Medical Imaging

Presented by

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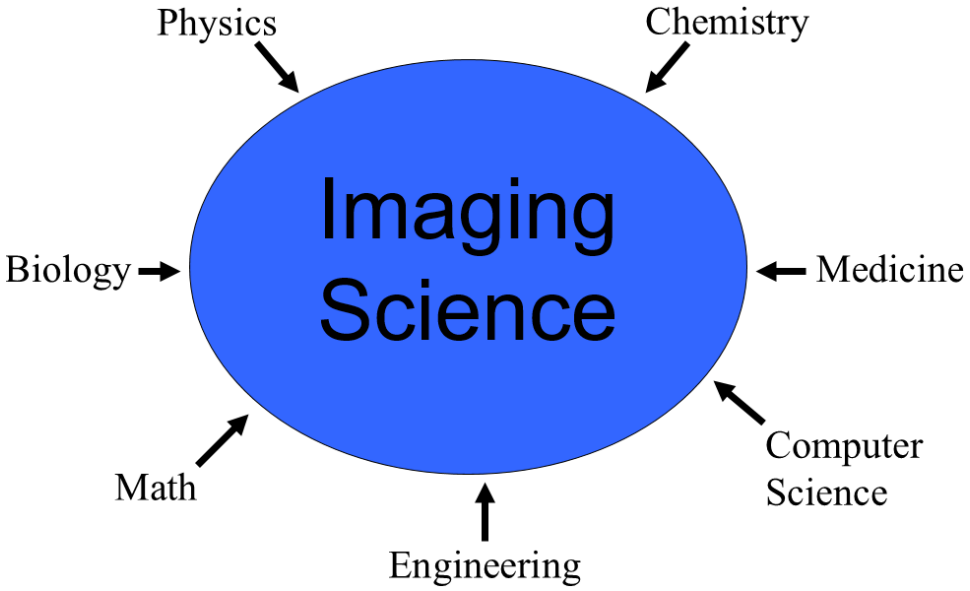
Second-year students

What is Medical Imaging?

