Edinburgh Imaging
www.ed.ac.uk/edinburgh-imaging

Common Image Processing Techniques 1

Semester 2 / Commences January **20 Credits**

Each Course is composed of Modules & Activities.

Modules:

Measure Lesion Size	NI4R
Assess Volume Qualitative	NI4R
Assess Volume Quantitative	NI4R
White Matter Lesion Rating – Qualitative	NI4R
White Matter Lesion Rating – Quantitative	NI4R
MR Spectroscopy – Advanced	NI4R
Multi-centre studies and combing data sets	NI4R
MR Permeability Imaging	NI4R

Each Module is composed of Lectures, Reading Lists, MCQ self-assessments, & Discussion Boards.

The summary table above shows whether the modules are available in the Neuroimaging for Research (NI4R) programme or the Imaging (IMSc) programme or indeed both.

Edinburgh Imaging
www.ed.ac.uk/edinburgh-imaging

Modules:

Measure Lesion Size:
- Measurement

Assess Volume Qualitative:
- Assessing whole brain volume
- Assessing regional brain volumes

Assess Volume Quantitative:
- Volumetric measurement principles
- Whole brain volume, ventricular volume and intracranial area measurement
- Temporal lobes and amygdalohippocampal volume measurement

White Matter Lesion Rating – Qualitative:
- An introduction to white matter lesions
- MR white matter lesion rating scales – Part A
- MR white matter lesion rating scales – Part B

White Matter Lesion Rating – Quantitative:
- Quantitative assessment – approaches and limitations
- Individualising and semiautomating thresholding

MR Spectroscopy – Advanced:
- Advanced 1
- Advanced 2

Multi-centre studies and combining data sets:
- Methods for combining large image datasets

MR Permeability Imaging:
- MR Permeability Imaging

We can also provide a more detailed syllabus showing what lectures will be given for each module, and the learning outcomes for each module.

Edinburgh Imaging
www.ed.ac.uk/edinburgh-imaging

Measure Lesion Size (NI4R only)

Lecture 1
Title: Measurement
Description: Principles and problems
Author(s): Dr. Andrew Farrall
Learning Objectives
- Outline how and why measurements are made from radiological images
- Describe the different sources of error which affect measurements

Assess Volume Qualitative (NI4R only)

Lecture 1
Title: Assessing whole brain volume
Description: Methods for assessing whole brain volume
Author(s): Prof. Joanna Wardlaw, Dr. Karen Ferguson
Learning Objectives
- Recognise common patterns of brain volume loss with age
- Outline the principles of rating volume loss using scales
- Describe specific scales
- Rate scans using the scales

Lecture 2
Title: Assessing regional brain volumes
Description: Methods for assessing regional brain volumes
Author(s): Prof. Joanna Wardlaw, Dr. Karen Ferguson
Learning Objectives
- Recognise patterns of focal brain atrophy
- Outline methods of rating regional volume loss
- Describe several specific scales
- Apply these scales to rating scans
- Discuss differences between quantitative and qualitative scales and why this may be important in research and clinical practice

Edinburgh Imaging
www.ed.ac.uk/edinburgh-imaging

Assess Volume Quantitative (NI4R only)

Lecture 1
Title: Volumetric measurement principles
Description: General principles behind measuring brain volume
Author(s): Dr Karen Ferguson, Prof. Joanna Wardlaw
Learning Objectives
- Outline the general approach to measuring brain volumes quantitatively

Lecture 2
Title: Whole brain volume, ventricular volume and intracranial area measurement
Description: Steps involved in measuring whole brain volume
Author(s): Dr Karen Ferguson, Prof. Joanna Wardlaw
Learning Objectives
- Describe how to measure whole brain volumes, ventricular volumes quantitatively and intracranial area as a proxy for intracranial volume

Lecture 3
Title: Temporal lobes and amygdalohippocampal volume measurement
Description: Steps involved in measuring temporal lobes and amygdalohippocampal volume
Author(s): Dr Karen Ferguson, Prof. Joanna Wardlaw
Learning Objectives
- Describe how to measure temporal lobe and amygdalohippocampal volumes quantitatively

