1 INSTRUCTIONAL SUPPORT

1.1 Instructor

Instructor: April Khademi, Ph.D., P.Eng.
Office: RICH 2521, ext. 56746
Email: akhademi@uoguelph.ca
Office hours: By appointment

2 LEARNING RESOURCES

2.1 Course Website

Course material, news, announcements, and grades will be regularly posted to the ENGG*6070 Courselink site. You are responsible for checking the site regularly.

2.2 Required Sources

1. A. Khademi, Advanced Medical Image Analysis, Lecture notes.

2.3 Recommended Resources

2.4 Additional Resources

Lecture Information: All the lecture notes will be posted on the course webpage.

Lab Information: There will be two labs that will posted on the course webpage. The required software for the labs, assignment and project can be found in all SOE computer labs. Students may use these machines when there is no lab or class scheduled in that room.

Assignment: One assignment that will be posted on the course webpage and discussed further in class.

Project: One project that will be posted on the course website and discussed further in class.

Miscellaneous Information: Supplementary information to the lecture notes will also posted on the course webpage.

2.5 Communication & Email Policy

Please use lectures as your main opportunity to ask questions about the course. Office hours will be scheduled on request. Major announcements will be posted to the course website. It is your responsibility to check the course website regularly. As per university regulations, all students are required to check their University of Guelph e-mail account regularly: e-mail is the official route of communication between the University and its students.

3 Assessment

3.1 Dates and Distribution

Labs: 30%
Assigned image processing problems and lab report. Lab report can require written and/or implementation-based solutions.
Lab1: due on Oct. 7, 2015
Lab2: due on Oct. 28, 2015

Note: Both paper and electronic copies are to be submitted (including code, data, and all other relevant materials).

Assignment: 20%
Implementation of a grayscale medical image processing algorithm with a four-page conference style paper required as the final report.
Assignment1: due on Nov. 11, 2015

Note: Both paper and electronic copies are to be submitted (including code, data, and all other relevant materials).
Individual Project: 50%

The course project will focus on the design and implementation of an advanced image analysis system for colour medical images with a full technical report.

Project: due on Dec.3, 2015

Note: Both paper and electronic copies are to be submitted (including code, data, and all other relevant materials).

3.2 Course Grading Policies

Passing grade: The passing grade is 65%.

Missed Assessments: If you are unable to meet an in-course requirement due to medical, psychological, or compassionate reasons, please email the course instructor. Please see below for specific details and consult the graduate calendar for information on regulations and procedures for Academic Consideration:
http://www.uoguelph.ca/registrar/calendars/graduate/current/genreg/sec_d0e1415.shtml

Accommodation of Religious Obligations: If you are unable to meet an in-course requirement due to religious obligations, please email the course instructor within two weeks of the start of the semester to make alternate arrangements. See the undergraduate calendar for information on regulations and procedures for Academic Accommodation of Religious Obligations:
http://www.uoguelph.ca/registrar/calendars/undergraduate/current/c08/c08-accomrelig.shtml

Missed in-class assessments: If you miss an in-class assessment due to grounds for granting academic consideration or religious accommodation, accommodations will be made for a make-up assessment sessions.

Late submission of Labs: labs and reports submitted within 48 hours past the deadline will be marked to a maximum grade of 60%, and those handed in beyond 48 hours will not be accepted.

Late submission of Assignment: Late submissions of assignments will not be accepted.

Late submission of Project: Late submissions of the project will not be accepted.

Grade Clarification: If you have questions about the grade your assignment received, please ask your instructor. Any item that is re-marked will be re-marked entirely. Therefore it is strongly suggested that you thoroughly review your entire document before making a re-marking request. Pencil-written works will not be re-marked. Re-marking requests will not be honoured more than one week after the document has been returned.
4 AIMS, OBJECTIVES & GRADUATE ATTRIBUTES

4.1 Course Description

State-of-the-art grayscale and colour image processing methodologies for medical images. Grayscale and colour medical imaging modalities (i.e. MRI, digital pathology) will be used to demonstrate theory and application. Emphasis is on robust design, and all the necessary components needed to build a clinical system. Topics include: preprocessing, segmentation, feature extraction/selection, classification, computer-aided diagnosis, compression, validation and commercialization. Students are expected to have knowledge of signals and systems.

