

CS9630 Image Processing and Analysis

Course Description Fall 2015

The University of Western Ontario
London, Ontario, Canada
Department of Computer Science

1. Instructor

- Name: Prof. John Barron
- Office Location: Middlesex 379
- Office Hours: informal (just drop by!) or make a specific appointment
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2. Description

- This course will teach the student the basic mathematical and computational concepts of Image Processing.

3. Background

- Programming Environment – MATLAB only (No C, C++ or Java). MatLab is available on the gaul (obelix) and csd (algeron, charlie) networks.
- Prerequisites – some basic mathematics (calculus and linear algebra) or permission of the instructor.

4. Text

- **Recommended Textbooks (buy or have access to):**
 - (a) Rafael C. Gonzalez, Richard E. Woods and Steven L. Eddins, “Digital Image Processing using MatLab”, 2nd edition, Gatesmark Publishing, 2009 (ISBN 9780982085400, 827pages). [A copy of this book is on 1-day reserve in the Taylor library.]
 - (b) Kelmur Kopka and Patrick W. Daly, “Guide to Latex”, 4th edition, Addison-Wesley, 2004 or a similar latex book.

- (c) Duane Hanselman and Bruce Littlefield, “Mastering MatLab”, Pearson Education, 2012 or a similar MatLab book.
- (d) Class notes and handouts via the course webpage.
- **Some Useful Reference Textbooks (not required to purchase):**
 - (a) Stephen J. Chapman, “MatLab Programming for Engineers”, 5th edition, Cengage Learning, 2016.
 - (b) Rafael C. Gonzalez, Richard E. Woods and “Steven L. Eddins, “Digital Image Processing using MatLab”, Pearson/Prentice Hall, 2004 (ISBN 9788177588989, 578 pages).
 - (c) Rafael C. Gonzalez and Richard C. Woods, “Digital Image Processing”, 3rd Edition, Pearson/Prentice Hall, 2008 (ISBN 9780131687288, 954 pages).
 - (d) Rafael C. Gonzalez and Richard C. Woods, “Digital Image Processing”, 2nd Edition, Prentice Hall, 2002 (ISBN 0-201-18075-8, 793 pages).
 - (e) Rafael C. Gonzalez and Richard C. Woods, “Digital Image Processing”, Addison-Wesley Publishing Company, 1992 (ISBN 0-201-50803-6, 716 pages).
 - (f) Rafael C. Gonzalez and Paul Wintz, “Digital Image Processing”, Addison-Wesley Publishing Company, 1987 (ISBN 0-201-18075-8, 793 pages).
 - (g) Edward R. Dougherty and Charles R. Giardina, “Image Processing - Continuous to Discrete”, Prentice-Hall, Inc., 1987.
 - (h) Ronald N Bracewell, “The Fourier Transform and Its Applications”, McGraw-Hill, 1986.
 - (i) Bernd Jähne, “Digital Image Processing, 4th edition, Springer, 1997.
 - (j) Azriel Rosenfeld and Avinash C. Kak, “Digital Picture Processing”, 2nd Edition (2 volumes) Academic Press, 1982.
 - (k) Rama Chellappa and Alexander A. Sawchuk, Volume 1: “Digital Image Processing” and Volume 2: “Digital Image Analysis”, IEEE Computer Society, 1985.
 - (l) William H. Press, Brian P. Flannery, Saul A. Teckolsky and William T. Vetterling, “Numerical Recipes in C”, Cambridge University Press, 1988.

5. Topics (Brief)

- Introduction to Image Processing
- Introduction to MatLab

- The 1D and 2D Fourier Transforms
- Filters (Low-Pass, High-Pass, Bandpass and Bandreject)
- Edge Detection and Region Growing
- Image Enhancement
- Image Noise (Modelling and Processing)
- Image Representation and Manipulation
- Morphological Image Processing

6. General Course Conduct

- Classes are held once a week on Tuesdays from 2:30pm-4:30pm in MC320
- Projected overheads will be used during the lectures, copies of these are available on the course webpage, www.csd.uwo.ca/courses/CS9630a/. The user ID is "class". The password for the notes will be supplied in class.
- There will be 2 assignments worth 35% each and a single open-book final exam, to be held in the last class, worth 30%. Independent work is required on the assignments and exams. Cheating in any form will not be tolerated.
- MMASc (Master's in Management of Applied Science) students enrolled in this class may have an alternate grading scheme which will form an addendum to the official course outline. Can such students please identify themselves to the instructor.
- For the assignments, a latex template will be provided (only latex can be used in this course, all graduate students must learn latex!!!). [Latex will be taught in class.] The tex file for each assignment will also be available on the course webpage.
- There **will** be a 5% penalty per day for late assignments (the weekend count as 1 day). Assignments will be passed in via Owl and the Owl submission date and time will be used to determine lateness. Assignments are due at 11:55pm so don't skip class to do your assignment.
- Note that you must also pass in a physical hardcopy of the assignment (your writeup and code). You can pass in the hardcopy during class or slip it under the professor's door (MC379). The hardcopy and electronic versions of your assignment must be the same.
- Programming must be done using Matlab only. [Note C, C++, Java, Fortran, etc. are not acceptable]. MatLab will be taught in this course and is used in the course

textbook. Any Matlab from R2009 (for sure) and after will be fine. If necessary, a sun network account will be supplied to any students without one.

