

Title: Understanding Image Processing Techniques

Duration: Three days course.

Audience: This course is intended for those who work in clinical and cognitive-related areas who do not have a background in computer sciences or image processing. Materials from the MSc Neuroimaging for Research correspondent to 20 credits will be available for participants from 2 weeks before the initial day of the course. They underpin the lectures and activities programmed during these 3 days.

The first day is for beginners. Materials on this day will cover: basics on computer architecture and functioning, basics on foetal and neonatal Magnetic Resonance Imaging, basics on statistics on images: normal and abnormal brains, basics concepts on image processing, main challenges on medical images and an introduction to MATLAB.

The second and third day cover contents that require a basic understanding of MATLAB. Contents will range from processing molecular to retinal images, giving also information about image processing for cancer therapy planning, processing of dynamic sequences and computational 3D models of brain structures. Software and tools for various types of medical image processing will be given.

Venue: Greenfield Suite. Hugh Robson Building, George Square.

Preliminary Outline of the course

Day one: Wednesday 1st of October 2014

MORNING SESSION: Dr. Maria C. Valdés Hernández

9:00am - 9:15am Presentations and Introduction

9:15am – 10:15am Basics on computer architecture and assembly (machine) language as the underpinning framework of digital images

Content: This interactive session will show how the computers work internally and how we can access the resources that the hardware has. Also give tips and tools so as the participants are able to discern and evaluate which version (e.g. 32 bits, 64 bits, memory capacity, processing speed, etc.) of any software to select or download and estimate timelines for tasks that involve image data processing.

10:15am – 10:30am Coffee and Tea break

10:30am - 11:30am Basic processing of medical imaging. Overview

Content: This lecture gives an overview of the types of MR images: structural and parametric ones, data formats, their main features and usability. Also explains basic principles of medical image processing, concepts of: signal intensity, contrast, histogram, equalisation, filtering, types of resolution, quantisation and others terms commonly used in the relevant literature.

11:30am - 12:30pm Detecting Tissue Damages Following Traumatic Brain Injury:-
Development of Automatic Multi-parametric Analysis of Quantitative MRI Data

Invited guest speaker: Dr. Benjamin Aribisala: Professor and Head of the Department of Computer Science at Lagos State University, Nigeria, and Honorary Fellow at the Department of Neuroimaging Sciences, University of Edinburgh.

Content: This lecture explains the use of machine learning algorithms in the classification of mild traumatic brain injury patients using multiparametric MRI quantitative data

12:30m – 1:30pm Lunch break

1:30pm – 2:30pm Statistics on medical images, normal and abnormal brains

Speaker: Dr. David Alexander Dickie (CCBS. University of Edinburgh)

Content: Overview about statistics on medical images and works related to determining normal and abnormal brains

2:30pm – 3:30pm The brain from its formation till adolescence.

Speaker: Dr. Devasuda Anblagan (CCACE-CCBS. University of Edinburgh)

Content: Overview of foetal and neonatal MRI, and the development of the brain since its formation till the adolescence.

3:30pm – 3:45pm Coffee and Tea break

3:45pm – 4:45pm Introduction to MATLAB

Speaker/Tutor: Eng. Anna K. Heye (CCBS. University of Edinburgh)

Day two: Thursday 2nd October 2014

9:30am - 10:00am Imaging inflammation in cardiovascular diseases

Speaker: Dr. Scott Semple (Reader in Medical Physics. CRIC, University of Edinburgh)

10:00am – 10:30am Imaging brain small vessel disease

Speaker: Dr. Maria Valdés Hernández (CCBS, University of Edinburgh)

10:30am – 11:00am Challenges in Ultrasound imaging.

Speaker: Dr. Carmel Moran (Reader in Medical Physics, University of Edinburgh)

11:00am – 11:15am Coffee break

MATLAB PRACTICAL SESSION

11:15am -12:30pm Basic Image Processing in MATLAB

12:30pm – 1:30pm Lunch break

1:30pm – 2:30pm Analysis of 3D Images in MATLAB

2:30pm – 3:30pm Brain Image Processing in MATLAB

3:30pm – 3:45pm Coffee break

3:45pm – 4:45pm Analysis of the results: Graphs and interaction with Excel spreadsheets

Day three: Friday 3rd October 2014

9:30am – 10:00am Computational modelling in Medical Images
Speaker: Dr. Maria C. Valdés Hernández (CCBS. University of Edinburgh)

10:00am – 10:45am Image Analysis on Cancer Therapy planning
Speaker: Dr. Bill Nailon (Edinburgh Cancer Research Centre)

10:45am -11:00am Coffee break

11:00am - 12:00am Is there something in your eye: retinal image analysis for systemic and neurological biomarker discovery

Speaker: Dr. Tom MacGillivray (CRIC.University of Edinburgh)

Content: This activity includes explanation about retinal imaging and how analysis can reveal, for example, the health of cerebral small vessels. This is combined with a practical activity where delegates will be able to perform retinal analysis using VAMPIRE (Vasculature Assessment and Measurement Platform for Images of the Retina). This software allows efficient measurements and automatic analysis of retinal parameters obtained from digital fundus camera images.

12:00m – 1:00pm Lunch break

1:00pm – 2:00pm Measuring lesion and tissue volumes from MRI structural images

Speaker: Dr. Maria C. Valdes Hernandez (CCBS. University of Edinburgh)

Content: Practical activity where the participants will be able to segment tissues and lesions using the software bric1936 and visualise the results.

2:00pm – 3:00pm Consideration about validation of image segmentation methods and concluding remarks

Speaker: Maria C. Valdés Hernández (CCBS. University of Edinburgh)