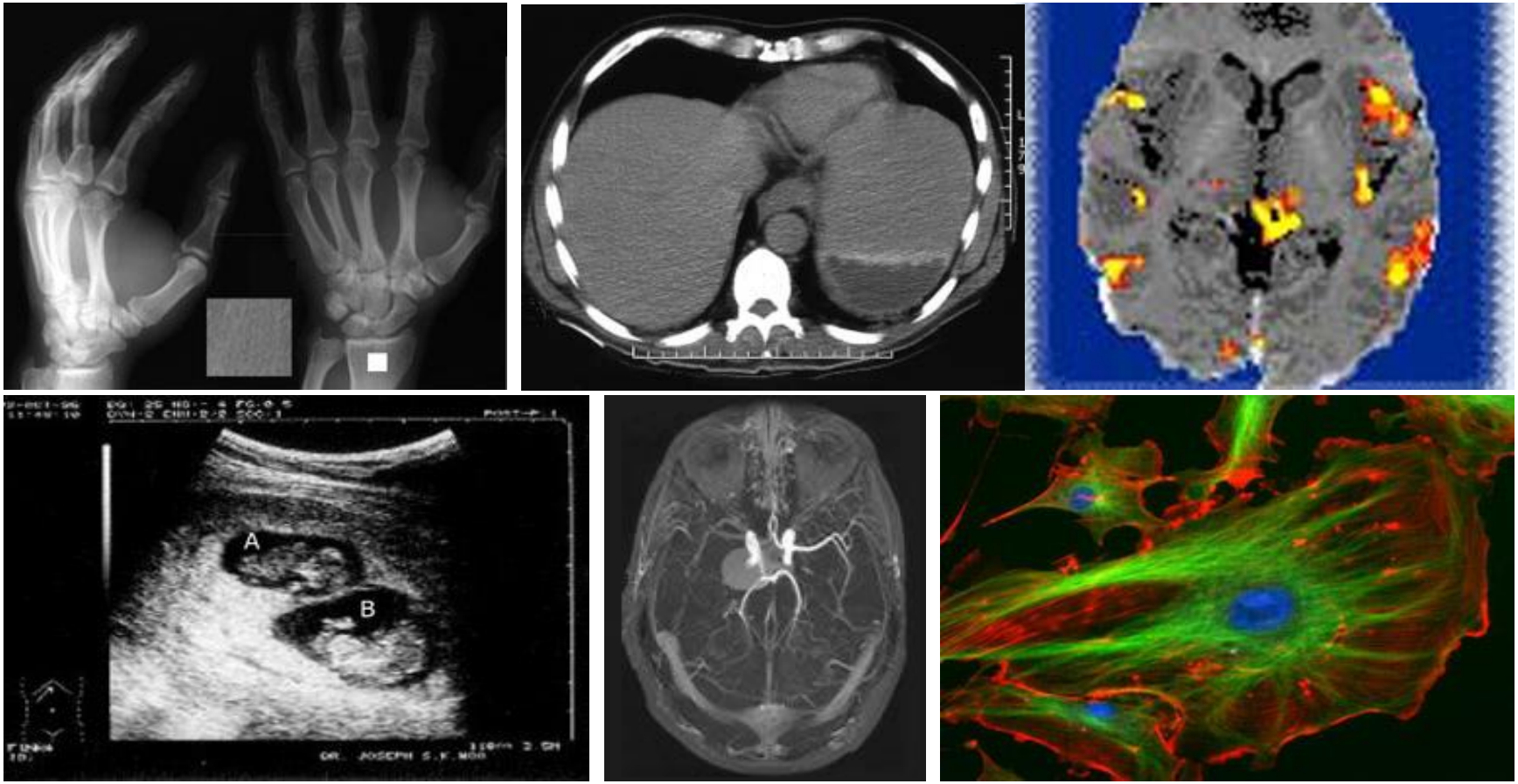
- Using an instrument to see the inside of a human body
  - Non-invasive
  - Some with exposure to small amount of radiation (X-ray, CT and nuclear medicine)
  - Some w/o (MRI and ultrasound)
- The properties imaged vary depending on the imaging modality
  - X-ray (projection or CT): attenuation coefficient to X-ray
  - Nuclear medicine (PET, SPECT): distribution of introduced radio source
  - Ultrasound: sound reflectivity
  - MRI: hydrogen proton density, spin relaxation

