

# Edinburgh Imaging

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## Image Analysis

**Semester 2 / January**

**10 Credits**

### Each Course is composed of Modules & Activities.

#### **Modules:**

Digital Image Basics	NI4R	IMSc
Image Sampling and Quantisation	NI4R	IMSc
Image Perception and Morphological Operations	NI4R	IMSc
Image Transformations and Modelling Application	NI4R	IMSc
Computational modelling in medical image processing	NI4R	IMSc
Validation techniques	NI4R	IMSc
Artefacts and errors	NI4R	IMSc

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

These Modules are taught on the following Programmes, or are incorporated into blended Courses which teach students enrolled outwith the Edinburgh Imaging Academy:

- NI4R - Neuroimaging for Research programme
- IMSc - Imaging programme

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## **Modules:**

### **Digital Image Basics:**

Digital image basics

### **Image Sampling and Quantisation:**

Image processing basics – part 1

### **Image Perception and Morphological Operations:**

Image processing basics – part 2

### **Image Transformations and Modelling Application:**

Image transformations and modelling application

### **Computational modelling in medical image processing:**

Computational modelling in medical image processing: basics

### **Validation techniques:**

Validation techniques 1

### **Artefacts and errors:**

Artefacts and errors in image processing

Methods to reduce the effect of artefacts in structural MRI

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## Digital Image Basics

Lecture 1

**Title: Digital image basics**

Description: Overview of how the image data is processed by computers and printers

Author(s): Dr Maria C. Valdés Hernández

**Learning Objectives**

- Identify the Central Processing Unit inside a computer
- Represent a decimal number in binary and hexadecimal formats
- Write the truth table of the main binary operations: using logical operators 'and', 'or' and 'not'
- Describe how the printer manages colours and how to convert a colour image from RGB to CMYK

## Image Sampling and Quantisation

Lecture 1

**Title: Image processing basics – part 1**

Description: Introduction to sampling, quantisation and sources of noise in images

Author(s): Dr Maria C. Valdés Hernández

**Learning Objectives**

- Define sampling and quantisation
- For a given image type, identify the different sources of noise and describe the possible causes and their effects

## Image Perception and Morphological Operations

Lecture 1

**Title: Image processing basics – part 2**

Description: Perception of images and morphological operations on images

Author(s): Dr Maria C. Valdés Hernández

**Learning Objectives**

- Discuss visual effects that can influence the perception of certain features on images
- Describe the morphological computational operations and how they are done

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## Image Transformations and Modelling Application

Lecture 1

**Title: Image transformations and modelling application**

Description: Introduction to Fourier and Laplace transforms, and the Markov chain model and their applications in imaging

Author(s): Dr Maria C. Valdés Hernández

### Learning Objectives

- Explain what the Fourier Transform is and discuss some of its adaptations and applications in medical imaging
- Explain what the Laplace Transform is and discuss some of its applications in medical imaging
- Discuss the Markov chain model and mention some of its applications in medical imaging

## Computational modelling in medical image processing

Lecture 1

**Title: Computational modelling in medical image processing: Basics**

Description: Modelling techniques used in medical image processing

Author(s): Dr Maria C. Valdés Hernández

Editor(s): Dr Andrew Farrall

### Learning Objectives

- Discuss different modelling types used in medical image processing
- Explain principles of the techniques presented

## Validation techniques

Lecture 1

**Title: Validation techniques 1**

Description: An outline of issues to be considered while evaluating papers on imaging processing techniques

Author(s): Dr Maria C. Valdés Hernández

Editor(s): Dr Andrew Farrall

### Learning Objectives

- Critically evaluate the validity of the results obtained from a segmentation technique in the literature
- Analyze the results of a segmentation algorithm performed on medical images

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## Artefacts and errors

### Lecture 1

**Title: Artefacts and errors in image processing**

Description: Description of the common artefacts in routine structural MRI scans

Author(s): Dr Maria C. Valdés Hernández

Editor(s): Dr Andrew Farrall

**Learning Objectives**

- Identify common artefacts in structural MRI scans
- Mention the nature and causes of each type of artefact
- Describe the effect of each type of artefact in common structural MRI sequences

*Acknowledgements*

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### Lecture 2

**Title: Methods to reduce the effect of artefacts in structural MRI**

Description:

Author(s): Dr Maria C. Valdés Hernández

**Learning Objectives**

- Identify the main post-processing methods used to reduce the effect of common artefacts in structural MRI scans
- Mention the principles upon which each technique is based
- Describe the image processing techniques applied to each type of artefact