MEDICAL IMAGE ANALYSIS

BE 4120 (4 Credits)

Course Description: This course introduces how to extract, model, and analyze information from medical imaging data and utilize applications to help diagnosis, treatment planning and prognosis. Medical Image Analysis includes topics in medical image segmentation, registration and multimodality fusion, feature extraction, statistical modeling and anomaly detection through shape and texture analysis with applications in MRI, CT, DTI, PET, SPECT, fMRI, etc. The course will provide students with a multidisciplinary background in current state-of-the-art in medical image analysis.

Course Objectives: At the completion of this course, the successful students will be able to:

1. Understand the need for and the challenges of medical image segmentation and apply discussed methods to segment structures of interest (a,e,j)
2. Understand the need for and the challenges of medical image registration and apply discussed methods to fuse multimodality images (e.g., a functional modality to an anatomical modality) (a,e,j)
3. Gain basic understanding of feature (volume, shape, texture, etc.) extraction and classification for medical applications (a,e,j)
4. Use existing applications (software) to perform the above tasks (b,k)

Prerequisites: BE 4100 Biomedical Signal Processing

*Program Outcomes

a) an ability to apply knowledge of mathematics, science, and engineering
b) an ability to design and conduct experiments, as well as to analyze and interpret data
c) an ability to design a system, component, or process to meet desired needs within realistic constraints such as economic, environmental, social, political, ethical, health and safety, manufacturability, and sustainability
d) an ability to function on multidisciplinary teams
e) an ability to identify, formulate, and solve engineering problems
f) an understanding of professional and ethical responsibility
g) an ability to communicate effectively
h) the broad education necessary to understand the impact of engineering solutions in a global, economic, environmental, and societal context
i) a recognition of the need for, and an ability to engage in life-long learning
j) a knowledge of contemporary issues
k) an ability to use the techniques, skills, and modern engineering tools necessary for engineering practice.
l) applying principles of engineering, biology, human physiology, chemistry, calculus-based physics, mathematics (through differential equations), and statistics
m) solving bio/biomedical engineering problems, including those associated with the interaction between living and non-living systems

n) analyzing, modeling, designing and realizing bio/biomedical engineering devices, systems, components, or processes systems
o) making measurements on and interpreting data from living systems