CUMMING SCHOOL OF MEDICINE
GRADUATE COURSE OUTLINE

COURSE TITLE: Advanced Medical Image Processing			
Course	MDSC 689.03		
Pre/Co-Requisites	None. Permission of the instructor as enrolment is limited.		
Faculty	Cumming School of Medicine, Graduate Science Education		
Instructor Name(s)	Nils Daniel Forkert Steven Boyd Sonny Chan	**Email**	nils.forkert@ucalgary.ca skboyd@ucalgary.ca sonny.chan@ucalgary.ca
Office Location	HSC 2913	**Office Hours**	
Telephone No.	403-210-6436		
Class Term, Days	Winter 2020, Tuesday		
Class Times	1400 – 1645		
Class Location	HRIC 3C70		

COURSE INFORMATION/DESCRIPTION OF THE COURSE

Medical imaging is a rapidly expanding critical tool for biomedical engineering research, and the ability to extract quantitative data from non-invasive imaging technologies provides important information for understanding injuries and diseases.
This course focuses on the development of computer-based methods to generate quantitative data from common three-dimensional medical imaging technologies. Students will be introduced to methods of image processing, visualization, and advanced algorithms to evaluate image data. Applications will be morphometric measurements, finite element methods to image data, and visualization methods. The course will focus on algorithm development, and students will perform a project implementing quantitative imaging algorithms related to their field of research. This will be a 'hands-on' course, and it is expected that all students have a basic knowledge of computer programming. The course is structured with regular weekly readings, and weekly projects related to image processing.

LEARNING RESOURCES/REQUIRED READING

Students will be required to access a computer. It does not have to be a powerful computer, although that will help because it will be used for processing image data.

It is recommended that students have a copy of the 4th edition of The Visualization Toolkit: An Object Oriented Approach to 3D Graphics, by Will Schroeder, Ken Martin, Bill Lorensen.

COURSE OBJECTIVES/LEARNING OUTCOMES

- Understand the concepts of 2D and 3D image data for a variety of imaging modalities.
- Apply image processing to medical image data and understand the appropriate applications and limitations of those methods.
- Learn algorithm development for large medical image data files.
- Understand existing algorithms for morphological analyses.
- Learn appropriate visualization methodologies for displaying 2D/3D image data, and for displaying quantitative results with open sourced visualization and image processing code.

CUT POINTS FOR GRADES

This course adheres to the grading system outlined in the University of Calgary, Faculty of Graduate Studies Calendar. Grades of A+ and A are not distinguished in the calculation of GPAs. Percentage/letter grade conversion used for this course is as follows

Grade	Grade Point Value	Percentage Conversion	Graduate Description
A+	4.00	95-100	Outstanding
A	4.00	90-94	Excellent – superior performance showing comprehensive understanding of the subject matter
A-	3.70	85-89	Very Good Performance
B+	3.30	77-84	Good Performance
B	3.00	72-76	Satisfactory Performance
B-	2.70	68-71	Minimum Pass for Students in the Faculty of Graduate Studies
C+	2.30	63-67	All grades below 'B-" are indicative of failure at the graduate level and cannot be counted toward Faculty of Graduate Studies course requirements

Assessment Components: The University policy on grading related matters is outlined in the 2019-2020 Calendar.

Assessment Methods	Description	Weight %	Due Date and Time
Weekly Assignments	There will be six weekly assignments, each valued at 6.66% for a total of 40% of the final grade	40	See schedule below
Final Project Presentation	Short (5 min) presentation of the final project	30	April 7, 2020 (2 pm)
Final Project Report	6-8 pages final report in journal paper format as distributed during the course	30	April 7, 2020 (2 pm)

ASSESSMENT AND EVALUATION INFORMATION

ATTENDANCE AND PARTICIPATION EXPECTATIONS:

Regular attendance and active participation at the classes is expected.

GUIDELINES FOR SUBMITTING ASSIGNMENTS:
All weekly assignments as well as the final presentation and report need to be submitted electronically prior to the due date and time described in the course timetable.

FINAL EXAMINATIONS:
The final examination is replaced by the final project presentation and corresponding report.

EXPECTATIONS FOR WRITING: The final report is expected to be 6-8 pages in a journal format distributed by the course instructors. Thorough language proof reading is suggested.

