

Title (Units): **COMP 7840 Management of Medical Visual Data (3,2,1)**

Course Aims: After completion of this course, students will learn (i) some fundamental image processing techniques, (ii) the characteristics of different types of medical images, (iii) the structure and components of visual information management systems, (iv) the architecture and application of picture archiving and communication systems.

Prerequisite: Nil

Course Intended Learning Outcomes (CILOs):

Upon successful completion of this course, students should be able to:

No.	Course Intended Learning Outcomes (CILOs)
	Knowledge
1	Describe the basic concepts and techniques in analog biosignal processing and digital image processing
2	Describe the characteristics and properties of different types of medical images
3	Explain the structure and components of visual information management systems
4	Explain and describe the picture archiving and communication systems for managing medical images
	Professional Skill
5	Design suitable structures for the effective storage, management, and distribution of medical data

Calendar Description: In this course, students will learn (i) some fundamental image processing techniques, (ii) the characteristics of different types of medical images, (iii) the structure and components of visual information management systems, (iv) the architecture and application of picture archiving and communication systems.

Teaching and Learning Activities (TLAs):

CILOs	TLAs will include the following:
1-4	Students will learn medical visual data processing techniques and management through lectures and tutorials. In order to help students to have good understanding of the medical visual data processing techniques, laboratory sessions will be designed. This is also one of the ways to evaluate students' understanding. Besides, assignment(s) and final examination will be designed to test the students' level of understanding.
1 - 5	Based on the knowledge they have learned, students are required to design a medical visual data application. Students are required to give a preliminary presentation/demonstration as well as a final formal presentation on their project. In both cases, instructor(s), teaching assistant and other students would ask questions related to their project. In this way, we could assess their graphics programming skills as well as understanding of graphic theories.

Assessment:

No.	Assessment Methods	Weighting	CILOs to be addressed	Remarks
1	Continuous Assessment	40%	1-5	Written and laboratory assignments are designed to evaluate the students understanding of the principles and practice of medical visual data management. Typically they require critical thinking and may include open-ended questions.
2	Examination	60%	1-4	Final examination questions are designed to assess students understanding of the methodology, characteristics and techniques of medical visual data management

Rubrics:

	Excellent (A)	Good (B)	Satisfactory (C)	Fail (F)
Creativity and originality on medical imaging application/system design	All of the concepts and content are different from the lectures with impressive creativity	Most of the concepts and content are different from the lectures with good creativity	Some of the new concepts	No new idea
Explain and the use of digital image processing algorithms	Make good use of algorithms	Often make good use of algorithms	Sometimes make good use of algorithms	Not able to make good use of algorithms
Explain the characteristics and properties of different types of medical images	Well explain the characteristics and properties of different types of medical images	Often explain the characteristics and properties of different types of medical images	Sometimes explain the characteristics and properties of different types of medical images	Not able to explain the characteristics and properties of different types of medical images
Explain and analyze the structure and components in PACS	Well explain and analyze the structure and components in PACS	Often explain and analysis of the structure and components in PACS	Sometimes explain the structure and components in PACS	Not able to explain the structure and components in PACS

Course Intended Learning Outcomes and Weighting:

Content	CILO No.
I. Fundamentals of Image Processing	1, 2
II. Medical Imaging and Its Properties	1, 2, 5
III. Visual Information Management	3, 4, 5
IV. Picture Archiving and Communication Systems	2,4
V. Case Studies and Applications	1,2,3,4,5

References:

1. Rafael C. Gonzalez, Richard E. Woods, *Digital Image Processing*, Third Edition, 2007.
2. Lawrence O’Gorman, Michael J. Sammon, Michael Seul, *Practical Algorithms for Image Analysis with CD-ROM*, Cambridge University Press, 2008.
3. Chris Guy and Dominic Ffytche, *An Introduction to the Principles of Medical Imaging*, Imperial College Press, 2000.
4. H. K. Huang, *PACS and Imaging Informatics: Basic Principles and Applications*, 2nd Ed., Wiley, 2004

Course Content in Outline:**Topic**

- I. Fundamentals of Image Processing
 - A. Analog biosignal characteristics and processing
 - B. Digital image representation
 - C. Spatial domain processing
 - D. Transform domain processing
 - E. Lossless and lossy compression

- II. Medical Imaging and Its Properties
 - A. Ultrasonic image
 - B. Magnetic Resonance Image
 - C. Computed Tomography Image
 - D. X-ray Image
- III. Visual Information Management
 - A. Semantics of medical images and visual data
 - B. Visual query specifications and paradigms
 - C. Metadata and annotation indexing
 - D. Search algorithms and measures of retrieval effectiveness
 - E. Multimedia medical data
 - F. Structure and design of visual information management systems
- IV. Picture Archiving and Communication Systems (PACS)
 - A. Architecture and operation of PACS
 - B. PACS data management and Web-based image distribution
 - C. PACS-based imaging informatics
 - D. Integration of PACS with Hospital Information Systems and Radiology Information Systems
 - E. Standards, interoperability and workflow protocols
- V. Case Studies and Applications