Medical imaging

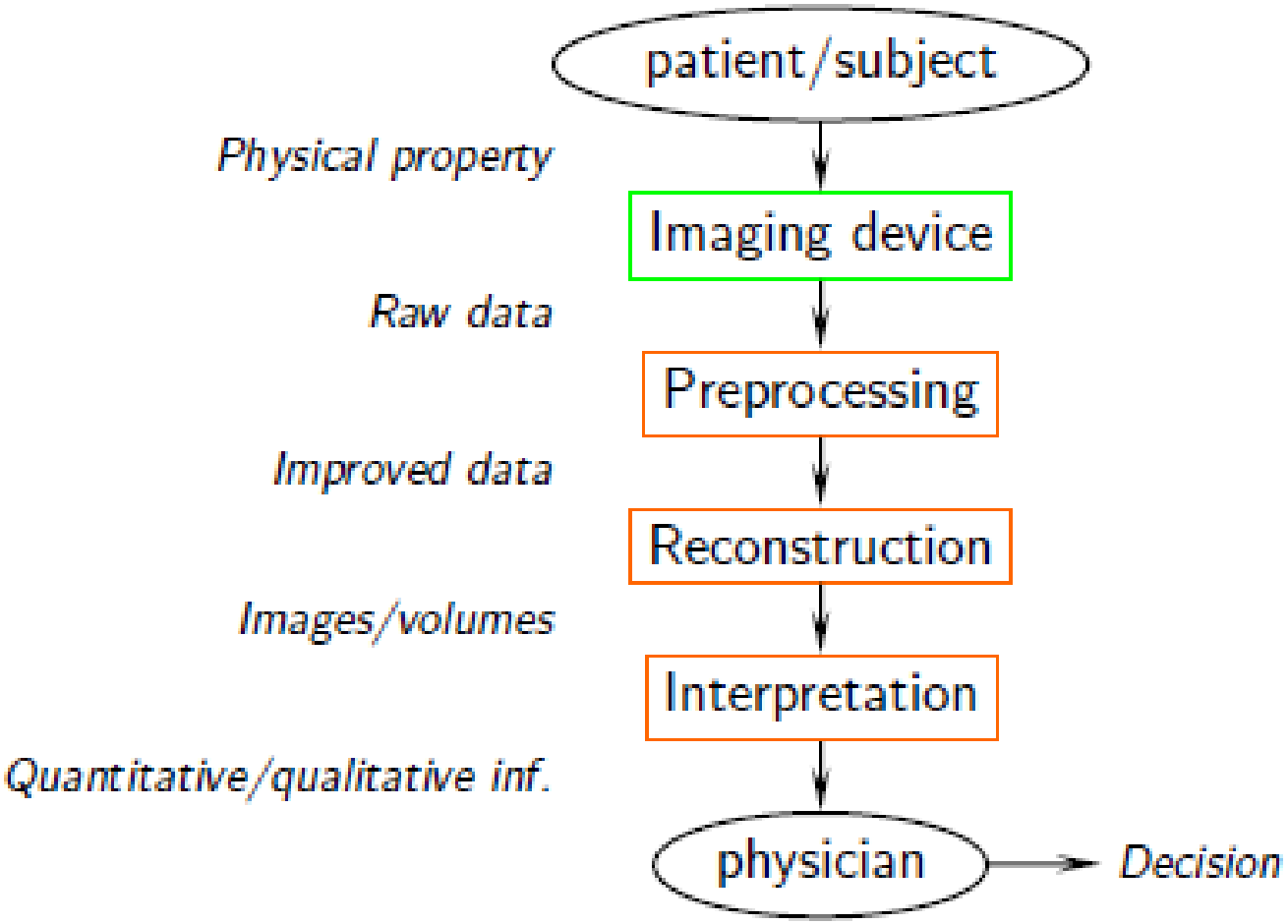
Medical imaging brings together a bunch of topics you have learned so far in a useful and elegant way. The subject combines physics, instrumentation, signals and systems, computer science, math, physiology, biology, and medicine for one noble purpose.



