

Module Specification

Module Summary Information

1	Module Title	Medical Image Processing
2	Module Credits	20
63	Module Level	6
4	Module Code	ENG6083

5	Module Overview
<p>Rationale:</p> <p>This module will enable you to build upon the knowledge and skills that you have developed earlier as part of this programme. It is intended that by engaging in this module, you will be able to develop a sound understanding of; digital image processing, medical image analysis and application within medical image processing.</p> <p>This involves being able to:</p> <ul style="list-style-type: none"> • Apply the fundamental principles of low level image processing to medical image datasets. • Analyse the suitability of high level processes in medical image analysis. • Justify technical decisions within the development of medical imaging solutions based on specific problem domains • Have strong familiarity in medical image formats and standards • Have awareness to the future direction within medical image processing, the problems faced and the potential future routes for development. <p>Alignment with Programme Philosophy and Aims</p> <p>This programme aims to enrich your problem-solving skills to address the upcoming challenges within medical image processing. The module will enable you to understand the real life problems within common applications of medical imaging. It will enable you to become proficient in the digital imaging data formats, types and standards alongside their individual requirements. The module will also present practical problems within medical image processing, notably tissue/region segmentation and via this practical case analysis approach you will be able to critique the processes and approaches available.</p> <p>This module has been carefully designed and developed to allow you to enhance your technical skills and prepare yourself for a technical, research or development role within medical imaging systems. This reflects the wealth of international activity within this field aiming to solve the many complex problems within the medical imaging field.</p> <p>Learning and Teaching Strategy</p> <p>The medical image processing module will be taught via a series of interactive seminars and sessions. These sessions will involve pre-session exploration of the theory, session questions and answers, session presentations, practical examples, development time and a post session reflection and further development.</p>	

The module will have its own distinct Moodle page which you will have to access to. This page will contain resources that are specific to the module such as the lecture material, supporting materials (videos, data sets, examples etc.), assessment details and important reading and wider material.

The Moodle page will also allow you access the state of art outputs that BCU have within the medical image processing field and link directly with the work undertaken by BCU's Digital, Media and Technology Lab. This will enable you to access cutting edge material on medical image processing.

As the medical image processing Moodle page will change to reflect the evolving nature of the field, It is important that you access it regularly as part of your learning will be to undertake weekly preparatory activities for each session followed by attempting short online formative activities to help with your learning. As part of this module, guest lectures will be facilitated to allow you the access to the wider medical image processing community.

Assessment Strategy

Assessment will be via a case study based development and analysis of a medical image processing piece of software. You will be required to analyse a problem, propose a solution, and via a self-guided study, develop a prototype solution. You will then report on the success of the solution and define limits based on your knowledge of the theory.

6	Indicative Content
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Session 1: Introduction:

Session will be 2h in duration. This will allow for 1h of presentation and theory analysis and 1h of practical application, reflection and theory exploration.

Medical Image Basics

Image formation

Image Capture

Image Standards

Session 2: Introduction:

Session will be 2h in duration. This will allow for 1h of presentation and theory analysis and 1h of practical application, reflection and theory exploration.

Medical Image applications

Case Studies in medical image processing

Session 3: Image Representation

Session will be 2h in duration. This will allow for 1h of presentation and theory analysis and 1h of practical application, reflection and theory exploration.

Pixels and Voxels

Greyscale and Colour Representation

Image File Formats

Session 4: Low Level image operations

Session will be 2h in duration. This will allow for 1h of presentation and theory analysis and 1h of practical application, reflection and theory exploration.

Histograms and Histogram Operations

Filtering

Noise removal

Session 5: Low Level image operations

Session will be 2h in duration. This will allow for 1h of presentation and theory analysis and 1h of practical application, reflection and theory exploration.

Filtering and Convolution processing

Session 6: Image Transformations

Session will be 2h in duration. This will allow for 1h of presentation and theory analysis and 1h of practical application, reflection and theory exploration.

Fourier transformation of images

Session 7: High Level image operations

Session will be 2h in duration. This will allow for 1h of presentation and theory analysis and 1h of practical application, reflection and theory exploration.

Introduction to segmentation

Thresholding

Region Growing

Session 8: High Level image operations

Session will be 2h in duration. This will allow for 1h of presentation and theory analysis and 1h of practical application, reflection and theory exploration.

Advanced segmentation

Morphological image operations

Segmentation evaluation (case study)

Session 9: 3D medical image processing

Session will be 2h in duration. This will allow for 1h of presentation and theory analysis and 1h of practical application, reflection and theory exploration.

Visualisation

Surface representation

3D segmentation and reconstruction

Session 10: Registration

Session will be 2h in duration. This will allow for 1h of presentation and theory analysis and 1h of practical application, reflection and theory exploration.

3D registration

Warping and de-warping

Image fusion

Session 11: Review

Session will be 2h in duration. This will allow for 1h of presentation and theory analysis and 1h of practical application, reflection and theory exploration.

Review, reflection and practical critique

Session 12: Review

Session will be 2h in duration. This will allow for 1h of presentation and theory analysis and 1h of practical application, reflection and theory exploration.

Review, reflection and practical critique

7		Module Learning Outcomes On successful completion of the module, students will be able to:
	1	Identify the standards, methods and theories associated with low and high level medical image processing.
	2	Evaluate the requirements for, and develop an, effective functioning medical image processing application.
	3	Appraise the suitability of image processes for specified medical applications.

8				Module Assessment			
Learning Outcome		Coursework		Exam		In-Person	
1,2,3,4		X					

9		Breakdown Learning and Teaching Activities	
Learning Activities		Hours	
Scheduled Learning (SL) includes lectures, practical classes and workshops, peer group learning, Graduate+, as specified in timetable		24	
Directed Learning (DL) includes placements, work-based learning, external visits, on-line activity, Graduate+, peer learning, as directed on VLE		n/a	
Private Study (PS) includes preparation for exams		176	
Total Study Hours:		200	