4.2 Course Aims

This course covers the state-of-the-art image processing algorithms for radiology and pathology medical images and the necessary components needed to build a complete clinical solution. Both colour and grayscale image processing methodologies are covered and emphasis is on robust design. Validation, commercialization and regulatory issues are discussed as well, as they are important for implementing real-world, clinical systems. Students will be exposed to both theory and application, with the goal of providing them with the 1) tools and methods needed to design and implement robust algorithms for medical images, 2) ability to recognize challenges and limitations of particular algorithms and applications, 3) competency to weigh different options to arrive at an optimal solution and 4) knowledge of the importance of quantification (algorithms) in medicine. Methods taught can be used for a variety of other image or video processing applications, including gaming, aerial/surveillance, digital photograph mining, face recognition, robotics and computer vision. Course evaluation is in the form of labs, an assignment and a project, which are graded based on the results of implemented algorithms and technical communication.

4.3 Learning Objectives

At the successful completion of this course, the student will have demonstrated the ability to:

1. Recognize different medical imaging modalities, and discuss their photometric and digital representation.

2. Identify, discuss and design grayscale image processing concepts for radiology images such as preprocessing, segmentation, feature extraction, classification, and validation.

3. Identify, discuss and design colour image processing concepts for digital pathology (colour) images such as preprocessing, segmentation, feature extraction, classification, and validation.

4. Recognize and assess the challenges of medical image analysis design, including image artifacts, and methods to handle these challenges.

5. Identify and discuss real-world applications of image analysis algorithms in medicine.

6. Evaluate, identify and discuss components needed to implement a clinical solution.

7. Implement medical image analysis algorithms.

8. Debug, visualize and evaluate a running algorithm.

9. Compose an engineering (technical) paper or report.
10. Identify and discuss the practical aspects of algorithm commercialization.

4.4 Instructor’s Role and Responsibility to Students

The instructor’s role is to develop and deliver course material in ways that facilitate learning for a variety of students. Selected lecture notes will be made available to students on Courselink/D2L but these are not intended to be stand-alone course notes. During lectures, the instructor will expand and explain the content of notes and provide example problems that supplement posted notes. Scheduled classes will be the principal venue to provide information and feedback for tests and project.

4.5 Students’ Learning Responsibilities

Students are expected to take advantage of the learning opportunities provided during lectures and tutorials. Students, especially those having difficulty with the course content, should also make use of other resources recommended by the instructor. Students who do (or may) fall behind due to illness, work, or extracurricular activities are advised to keep the instructor informed. This will allow the instructor to recommend extra resources in a timely manner and/or provide consideration if appropriate.

5 Teaching and Learning Activities

5.1 Timetable

<table>
<thead>
<tr>
<th>Lectures</th>
<th>Time</th>
<th>Room</th>
</tr>
</thead>
<tbody>
<tr>
<td>Tu</td>
<td>11:00 to 12:00</td>
<td>RICH 3527</td>
</tr>
<tr>
<td>We</td>
<td>13:00 to 15:00</td>
<td>RICH 3527</td>
</tr>
</tbody>
</table>
5.2 Lecture Schedule