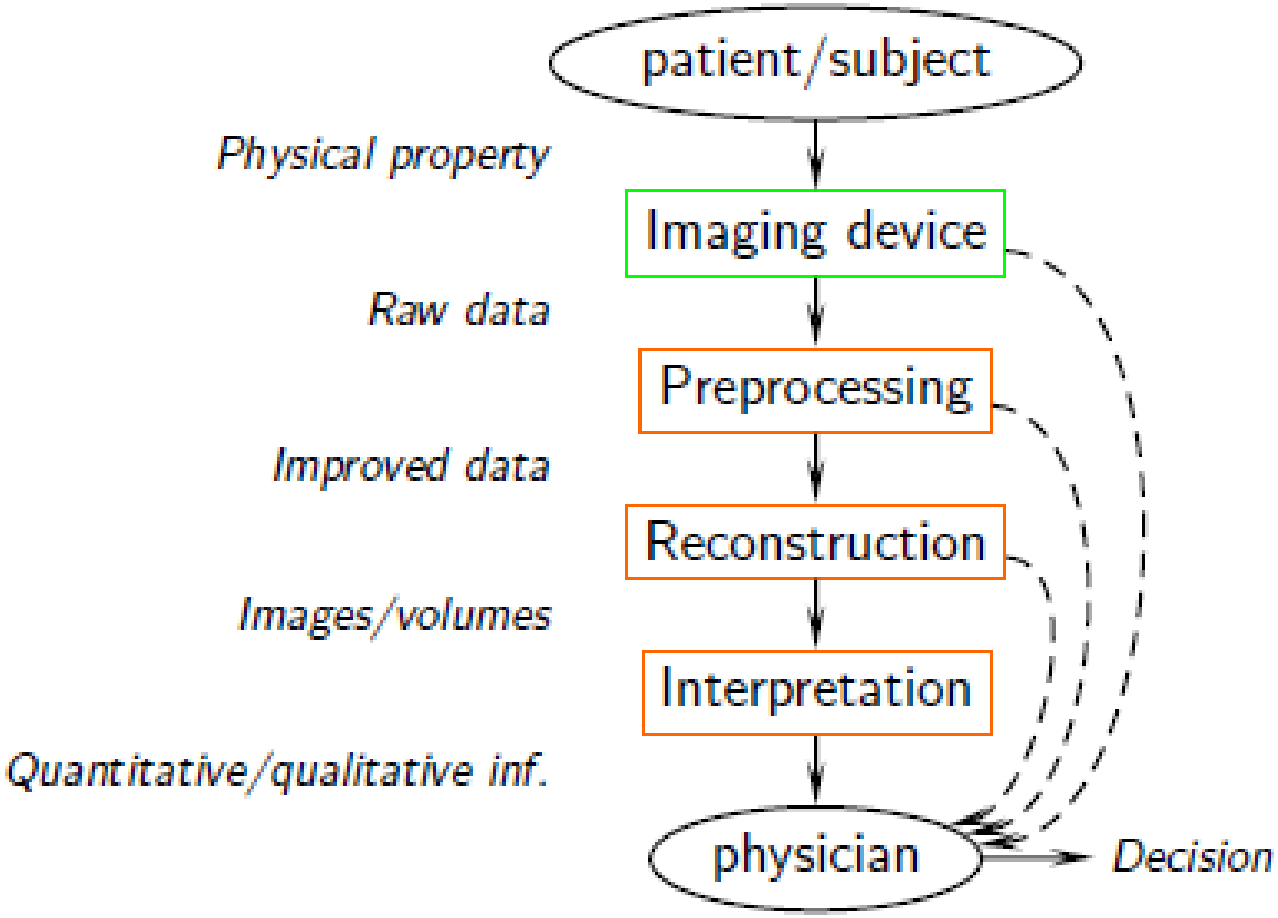
Examples of Medical Images



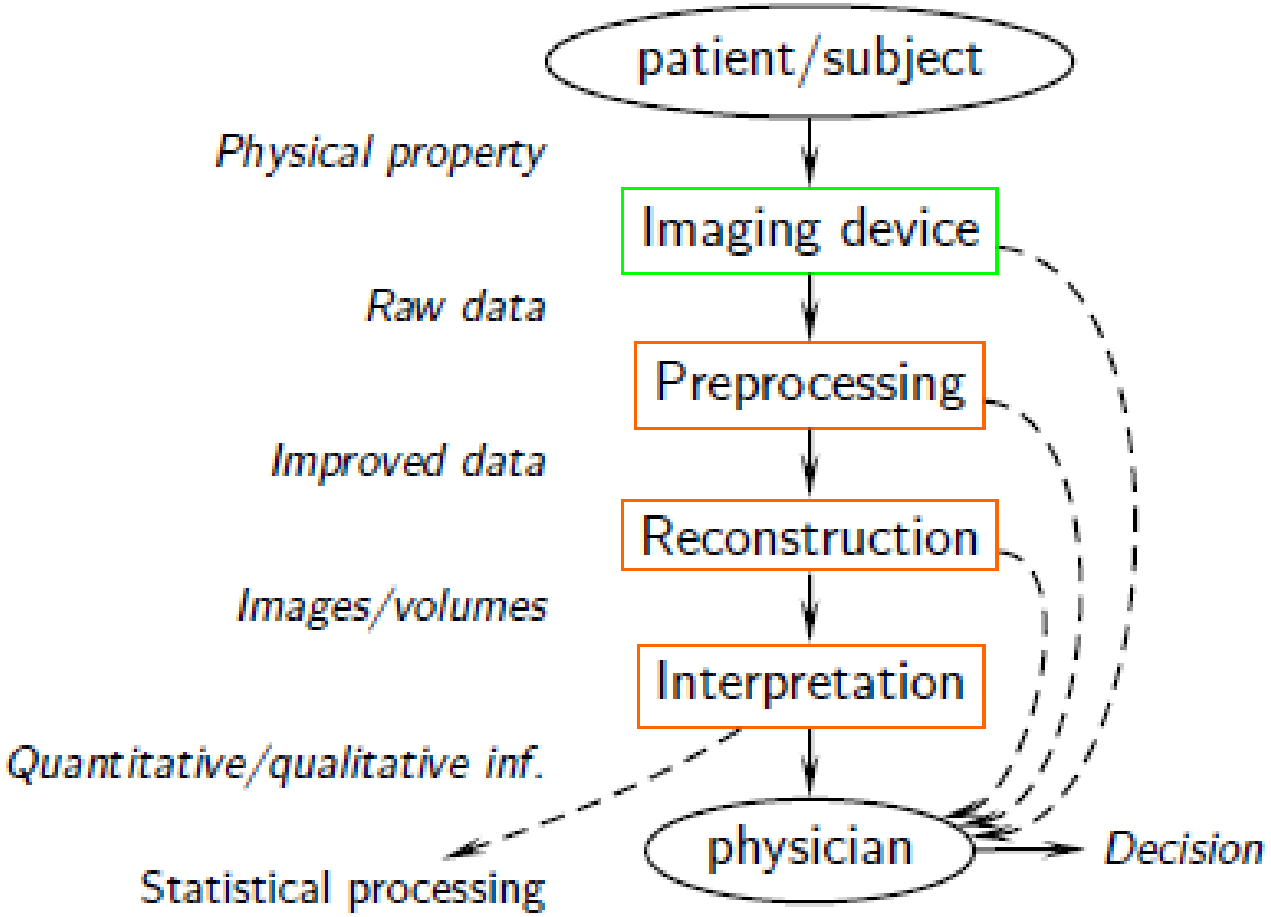
Medical Imaging Pipeline

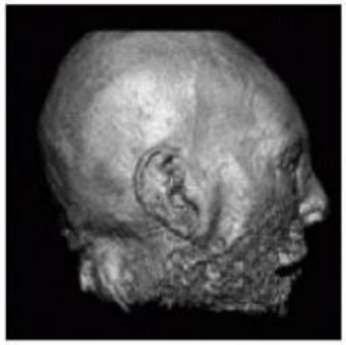


Medical Imaging Pipeline



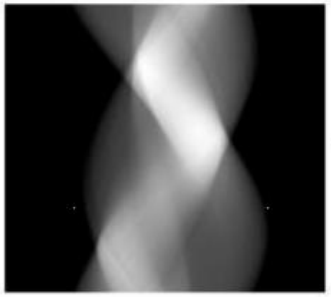
Medical Imaging Pipeline





object

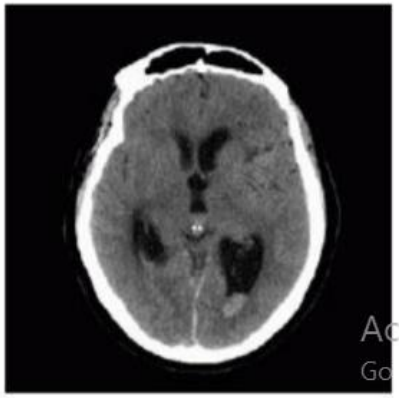
imaging device



data

imaging algorithm

reconstructed cross-sectional image