LATE AND/OR MISSING ASSIGNMENTS: Late assignments will not be accepted.

Is a passing grade on a particular component essential to pass the course as a whole?

	COURSE TIMETABLE		
Course Schedule Date	**Topic & Reading**	**Instructor**	**Assignments/Due Dates & Times**
January 14, 2020	Course Introduction	N.D. Forkert	
January 21, 2020	Quantitative Image Analysis	N.D. Forkert	January 27, 2020 (11:30 pm)

January 28, 2020	Filtering	N.D. Forkert	February 03, 2020 (11:30 pm)
February 04, 2020	Segmentation	N.D. Forkert	February 10, 2020 (11:30 pm)
February 11, 2020	Visualization	S. Chan	February 17, 2020 (11:30 pm)
February 18, 2020	Reading Week		
February 25, 2020	Registration	S. Chan	March 2, 2020 (11:30 pm)
March 3, 2020	Quantitative analysis and non-metric parameters	S. Boyd	March 9, 2020 (11:30 pm)
March 10, 2020	Geometry Processing	S. Chan	
March 17, 2020	Finite Element Modelling	S. Boyd	
March 24, 2020	Fourier Transform	N. Forkert	
March 31, 2020	Computer-aided diagnosis	N. Forkert	
	Final Report		April 7, 2020
April 7, 2020	Final Presentation	N. Forkert, S. Boyd, and S. Chand	

	INTERNET AND ELECTRONIC COMMUNICATION DEVICE INFORMATION
	Cell phones must be turned off in class unless otherwise arranged with the instructor. The use of laptop and mobile devices is acceptable when used in a manner appropriate to the course and classroom activities. Students are to refrain from accessing websites that may be distracting for fellow learners (e.g. personal emails, Facebook, YouTube). Students are responsible for being aware of the University's Internet and email use policy, which can be found at https://www.ucalgary.ca/policies/files/policies/electronic-communicationspolicy.pdf.

MEDIA AND RECORDING IN LEARNING ENVIRONMENTS
Media recording for lesson capture

The instructor may use media recordings to capture the delivery of a lecture. These recordings are intended to be used for lecture capture only and will not be used for any other purpose. Although the recording device will be fixed on the Instructor, in the event that incidental student participation is recorded, the instructor will ensure that any identifiable content (video or audio) is masked, or will seek consent to include the identifiable student content to making the content available on University approved platforms.

Media recording for assessment of student learning

The instructor may use media recordings as part of the assessment of students. This may include but is not limited to classroom discussions, presentations, clinical practice, or skills testing that occur during the course. These recordings will be used for student assessment purposes only and will not be shared or used for any other purpose.

Media recording for self-assessment of teaching practices

The instructor may use media recordings as a tool for self-assessment of their teaching practices. Although the recording device will be fixed on the instructor, it is possible that student participation in the course may be inadvertently captured. These recordings will be used for instructor self-assessment only and will not be used for any other purpose.

Student Recording of Lectures

Audio or video recording of lectures is prohibited except where explicit permission has been received from the instructor.

UNIVERSITY OF CALGARY POLICIES AND SUPPORTS

ACADEMIC ACCOMMODATIONS

Students seeking an accommodation based on disability or medical concerns should contact Student Accessibility Services; SAS will process the request and issue letters of accommodation to instructors. For additional information on support services and accommodations for students with disabilities, visit www.ucalgary.ca/access/. Students who require an accommodation in relation to their coursework based on a protected ground other than disability should communicate this need in writing to their Instructor. The full policy on Student Accommodations is available at http://www.ucalgary.ca/policies/files/policies/student-accommodation-policy.pdf

IMPORTANT INFORMATION

Any research in which students are invited to participate will be explained in class and approved by the appropriate University Research Ethics Board

COPYRIGHT

It is the responsibility of students and professors to ensure that materials they post or distribute to others comply with the Copyright Act and the University's Fair Dealing Guidance for Students (library.ucalgary.ca/files/library/guidance_for_students.pdf). Further information for students is available on the Copyright Office web page (https://library.ucalgary.ca/copyright)