<table>
<thead>
<tr>
<th>Weeks</th>
<th>Lecture Topics</th>
<th>References</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Introduction to Medical Imaging and Processing</td>
<td>Notes 1</td>
</tr>
<tr>
<td>2</td>
<td>Digital Image Fundamentals (Grayscale)</td>
<td>Notes 2</td>
</tr>
<tr>
<td>3</td>
<td>Digital Image Fundamentals (Colour)</td>
<td>Notes 3</td>
</tr>
<tr>
<td>4</td>
<td>Image Degradation Models and Quality</td>
<td>Notes 4</td>
</tr>
<tr>
<td>5</td>
<td>Preprocessing Techniques (Grayscale)</td>
<td>Notes 5</td>
</tr>
<tr>
<td>6</td>
<td>Preprocessing Techniques (Colour)</td>
<td>Notes 6</td>
</tr>
<tr>
<td>7</td>
<td>Image Segmentation</td>
<td>Notes 7</td>
</tr>
<tr>
<td>8</td>
<td>Feature Extraction</td>
<td>Notes 8</td>
</tr>
<tr>
<td></td>
<td>Feature Selection and Dimensionality Reduction</td>
<td></td>
</tr>
<tr>
<td>9</td>
<td>Classification</td>
<td>Notes 9</td>
</tr>
<tr>
<td>10</td>
<td>Validation</td>
<td>Notes 10</td>
</tr>
<tr>
<td></td>
<td>Research and Clinical Applications</td>
<td></td>
</tr>
<tr>
<td>11</td>
<td>Medical Image Compression</td>
<td>Notes 11</td>
</tr>
<tr>
<td>12</td>
<td>Commercialization of Algorithms</td>
<td>Notes 12</td>
</tr>
</tbody>
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5.3 Other Important Dates

Drop Date: The last date to drop one-semester courses, without academic penalty, is Nov 6th, 2015. Two-semester courses must be dropped by the last day of the add period in the second semester. Refer to the Graduate Calendar for the schedule of dates:

https://www.uoguelph.ca/registrar/calendars/graduate/current/sched/sched-dates-f10.shtml

6 LAB SAFETY

Safety is critically important to the School and is the responsibility of all members of the School: faculty, staff and students. As a student in a lab course you are responsible for taking all reasonable safety precautions and following the lab safety rules specific to the lab you are working in. In addition, you are responsible for reporting all safety issues to the laboratory supervisor, GTA or faculty responsible.

7 ACADEMIC MISCONDUCT

The University of Guelph is committed to upholding the highest standards of academic integrity and it is the responsibility of all members of the University community – faculty, staff, and students – to be aware of what constitutes academic misconduct and to do as much as possible to prevent academic offences from occurring. University of Guelph students have the responsibility of abiding by the University's policy on academic misconduct regardless of their location of study; faculty, staff and students have the
responsibility of supporting an environment that discourages misconduct. Students need to remain aware that instructors have access to and the right to use electronic and other means of detection. The Academic Misconduct Policy is detailed in the Graduate Calendar:
https://www.uoguelph.ca/registrar/calendars/graduate/2014-2015/genreg/sec_d0e1780.shtml

7.1 Resources

The Academic Misconduct Policy is detailed in the Graduate Calendar:
https://www.uoguelph.ca/registrar/calendars/graduate/2014-2015/genreg/sec_d0e1780.shtml

A tutorial on Academic Misconduct produced by the Learning Commons can be found at:
http://www.academicintegrity.uoguelph.ca/

Please also review the section on Academic Misconduct in your Engineering Program Guide.

The School of Engineering has adopted a Code of Ethics that can be found at:
http://www.uoguelph.ca/engineering/undergrad-counselling-ethics

8 RECORDING OF MATERIALS

Presentations which are made in relation to course work—including lectures—cannot be recorded or copied without the permission of the presenter, whether the instructor, classmate or guest lecturer.

9 ACCESSIBILITY

The University of Guelph is committed to creating a barrier-free environment. Providing services for students is a shared responsibility among students, faculty and administrators. This relationship is based on respect of individual rights, the dignity of the individual and the University community's shared commitment to an open and supportive learning environment. Students requiring service or accommodation, whether due to an identified, ongoing disability for a short-term disability should contact the Centre for Students with Disabilities as soon as possible

For more information, contact CSD at 519-824-4120 ext. 56208 or email csd@uoguelph.ca or see the website: http://www.uoguelph.ca/csd/

10 RESOURCES

The Academic Calendars are the source of information about the University of Guelph’s procedures, policies and regulations which apply to undergraduate, graduate and diploma programs:
http://www.uoguelph.ca/registrar/calendars/index.cfm?index