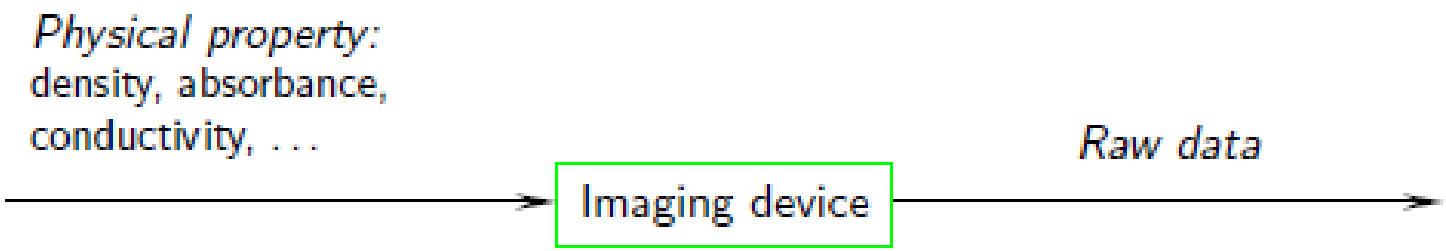


Patients/ subject

- Inclusion criteria
- Exclusion criteria

Protocol of the study

Medical Imaging Devices

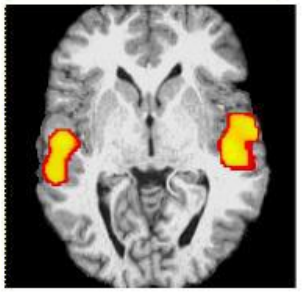


Imaging Modalities Overview

CT

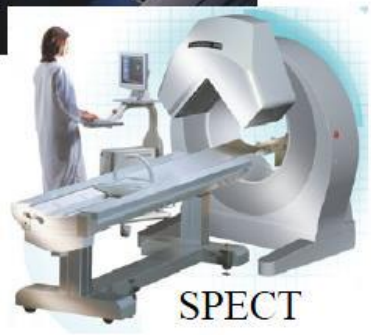
X-ray

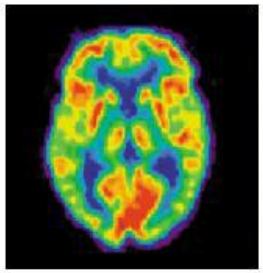
MRI / fMRI

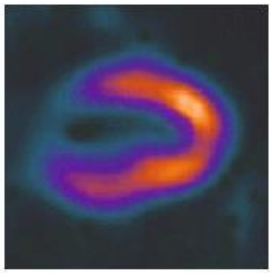


magnetic spin

