Image Theory, perception and processing – Provisional Lecture Synopses

Image Theory, Processing and Perception

A one day course module on the underpinning theory of medical imaging, including the mathematics of formation, image processing and human visual perception. Much of the material in this course is generally applicable to all types of imaging system. Illustrations and examples from medical imaging will be used throughout including ultrasound, nuclear medicine, MRI and x-ray CT.

Mathematics of Image Formation

Lecturer: Dr Matt Blackledge

Image formation – representation of images, convolution and Fourier theory.
Describing imaging systems – linear systems, point spread function and transfer functions.
Sampling theory – finite apertures and the sinc function. Nyquist rate and Whittaker-Shannon theory. Sampling artefacts, aliasing pre- and post-sample blurring.
Noise – fixed pattern noise, Poisson noise, Johnson noise and nonlinearity.
Introduction to image enhancement and filtering – point operators, spatial operators and transform operators.

Image Processing Techniques

Lecturer: Dr John Suckling

Introduction and definitions – image sources, formats and colour representation and notation.
Simple image processing techniques – contrast stretching, thresholding & pseudocolour, histogram equalisation and spatial filtering.
Image analysis – fractal dimension, edge detection, object moments, erode and dilate.
Linear scale space – irreducible and composite invariants
Image classification – supervised and Bayesian classifiers, neural networks, unsupervised classifiers
Image registration – cost functions, optimisation and interpolation.

Perception and Interpretation of Medical Images

Lecturer: Mr Mark O'Leary

The abilities and limitations of the human vision.
Contrast discrimination, spatial discrimination and image noise.
Image display systems – controls and gamma characteristics.
Experimental methods of assessing man & machine performance – ROC analysis, contrast detail tests etc.

Three-Dimensional Image Display
Lecturer: Ed McDonagh

Methodology of 3D display.