الجامعة العربية المفتوحة
Arab Open University

Module Specification

1. Factual information			
Module title	**MT390: Image Processing**	**Level**	**3**
Module tutor	TBA	**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:

- 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**
On successful completion of this course, the student will be able to demonstrate knowledge and understanding of: **A1.** Basic image representation concepts. **A2.** Spatial domain image processing techniques of intensity transformation and filtering. **A3.** Frequency domain image processing techniques of filtering and masking. **A4.** Data reduction and image coding methods. **A5.** Basic image segmentation concepts and techniques.	• 25% face-to-face tutorial sessions • TMA work • Course learning booklets and support material

B. Cognitive skills	**Learning and teaching strategy**
On successful completion of this course, the student will be able to: **B1.** Critically evaluate and suggest spatial domain processing techniques for image enhancement purposes. **B2.** Analyse and suggest appropriate frequency domain filtering techniques suitable for image processing tasks. **B3.** Critically interpret histogram data of images and suggest appropriate image processing techniques for image enhancement. **B4.** Analyze various image coding techniques and select the appropriate one for a particular task. **B5.** Evaluate and interpret image segmentation results.	• 25% face-to-face tutorial sessions • TMA work • Course learning booklets and support material

C. Practical and professional skills	**Learning and teaching strategy**
On successful completion of this course, the student will be able to: **C1.** Apply skills and concepts from the course to develop practical image processing projects. **C2.** Develop, Interpret and Implement image enhancement techniques both in the spatial and frequency domains.	• 25% face-to-face tutorial sessions • TMA work • Course learning booklets and support material

C. Practical and professional skills	Learning and teaching strategy
C3. Perform Matlab simulations of practical image processing algorithms including image enhancement, coding and segmentation.	

D Key transferable skills	Learning and teaching strategy
On successful completion of this course, the student will be able to: **D1.** Apply the mathematical and algorithmic skills acquired in this course to other areas of study and work. **D2.** Carry out independent learning on topics related to image processing and computing. **D3.** Communicate ideas and concepts about image processing techniques effectively both in writing as well as in any group discussion or environment.	• 25% face-to-face tutorial sessions • TMA work • Course learning booklets and support material

6. Indicative content.

- 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
- Extension to Functions of Two Variables
- 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

6. Indicative content.
• Basics of Lossless and Lossy Image Coding techniques • Basic Image Segmentation techniques

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

8. Mapping of assessment tasks to learning outcomes

Assessment tasks	Learning Outcomes															
	A1	A2	A3	A4	A5	B1	B2	B3	B4	B5	C1	C2	C3	D1	D2	D3
TMA	X	X	X			X	X	X			X	X	X	X	X	X
MTA	X	X	X			X	X	X				X			X	
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**
Dr. Hamayun Ahmed Khan (GCC)	

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	**Springer London**	**U.K**

10. Key reading list				
Author	**Year**	**Title**	**Publisher**	**Location**
Maria Petrou, Costas Petrou	**2010**	Java 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.