Nuclear







metabolic tracer X-ray emission

Ultrasound

sound waves

Medical Imaging Modalities: History

- **1895: X-ray†**
- **~1950: Ultrasound**
- **~1955: Radionuclide**
- **1972: CT†**
- **~1980: MRI†**

†Nobel Prize

Classification of medical modalities

- What is the energy source?

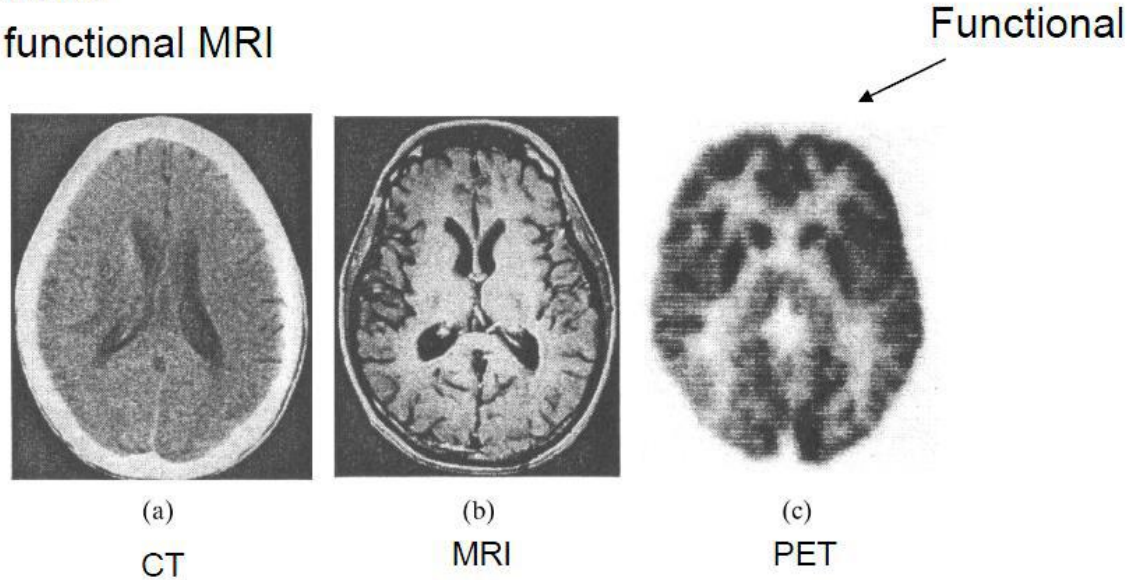
External, internal, combined

- What information do we need?