Edinburgh Imaging
www.ed.ac.uk/edinburgh-imaging

White Matter Lesion Rating – Qualitative (NI4R only)

Lecture 1
Title: An introduction to white matter lesions
Description: Types of white matter lesions and methods of quantifying them
Author(s): Joanna Wardlaw, Karen Ferguson, with assistance from Susie Shenkin
Learning Objectives
- Describe age-related white matter changes, including variation in type and appearance
- Outline what they are associated with and their causes
- Recognise the different types of white matter lesions on brain images
- Briefly outline rating scales used for white matter lesion rating

Lecture 2
Title: MR white matter lesion rating scales-Part A
Description: A description of commonly used MR scales for quantifying white matter lesions with examples
Author(s): Joanna Wardlaw and Karen Ferguson
Learning Objectives
- Describe different MR scales used for rating WML
- Rate WML using these scales
- Discuss the principles of subjective rating of any imaging feature
- Explain ceiling and floor effects

Lecture 3
Title: MR white matter lesion rating scales-Part B
Description: A description of commonly used MR scales for quantifying white matter lesions with examples
Author(s): Joanna Wardlaw and Karen Ferguson
Learning Objectives
- Describe different MR scales used for rating WML
- Describe scales that can be used with CT or MR
- Describe scales that can be used to rate change in white matter lesions over time
- Compare scales
- Rate WML using these scales

Edinburgh Imaging
www.ed.ac.uk/edinburgh-imaging

White Matter Lesion Rating – Quantitative (NI4R only)

Lecture 1
Title: Quantitative assessment- approaches and limitations
Description: Outlining quantitative approaches to white matter lesion rating
Author(s): Prof. Joanna Wardlaw
Learning Objectives
- Outline several approaches to measuring white matter lesion volume quantitatively
- Discuss problems with these approaches
- Analyze relative merits of quantitative vs qualitative approaches

Lecture 2
Title: Individualising and semi-automating thresholding
Description: Approaches being used locally to improve the volume measurement
Author(s): Prof. Joanna Wardlaw
Learning Objectives
- Outline several approaches to improve the quantitative volume measurement

Edinburgh Imaging
www.ed.ac.uk/edinburgh-imaging

MR Spectroscopy – Advanced (NI4R only)

Lecture 1
Title: Advanced 1
Description: Chemical Shift Imaging & 2D Spectroscopy
Author(s): Dr. Kristin Haga
Learning Objectives

- Understand the limitations of traditional 1D, 1H MRS
- Describe “Chemical Shift Imaging” and list a couple of its applications
- Discuss some of the other (non 1H) nuclei that can be used in MRS studies
- Explain what is meant by “J-coupling” in 2D MRS
- Consider some of the advantages and limitations of advanced MRS methods

Lecture 2
Title: Advanced 2
Description: Multi-nuclear spectroscopy & applications of spectroscopy
Author(s): Dr. Kristin Haga
Learning Objectives

- Discuss some of the other (non 1H) nuclei that can be used in MRS studies
- Understand applications of spectroscopic techniques in clinical situations

Multi-centre studies and combining data sets (NI4R only)

Lecture 1
Title: Methods for combining large image datasets
Description: The need for methods to combine image data from multiple subjects and scanners, problems encountered and methods for overcoming these.
Author(s): Dr. Dominic Job
Learning Objectives

- Describe reasons for combining image datasets
- Describe the range of problems encountered
- Outline current and developing methods for overcoming these problems

MR Permeability Imaging (NI4R only)

Lecture 1
Title: MR Permeability Imaging
Description: Imaging endothelial permeability
Author(s): Dr. Paul Armitage
Learning Objectives

- Define what permeability is
- Explain why permeability is interesting to measure in the brain
- Describe how contrast agent concentration can be estimated from the signal change measured following contrast agent administration
- Describe how blood-brain barrier permeability can be estimated from temporal measurements of contrast agent concentration
- Discuss the clinical application of MR permeability imaging to tumour investigation and other disorders