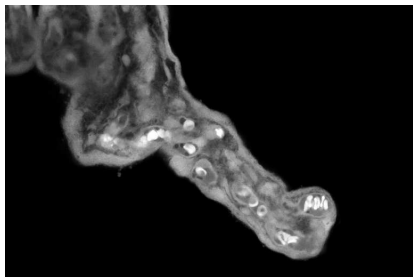
Electromagnetic spectrum



Examples

Microscopy

Optical microscopy – since 17th century; Jensen, van Leeuwenhoek, Galilei, ...



X-rays / Radiography



1895, W. Röntgen



B. Röntgen hand



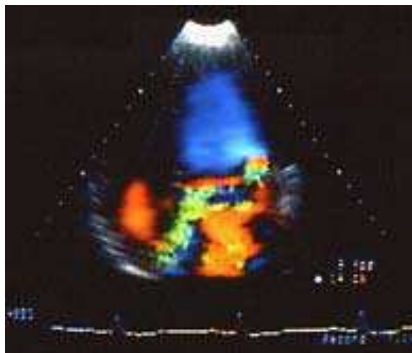
modern hand

Computed tomography

The machine:



Ultrasound – Equipment



MEG and EEG

Magnetoencephalography

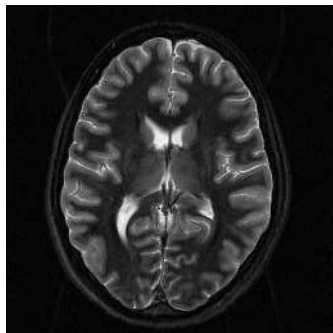


Electroencephalography



Magnetic resonance imaging (MRI)

Larmor, Bloch, Purcell, Rabi, Lauterbur, . . . around 1973.



... and many others

- ▶ SPECT (Single Photon Emission Computed Tomography)
- ▶ PET (Positron Emission Tomography)
- ▶ gamma camera
- ▶ tomography
- ▶ ...

OK, here ends the preview. Questions?

... otherwise let us start with image processing