

BMM 411 – BIOMEDICAL IMAGE PROCESSING

Instructor: Galip ÖZDEMİR galipp@gmail.com g.ozdemir@etu.edu.tr

Credit: 3

Term: 2018/2019 Summer

Lecture Location: Tuesdays @177 & Thursdays @176

Lecture Hours: Tuesdays 8:30-10:20 & Thursdays 10:30-12:20

Assistant: to be announced later

Office: 175/3 (Please send an e-mail first!!)

Web Page: g.ozdemir.etu.edu.tr

www.piazza.com/etu.edu.tr/summer2019/bmm411

Reference Book:

Rafael C. Gonzalez, Richard E. Woods - Digital Image Processing 2nd edition, Pearson Education, ISBN-13: 978-0131687288

Objectives

- to learn theoretical backgrounds of image processing
 - to analyze an image mathematically
 - to improve algorithmic prospective
 - to gain experience on implementing algorithms
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Contents

1) How do we see? How does camera?

Human visual system
Analog images
Analog to Digital images
Digital image properties
How are digital images stored?
Rotation, translation & scaling

2) Medical Image Modalities

Microscopes
X-Ray
Magnetic Resonance Imaging (MRI)
Computed Tomography (CT)
DICOM format

3) 2-D Fourier Transformation

Convolution
Filters
Fourier Transform
Fast-Fourier Transform (FFT)

4) Basic Image Operations

- What is histogram?
- Noise & Denoising
- Contrast Enhancement
- Chain Coding
- Edge detection algorithms
- Template matching

5) Image Segmentation Algorithms

- Otsu's Thresholding
- Region-growing
- K-means clustering
- Split & Merge
- Fuzzy c-means
- Watershed
- Expectation Maximization
- Active Contours (Snakes)
- Applications in Medical Imaging

6) Image Compression

- Lossless Compression
 - Huffman Coding
 - Run-Length Encoding (RLE)
- Lossy Compression
 - Dynamic Window Based RLE
 - Block Truncating Coding
 - JPEG
- Applications in Medical Imaging

Grading

Mid-Term: %25

Final: %40

Assignments:

Homework / Quizzes / Project (MATLAB/Python Implementation): %35

Total of **60 points** is required to pass the class.

Exams are all in **closed book** and **in ENGLISH**. None of additional course material is allowed (including cheat sheets). You are expected to answer exam questions **in ENGLISH**.

Mid-Term & Final Exam date: to be announced later

Attending >70% of all lectures is **mandatory** due to regulations.

Project is based on **MATLAB/Python** implementation of a journal paper published on 2015 or later (i.e segmentation/recognition algorithm). Groups of 2-3 students are encouraged. Individual study is also welcomed. There **CAN NOT** be any groups having 4 or more students under ANY circumstances!!

Project Proposal: **May 24th 2019**

(1 page at most - 10% of Project grade)

Preliminary Report Submission: **June 28th 2019**

(3 pages at most - 30% of Project grade)

Project Demo/Presentation/Final Report Submission: **July 23rd - 25th 2019**
(60% of Project grade)