INDIAN INSTITUTE OF INFORMATION TECHNOLOGY

DESIGN AND MANUFACTURING (IIITDM) KANCHEEPURAM

INTRODUCTION OF NEW COURSE

<table>
<tr><td>Course Title</td><td>Medical Image Analysis</td><td>Course Code</td><td colspan="4">EC51XX</td></tr>
<tr><td>Dept./ Specialization</td><td>ECE</td><td>Structure (LTPC)</td><td>3</td><td>1</td><td>0</td><td>4</td></tr>
<tr><td>To be offered for</td><td>UG/ PG</td><td>Status</td><td colspan="2">Core ☐</td><td colspan="2">Elective ■</td></tr>
<tr><td>Faculty Proposing the course</td><td>Dr. Rohini. P</td><td>Type</td><td colspan="2">New ■</td><td colspan="2">Modification ☐</td></tr>
<tr><td colspan="2">Recommendation from the DAC</td><td>Date of DAC</td><td colspan="4"></td></tr>
<tr><td>External Expert(s)</td><td colspan="6"></td></tr>
<tr><td>Pre-requisite</td><td>Probability and Random Process
Basic knowledge on MATLAB/ Python</td><td colspan="2">Submitted for approval</td><td colspan="3">49 Senate</td></tr>
<tr><td>Learning Objectives</td><td colspan="6">This course introduces the students to various image processing tools that can be applied to medical images. The course will also make the students equipped with MATLAB/Python tools for analyzing the medical images.</td></tr>
<tr><td>Learning Outcomes</td><td colspan="6">Upon completion of the course, the students will be able to
1. Understand the different types of available medical images and their acquisition protocol
2. Acquire knowledge on the image processing tools utilized for analyzing medical images
3. Develop suitable process flow specific to the type of medical image
4. Design new algorithm for medical applications and regularize them for clinical usage</td></tr>
<tr><td>Contents of the course
(With approximate break-up of hours for L/T/P)</td><td colspan="6">Module 1 – Introduction - (6/2)
Importance of Medical Image analysis, Digital image acquisition (X-ray, CT, MRI, Nuclear imaging, Ultrasound), Objectives and difficulties in medical image analysis

Module 2 - Preprocessing of Medical Images – (9/3)
Measures of Image Quality, Image Enhancement Techniques, Noise Reduction, Registration and Normalization, Case study examples - X-ray, MRI

Module 3 - Delineation of region of interest – (9/4)
Segmentation: Principles and Basic Techniques, Parametric Image-Based Segmentation, Region-Based methods, Edge-Based methods, Segmentation by Pattern Comparison, Morphological operators, Case study – Detection of spinal cord, brain structures from MRI

Module 4 - Feature Engineering, Pattern Classification and Diagnostic Decision – (9/3)
Shape Features, Texture Features, Analysis of Oriented Patterns, Feature Selection, Reliability of Features, Introduction to supervised and unsupervised pattern classification, Probabilistic Models, Logistic Regression, Neural Networks, Classifiers and Decisions, Measures of Diagnostic Accuracy, Case study - Classification of Breast Masses and Tumors</td></tr>
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	Module 5 - Deep learning based image analysis – (9/2) Introduction to Deep Learning, Deep Feed-Forward Neural Networks, Convolutional Neural Networks, Modifications of Convolutional Neural Networks, Applications of Convolutional Neural Networks (supervised learning, unsupervised learning, image classification, semantic segmentation), Recurrent Neural Networks, Encoder-Decoder Architecture
Text Book	1. Rangayyan, Rangaraj M. Biomedical image analysis. CRC press, 2004. 2. Jiri Jan "Medical Image Processing, Reconstruction and Analysis: Concepts and Methods", Vol. 2. CRC Press, 2019.
Reference Books	1. John L. Semmlow, and Benjamin Griffel. Biosignal and medical image processing. CRC press, 2014. 2. Kayvan Najarian and Robert Splinter, "Biomedical Signal and Image Processing", Second Edition, CRC Press, 2005. 3. Atam Dhawan,"Medical image analysis" 2nd ed. John Wiley & Sons, 2011. 4. Jerry L. Prince and Jonathan Links, "Medical Imaging Signals and Systems", First Edition, Prentice Hall, 2005.