

Module Specification

1. Factual information			
Module title	MT390: Image Processing	Level	3
Module tutor	Dr. Farid Jaradi	Credit value	10
Module type	Taught	Notional learning hours	3

2. Rationale for the module and its links with other modules
Image Processing is an important field of study and MT390 is meant to provide students with the basic knowledge of this field. Along with the importance of Image Processing in traditional areas such as Medical Diagnosis, Industrial Inspections, Security Systems, Robotics etc., the pervasiveness of smart phones equipped with powerful cameras has increased the need for Image Processing due to the availability of large amount of image data. This module is intended to provide students the opportunity to study the basics of the important field of Image Processing.

3. Aims of the module
The aims of this module are to: <ul style="list-style-type: none">• Introduce students to the important field of Image Processing.• Teach students the fundamental concepts related to image Representations and Enhancements.• Impart to the students knowledge about Intensity Transformations and Spatial Domain Filtering.• Introduce students to the concepts of 2-D Fourier Transform and the basics of Frequency Domain Filtering.• Introduce students to the topics of Image Segmentation, Image Coding and their related techniques.• Enable students to implement basic image processing algorithms using the Matlab Programming environment.

4. Pre-requisite modules or specified entry requirements
MT132: Linear Algebra & M251 : Object Oriented Programming using Java

5. Intended learning outcomes	
A. Knowledge and understanding	Learning and teaching strategy
<p>On successful completion of this course, the student will be able to demonstrate knowledge and understanding of:</p> <p>A1. Basic image representation concepts.</p> <p>A2. Spatial domain image processing techniques of intensity transformation and filtering.</p> <p>A3. Frequency domain image processing techniques of filtering and masking.</p> <p>A4. Data reduction and image coding methods.</p> <p>A5. Basic image segmentation concepts and techniques.</p>	<ul style="list-style-type: none"> • 25% face-to-face tutorial sessions • TMA work • Course learning booklets and support material
B. Cognitive skills	Learning and teaching strategy
<p>On successful completion of this course, the student will be able to:</p> <p>B1. Critically evaluate and suggest spatial domain processing techniques for image enhancement purposes.</p> <p>B2. Analyse and suggest appropriate frequency domain filtering techniques suitable for image processing tasks.</p> <p>B3. Critically interpret histogram data of images and suggest appropriate image processing techniques for image enhancement.</p> <p>B4. Analyze various image coding techniques and select the appropriate one for a particular task.</p> <p>B5. Evaluate and interpret image segmentation results.</p>	<ul style="list-style-type: none"> • 25% face-to-face tutorial sessions • TMA work • Course learning booklets and support material
C. Practical and professional skills	Learning and teaching strategy
<p>On successful completion of this course, the student will be able to:</p> <p>C1. Apply skills and concepts from the course to develop practical image processing projects.</p> <p>C2. Develop, Interpret and Implement image enhancement techniques both in the spatial and frequency domains.</p> <p>C3. Perform Matlab simulations of practical image processing algorithms including</p>	<ul style="list-style-type: none"> • 25% face-to-face tutorial sessions • TMA work • Course learning booklets and support material

C. Practical and professional skills	Learning and teaching strategy
image enhancement, coding and segmentation.	

D Key transferable skills	Learning and teaching strategy
<p>On successful completion of this course, the student will be able to:</p> <p>D1. Apply the mathematical and algorithmic skills acquired in this course to other areas of study and work.</p> <p>D2. Carry out independent learning on topics related to image processing and computing.</p> <p>D3. Communicate ideas and concepts about image processing techniques effectively both in writing as well as in any group discussion or environment.</p>	<ul style="list-style-type: none"> • 25% face-to-face tutorial sessions • TMA work • Course learning booklets and support material

6. Indicative content.
<ul style="list-style-type: none"> • Image sources and generation • Image sampling and quantization • Same basic relationship between pixels • Intensity transformations and spatial filtering background. • Some Basic Intensity Transformation Functions • Histogram Processing • Fundamentals of Spatial Filtering • Smoothing Spatial Filters • Sharpening Spatial Filters • Combining Spatial Enhancement Methods • The Discrete Fourier Transform (DFT) of one Variable <p>Extension to Functions of Two Variables</p> <ul style="list-style-type: none"> • Some Properties of the 2-D Discrete Fourier Transform • The Basics of Filtering in the Frequency Domain • Image Smoothing Using Frequency Domain Filters • Image Sharpening Using Frequency Domain Filters • Basics of Lossless and Lossy Image Coding techniques • Basic Image Segmentation techniques

7. Assessment strategy, assessment methods and their relative weightings
<p>TMA Work: 20%</p> <p>MTA: 30%</p> <p>Final Exam: 50%</p>

8. Mapping of assessment tasks to learning outcomes																
Assessment tasks	Learning Outcomes															
	A 1	A 2	A 3	A 4	A 5	B 1	B 2	B 3	B 4	B 5	C 1	C 2	C 3	D 1	D 2	D 3
TMA	X	X	X			X	X	X			X	X	X	X	X	X
MTA	X	X	X			X	X	X				X			X	

8. Mapping of assessment tasks to learning outcomes																
Assessment tasks	Learning Outcomes															
	A 1	A 2	A 3	A 4	A 5	B 1	B 2	B 3	B 4	B 5	C 1	C 2	C 3	D 1	D 2	D 3
Final Exam		X	X	X	X	X	X	X	X	X		X			X	

9. Teaching staff associated with the module	
Tutor's name and contact details	Contact hours
Name: Dr. Farid Jaradi Email ID: fjradi@aou.edu.kw	

10. Key reading list				
Author	Year	Title	Publisher	Location
Text Book: Rafael C. Gonzalez, Richard E. Woods	2008	Digital Image Processing	Pearson	U.S.A
Reference Books: W. Burger and M.J. Burge	2016	Digital Image Processing — An Algorithmic Introduction Using Java	Springer London	U.K
Maria Petrou, Costas Petrou	2010	Image Processing: The Fundamentals	Wiley	U.S.A
Rafael C. Gonzalez, Richard E. Woods, Steven L. Eddins	2009	Digital Image Processing Using MATLAB	Gatesmark Publishing	U.S.A
Chris Solomon, Toby Breckon	2011	Fundamentals of Digital Image Processing: A Practical Approach with Examples in Matlab 1st Edition	Wiley	U.S.A

11. Other indicative text (e.g. websites)

AOU LMS:

lms.arabou.edu.kw

MOOCs:

Fundamentals of Digital Image and Video Processing, Northwestern University:

<https://www.coursera.org>

Image and Video Processing: From Mars to Hollywood, Duke University:

<https://www.coursera.org>

Video Lectures:

Introduction to Digital Image Processing, ECSE-4540, Spring 2015, RPI, USA.

Digital Image Processing, IIT.

Image Processing and Analysis, UCDavis, USA.

Digital Image Processing I, ECE 637, Purdue.