- All marks on assignments are considered to be final 1 week after the graded assignment is handed back in class, even if not picked up. Any grade adjustments must be requested in that 1 week interval.
- Electronic information, including some C/MatLab code, various data and copies of the assignment handouts, are/will be available the course webpage.

7. Important Dates:

- First Class: Tuesday, September 15th
- Last Class (final exam): Tuesday, December 8th
- The final exam is on the last day of classes (December 8th) or 1 week later (December 15th at class time) [this depends on how much material we have covered].
- Monday, October 12th is a holiday (Thanksgiving Day). This holiday does not affect our class.
- There is a short 2 day study break this semester, Thursday, October 30st to Friday, October 31st. The study break does not affect our class.
- The exam period (undergraduate) is December 11th to 22nd.

Scholastic Offenses

- We expect our students to conduct themselves academically in a manner that upholds the integrity and reputation of our academic programs. Cheating on assignments, exams, essays and term papers is considered to be a serious violation of ethical conduct, and will not be tolerated.
- Assignments: Academic dishonesty in assignments includes (but is not limited to):
 - Unacceptable collaboration: What is unacceptable? There is a difference between discussing assignments and solutions with fellow students, and working together on the solutions to the point where the work submitted is clearly not individual work. If in doubt, ask your instructor.
 - Copying of another student's assignment
 - Allowing another student to copy

- Using code from an external source (text, instructor, course website) where a student’s own code is expected (if in doubt, ask your instructor)
- Altering of assignment results.
- Cheating on exams or tests includes (but is not limited to):
 - Using unauthorized aids
 - Communicating in any way with another student during the exam
 - Copying answers of another student
 - Altering an exam after it is marked.
- Essays and Term Papers: The Department has zero tolerance for plagiarism. The University Senate defines plagiarism as follows: “Students must write their essays and assignments in their own words. Whenever students take an idea, or a passage of text from another author, they must acknowledge their debt both by using quotation marks where appropriate and by proper referencing such as footnotes or citation. Plagiarism is a major academic offense (see Scholastic Offense Policy in the Western Academic Calendar).”

For further clarification of what constitutes plagiarism, refer to the paper titled “Collaboration, Plagiarism and Proper Attribution” by Professor Jamie Andrews¹. If in doubt, you should consult with your instructor.

Scholastic offenses will be reported by the instructor to the Graduate Chair. A penalty will be determined. The Graduate Calendar requires that the Dean of Graduate Studies be consulted by the Graduate Chair. Penalties may range from a reprimand to required withdrawal from the university.

Minimum penalties in CS9630a will be minus the total grade for the assignment/exam for which a cheating offense has occurred. It will be effectively impossible to pass this course if you have been caught cheating!!!

¹<http://www.csd.uwo.ca/~aija/polproc/plagiarism.pdf>

Graduate Student Health and Wellness

As part of a successful graduate student experience at Western, we encourage students to make their health and wellness a priority. Western provides several on campus health-related services to help you achieve optimum health and engage in healthy living while pursuing your graduate degree. For example, to support physical activity, all students, as part of their registration, receive membership in Western's Campus Recreation Centre. Numerous cultural events are offered throughout the year. Please check out the Faculty of Music web page <http://www.music.uwo.ca/> and our own McIntosh Gallery <http://www.mcintoshgallery.ca/>. Information regarding health and wellness-related services available to students may be found at <http://www.health.uwo.ca/>.

Students seeking help regarding mental health concerns are advised to speak to someone they feel comfortable confiding in, such as their faculty supervisor, their program director (graduate chair), or other relevant administrators in their unit. Campus mental health resources may be found at http://www.health.uwo.ca/mental_health/resources.html.

To help you learn more about mental health, Western has developed an interactive mental health learning module, found here: http://www.health.uwo.ca/mental_health/module.html. This module is 30 minutes in length and provides participants with a basic understanding of mental health issues and of available campus and community resources. Topics include stress, anxiety, depression, suicide and eating disorders. After successful completion of the module, participants receive a certificate confirming their participation.