Medical Image Processing

BENG 499-002/BENG 590-003 – Spring 2016

Lecture Location: Robinson A123

Lecture Hours: Thursdays, 4:30-7:10 pm

Credit Hours: 3

Instructor: Vasiliki Ikonomidou

E-mail: vikonomi@gmu.edu

Office: Long and Kimmy Nguyen Engineering Building, 3909

Office Hours: Tuesdays 3-4 pm; Thursdays 2-3 pm; other times by appointment

I will try to respond to e-mails within two business days of receiving them. Due to University regulations, you need to use your GMU e-mail account in all correspondence related to the course. Please put BENG 499 or BENG 590 in the subject line!

Announcements and additional course materials will be posted on Blackboard. It is the students’ responsibility to regularly check it.

Prerequisites:

While the course does not have any formal prerequisites, a familiarity with basic concepts of signal processing is assumed. It is also assumed that you are familiar and able to program with MATLAB.

Grading Policies

Your grade in the course will be a weighted average of your grades in homeworks, project, midterm and final exam as described below:

Homework (30%)

Homework constitutes a major component of the course. It should demonstrate an understanding of the background, and a clear and critical presentation of the procedure followed and the results obtained. “Critical” means questioning what was done and why such results were obtained. Assignments should be typed and delivered electronically on Blackboard. They will
usually consist of computer code, processed images and a write-up. Computer code should have comments to help make it readable, and it should be working; there will be no partial credit for non-working code. Overall, all solutions should have enough comments to make the thinking process clear. Processed images should be saved in separate files in jpg, png or tiff format. The write-up, preferably in pdf format, should address the problem, the methodology used to solve it, and comment on the results. Additionally, it should provide a short documentation to the code – how it is to be used, what the main variables are, how the algorithm works. Please take care to use proper grammar and syntax.

Homework is due at the beginning of the class a week after it is given, and will not be accepted afterwards. In case of a documented medical emergency that doesn’t allow you to submit on time, please notify the instructor. Also, if you are unable to submit an assignment due to observance of a religious holiday, please notify the instructor in advance; in case of a documented medical emergency, please notify the instructor as soon as possible.

Project (20%)

The class project will be a larger computing assignment dealing with processing of medical images. For the BENG 499 option of the course, the project may follow the material in the textbook or use existing medical imaging software; for the ECE 590 option, it is expected that students will research relevant bibliography to identify and implement algorithms in MATLAB or ImageJ in order to address the problem at hand. At the last meeting of the class, students are expected to give a 10-12 minute presentation of their project (with a PowerPoint); a draft of the report is expected the day before the presentation. Final written reports, which may include any corrections pointed out during the presentation, are due at the day of the final exam.

Midterm (20%)

The midterm will be a take home exam.

Final Exam (30%)

The final exam will be cumulative, open book / open note.

Academic Integrity

All George Mason University students have agreed to abide by the letter and the spirit of the Honor Code. You can find a copy of the Honor Code at academicintegrity.gmu.edu. All violations of the Honor Code will be reported to the Honor Committee for review.

If for an assignment you use material from other sources, like books, articles or the web, such sources must be cited appropriately. All assignments and exams must
contain a signed honor pledge: “On my honor, I have not given nor received any help on this assignment/exam”, otherwise they will not be graded.

For all assignments and exams, code submitted and write-ups are expected to be your own. While discussing an assignment with a classmate is a normal part of the learning process, sharing code and write-ups is not permitted. Likewise, copying text and/or code from books or the Internet constitutes plagiarism. Limited citing should be clearly marked as such, and appropriately referenced.

Disability statement

If you have a documented learning disability or other condition that may affect academic performance you should: 1) make sure this documentation is on file with the Office of Disability Services (SUB I, Rm. 222; 993-2474; http://www.gmu.edu/student/drc/) to determine the accommodations you need; and 2) talk with me to discuss your accommodation needs.

WAVES: Wellness, Alcohol and Violence Education and Services
WAVES promotes wellness within the Mason community through health education, alcohol/drug assessment and education, and violence awareness, prevention and sexual assault response. We help students make healthy, safe choices and encourage lifelong, thoughtful healthy decision-making through individualized support, creative programming, and evidence-based education and outreach.

WAVES office 703-993-9999
SUB I, Suite 3200
24-Hour Sexual and Intimate Partner Violence Crisis Line 703-380-1434
waves.gmu.edu

- 703-360-7273 (Fairfax County Office for Women and Domestic and Sexual Violence Services 25 hotline)
- 703- 228-4848 (Arlington County Domestic Violence Services Hotline)
- 703-368-4141 (Prince William County Sexual Assault Victims Advocacy Services (SAVAS) hotline)
- 1-800-838-8238 (Virginia Family Violence and Sexual Assault Hotline)
- 1-800-656-HOPE (Rape, Abuse and Incest National Network)
https://ohl.rainn.org/online/

CAPS: Counseling and Psychological Services
Counseling and Psychological Services (CAPS) provides a wide range of free confidential services to students, faculty, and staff. Services are provided by a staff of professional clinical psychologists, social workers, counselors, learning specialists, and psychiatric providers. CAPS individual and group counseling, workshops, and outreach programs are designed to enhance students’ personal experience and academic performance. Visit us at caps.gmu.edu for additional resources.
For consultation or emergency assistance during office hours call 703-993-2380.
For assistance during non-office hours, call University Police at 703-993-4357.
703-527-4077 (CrisisLink)
1-800-273-8255 (National Suicide Prevention Lifeline)
1-877-838-2838 (Veterans' Crisis Hotline)

**Student Health Services (SHS)** — Provides *confidential* health care to enrolled students in emergency and non-emergency circumstances on the Fairfax, Arlington and Prince William campuses. If there is a medical emergency and Student Health Services (SHS) is closed, please contact the free after-hours nurse (703-993-2831), a hospital emergency room, an urgent care facility, or call 911.

**SUB 1, Suite 2300**
703-993-2831

**University Police:**
Emergency: 911    Non-Emergency: (703) 993-2810
Reporting a Crime (Crime Solvers Anonymous Tip Hot-Line): (703) 993-4111
Mason Police Website: http://police.gmu.edu/
Eric Heath, Chief of Police   Phone: (703) 993-3840   E-mail: eheath2@gmu.edu

**Academic courtesy**

You can help make this a better experience by:
• Arriving in time for the class
• Silencing your cell phone and not using any electronic devices other than your laptop (but, no web surfing or e-mailing!).
• No electronic devices are allowed in class during exams.
• Not eating or drinking in class
• Not preparing to leave until the instructor indicates that the lecture is over

**Detailed Course Information**

BENG 499 / ECE 590 “Medical Image Processing” aims at familiarizing the student with the basic concepts of image processing as they are applied to medical imaging problems. The class consists of two parts. The first part provides a brief overview of basic image processing, including image enhancement and restoration techniques. The second part addresses problems that are central to medical image processing practice, including registration, segmentation and feature detection.

By the end of the course, the student should be able to:
• Identify and apply the algorithms needed for a medical image analysis problem
• Implement basic image processing algorithms in MATLAB
• Judge image quality
• Understand the different classes of image segmentation and registration algorithms, and know how their choice affects the outcome
• Discuss the application of feature recognition and classification to computer-assisted diagnosis

Textbook


Calendar (all dates, topics and assignments are subject to change)

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Important Dates:

First day of classes: 1/19
Last day to add / drop classes without penalty: 1/26
Final drop deadline (67% tuition penalty): 2/19
Spring Break: 3/7-3/13
Last Day of Classes: 5/2
Final Exam: 5/5, 4:30-7:15 pm