Medical Image Computing

MSc 180 credits. Postgraduate Diploma 120 credits.
The course has 8 modules each with 15 credits and a research project carrying 60 credits.

<table>
<tr><th></th><th>Weeks 1-5</th><th>Weeks 6-10</th></tr>
<tr><td>Tuesday
Term 1</td><td>Foundations of Anatomy and Scientific Computing
MATLAB
Linear Algebra
Eigenvalues/SVD
Optimisation
continues on Thursdays weeks 6-10

Computer Assisted Radiology
Human and Computer Reasoning and Perception
Computer Aided Diagnosis
Knowledge Representation and Ontologies
Uncertainty
Machine Learning
continues Thursdays weeks 6-10</td><td>Physics for Imaging and Therapy

Interactions
Detectors
Sources
Dosimetry
Introduction to MRI
Introduction to nuclear medicine
Radiation Protection.</td></tr>
<tr><td>Thursday
Term 1</td><td>Computing and Statistics in Medicine
Image Processing
Computing and Medical Informatics
Statistics, probability and error propagation, Signal Processing</td><td>Foundations of Anatomy and Scientific Computing
continues from Tuesdays weeks 1-5
Anatomy and Physiology

Computer Assisted Radiology
see Tuesday weeks 1-5</td></tr>
<tr><td>Tuesday
Term 2</td><td>Medical Imaging (ionising)
Diagnostic Radiology, CT, Nuclear Medicine, PET, Image reconstruction.</td><td>Medical Imaging (non-ionising)
MRI, Ultrasound, Optical Imaging.</td></tr>
<tr><td>Thursday
Term 2</td><td>Information Processing in Medical Imaging
From voxels to information: tissue classification (supervised and unsupervised), object delineation. Segmentation algorithms in medical imaging. e.g. MASS or Analyze

Registration theory and practice.
Technologies to measure change over time. 4D analysis of motion, fusion of multiple modality images.

Classification, Markov Randon Fields, Monte Carlo Markov Chain, Bayes, MAP estimation.

Regulatory Issues
IPR, Copyright, licensing, QA, regulatory approval, anonymisation, data protection.

C++, OOP

Hands-on installation and use of packages and libraries e.g. SPM, FSL, Insight, vtk, viewing software.</td><td>Image Directed Analysis and Therapy
Visualisation, rendering and interaction.

Quantitative measures from images
- volume measures (brain atrophy, ejection fraction, cartilage volume)
- intensity measures (apparent diffusion coefficient, perfusion)
- pharmacokinetic uptake measures

Imaging bio-markers for clinical trials

Anatomical model creation from images and statistics. Anatomical atlases. Geometric or population based shape models.

Imaging in Radiotherapy

Applications to Image Guided Surgery, treatment planning.

Histological Correlations

Imaging in the Life Sciences

Case-studies</td></tr>
<tr><td>Term 3</td><td colspan="2">Research Project (60 credits)</td></tr>
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