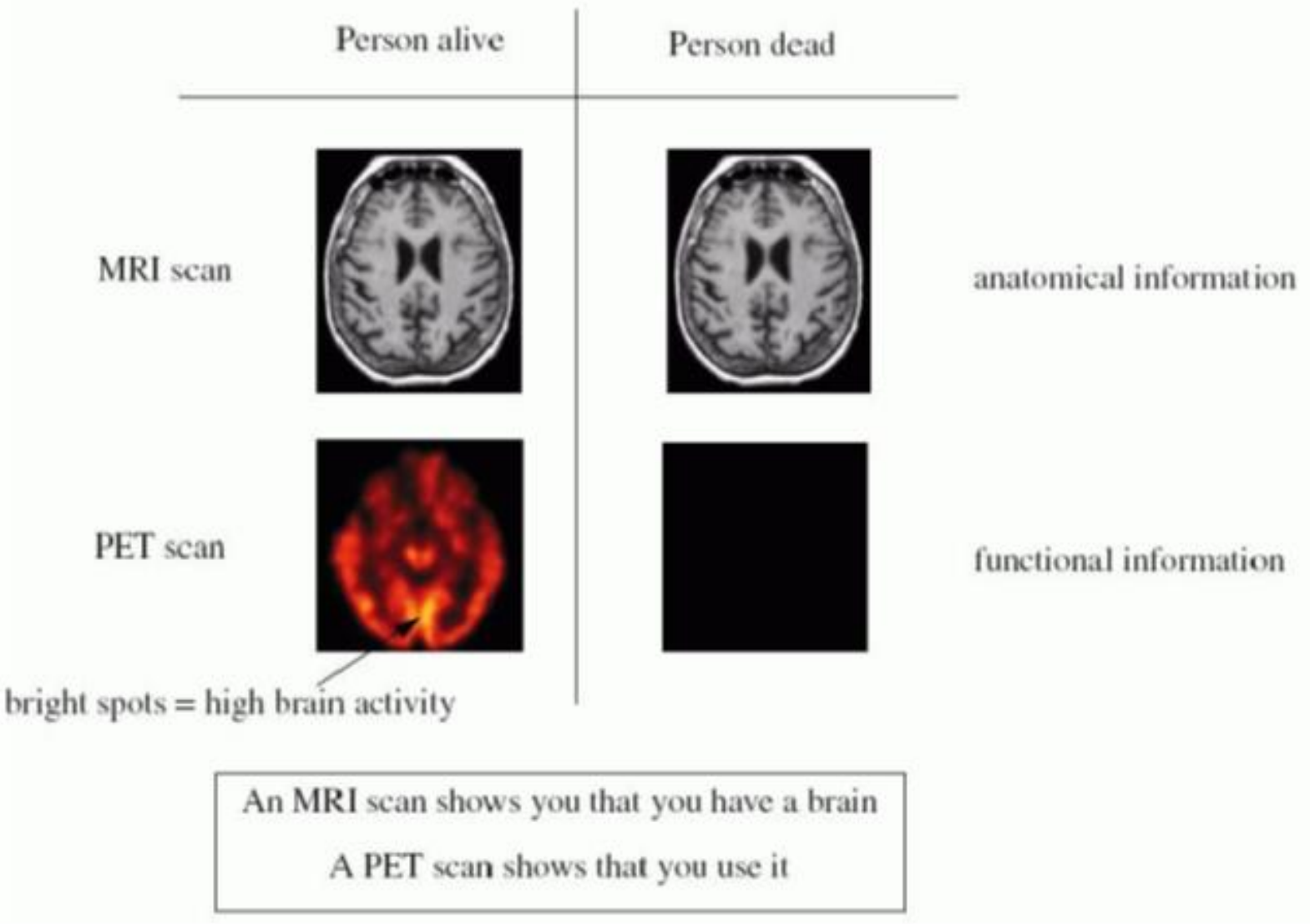
Anatomical, physiological, functional

Anatomical vs. Functional Imaging

- Some modalities are very good at depicting anatomical (bone) structure
  - X-ray, X-ray CT
  - MRI
- Some modalities do not depict anatomical structures well, but reflect the functional status (blood flow, oxygenation, etc.)
  - Ultrasound
  - PET, functional MRI



Anatomic vs Functional Imaging



An MRI scan shows you that you have a brain

A PET scan shows that you use it