A NOTE REGARDING INSTRUCTOR INTELLECTUAL PROPERTY

Generally speaking, course materials created by professor(s) (including course outlines, presentations and posted notes, labs, case studies, assignments and exams) remain the intellectual property of the professor (s). These materials may NOT be reproduced, redistributed or copied without the explicit consent of the professor. The posting of course materials to third party websites such as note-sharing sites without permission is prohibited. Sharing of extracts of these course materials with other students enrolled in the course *at the same time* may be allowed under fair dealing

ACADEMIC INTEGRITY

The Cumming School of Medicine expects intellectual honesty from its students. Course participants should be aware of University policies relating to Principles of Conduct, Plagiarism and Academic Integrity. These are found in the printed Faculty of Graduate Studies Calendar, or online under Academic Regulations in the Faculty of Graduate Studies Calendar, available at **Faculty of Graduate Studies Academic Regulations**

ACADEMIC MISCONDUCT

For information on academic misconduct and its consequences, please see the University of Calgary Calendar at http://www.ucalgary.ca/pubs/calendar/current/k.html

EMERGENCY EVACUATION AND ASSEMBLY POINTS

Assembly points for emergencies have been identified across campus. The primary assembly points for South Campus (Health Science Centre (HSC); Health & Research Innovation Centre (HRIC); Heritage Medical Research Building (HMRB) and Teaching, Research and Wellness (TRW)) are:

- HSC and HMRB: HRIC Atrium (alternate assembly point is Parking Lot 6)
- HRIC: HMRB Atrium (alternate assembly point is Parking Lot 6)
- TRW: McCaig Tower (alternate assembly point is HMRB – Atrium)

APPEALS

If there is a concern with the course, academic matter or a grade, first communicate with the instructor. If these concerns cannot be resolved, students can proceed with an academic appeal, as per Section N of the Faculty of Graduate Studies Calendar. Students must follow the official process and should contact the Student Ombuds Office (http://www.ucalgary.ca/provost/students/ombuds) for assistance with this and with any other academic concerns, including academic and non-academic misconduct

THE FREEDOM OF INFORMATION AND PROTECTION OF PRIVACY (FOIP) ACT

This course is conducted in accordance with the Freedom of Information and Protection of Privacy Act (FOIP) and students should identify themselves on written assignments (exams and term work.) by their name and ID number on the front page and ID on each subsequent page. Assignments given by you to your course instructor will remain confidential unless otherwise stated before submission. The assignment cannot be returned to anyone else without your expressed permission to the instructor. Grades will be made available on an individual basis and students will not have access to other students' grades without expressed consent. Similarly, any information about yourself that you share with your course instructor will not be given to anyone else without your permission

WELLNESS AND MENTAL HEALTH RESOURCES

The University of Calgary recognizes the pivotal role that student mental health plays in physical health, social connectedness and academic success, and aspires to create a caring and supportive campus community where individuals can freely talk about mental health and receive supports when needed. We encourage you to explore the excellent mental health resources available throughout the university community, such as counselling, self-help resources, peer support or skills-building available through the SU Wellness Centre (Room 370, MacEwan Student Centre), https://www.ucalgary.ca/wellnesscentre/services/mental-health-services and the Campus Mental Health Strategy website https://www.ucalgary.ca/mentalhealth/"

SUPPORTS FOR STUDENT LEARNING, SUCCESS, AND SAFETY

Student Ombudsman: The Student Ombuds' Office supports and provides a safe, neutral space for students. For more information, please visit www.ucalgary.ca/ombuds/ or email ombuds@ucalgary.ca

Student Union: The SU Vice-President Academic can be reached at (403) 220-3911 or suvpaca@ucalgary.ca; Information about the SU, including elected Faculty Representatives can be found here: https://www.su.ucalgary.ca

Graduate Student's Association: The GSA Vice-President Academic can be reached at (403) 220- 5997 or gsa.vpa@ucalgary.ca; Information about the GSA can be found here: https://gsa.ucalgary.ca

SAFEWALK

Campus security will escort individuals, day or night, anywhere on campus (including McMahon Stadium, Health Sciences Centre, Student Family Housing, the Alberta Children's Hospital and the University LRT station). Call 403-220-5333 or visit http://www.ucalgary.ca/security/safewalk. Use any campus phone, emergency phone or the yellow phone located at most parking lot pay booths. Please ensure your personal safety by taking advantage of this service.