

**SYDE 575**  
**Image Processing**  
**Fall 2009**

**General Information:**

*Instructor:* Alexander Wong E2-1303D ([a28wong@engmail.uwaterloo.ca](mailto:a28wong@engmail.uwaterloo.ca))

*TAs:* Akshaya Mishra E2-1303D ([akmishra@engmail.uwaterloo.ca](mailto:akmishra@engmail.uwaterloo.ca))

*Text:* Gonzalez and Woods, Digital Image Processing, 3rd edition (2nd edition acceptable as well), Prentice Hall, 2008.

*575 Home Page:* [www.einfodaily.com/piTunez/syde575.htm](http://www.einfodaily.com/piTunez/syde575.htm)

*Class Times:* Tu Th 10:00AM-11:20AM E2 1303E

*Tutorials:* Th 9:00AM-9:50AM E2 1303E

*Labs:* W 1:30PM-4:20PM E2 1302B

Office Hours: TBD

**Course Description:**

Starting with a discussion on psychological models of the human vision, this course moves on to cover both fundamental and state-of-the-art image processing methods for image enhancement, image restoration, and image representation, in both the spatial domain and frequency domain. Special topics such as applications in computer vision (segmentation, feature extraction and description), remote sensing, medical imaging, computer graphics, and multimedia processing are presented throughout the term.

**Course Objectives:**

At the end of the course you should be able to:

- Explain the principles of image processing and vision from psychological and signal processing perspectives.
- Apply basic techniques for image enhancement, restoration, and image representation.
- Discuss and appreciate state-of-the-art methods in image processing.
- Understand the usefulness of image processing in a wide range of fields such as remote sensing and medical imaging.

**Course Grading:**

1. Homework problems will be assigned from time to time but will not be graded. Solutions to homework problems will be presented during tutorials.
2. Three computer labs will be assigned during the term, emphasizing different applications in image processing that is complementary to concepts discussed in course material. The labs will be undertaken in groups of two students. 15% of the course grade will be based upon the lab reports. Labs have to be sent to the TA's e-mail address by midnight of the due date. Late labs will have 25% of the lab mark deducted for each day or part of a day that the lab is late.
3. There will be a term project related to a image processing concept of their choice. This project is to be done individually. The range of project topics is very broad, ranging from comparative analysis of state-of-the-art image processing algorithms to new image processing algorithms. 15% of the course grade will be based on the term project.
4. Midterm in mid-October: 20% of the course grade.
5. The final exam is worth 50% of the course grade.

**Course Outline (Both fundamental concepts and state-of-the-art techniques will be introduced for each topic):**

1. Introduction to Image Processing, Psychovisual Model
2. Overview of Signal Processing (e.g., convolution, Fourier analysis, MSE/PSNR)

3. Spatial Domain Methods for Image Enhancement (e.g., denoising, blurring, sharpening, gamma correction, downsampling, upsampling, super-resolution)
4. Frequency Domain Methods for Image Enhancement (e.g., denoising, sharpening, homomorphic filters)
5. Image Restoration (e.g., Lee filter, Wiener filter, inpainting)
6. Color Image Processing (e.g., HSI, YCbCr, RGB color models, pseudocolor)
7. Image Compression (e.g., image transforms, palette-based compression, quantization, channel compression)
8. Video Compression (e.g., intra-frame and inter-frame differential coding, motion estimation)
9. Image Representation (e.g., texture, Hough transform, moments, histogram)

**Note on Plagiarism and Cheating:**

Both plagiarism and cheating during the course will not be tolerated. Students found cheating or plagiarizing will be given a minimum of zero percent (0%) for the exam or assignment in question. Please refer to Policy 71 on student academic discipline.

**Academic Integrity:**

In order to maintain a culture of academic integrity, members of the University of Waterloo community are expected to promote honesty, trust, fairness, respect and responsibility. [Check [www.uwaterloo.ca/academicintegrity/](http://www.uwaterloo.ca/academicintegrity/) for more information.]

**Grievance:**

A student who believes that a decision affecting some aspect of his/her university life has been unfair or unreasonable may have grounds for initiating a grievance. Read Policy 70, Student Petitions and Grievances, Section 4, [www.adm.uwaterloo.ca/infosec/Policies/policy70.htm](http://www.adm.uwaterloo.ca/infosec/Policies/policy70.htm). When in doubt please be certain to contact the department's administrative assistant who will provide further assistance.

**Discipline:**

A student is expected to know what constitutes academic integrity [check [www.uwaterloo.ca/academicintegrity/](http://www.uwaterloo.ca/academicintegrity/)] to avoid committing an academic offence, and to take responsibility for his/her actions. A student who is unsure whether an action constitutes an offence, or who needs help in learning how to avoid offences (e.g., plagiarism, cheating) or about "rules" for group work/collaboration should seek guidance from the course instructor, academic advisor, or the undergraduate Associate Dean. For information on categories of offences and types of penalties, students should refer to Policy 71, Student Discipline, [www.adm.uwaterloo.ca/infosec/Policies/policy71.htm](http://www.adm.uwaterloo.ca/infosec/Policies/policy71.htm). For typical penalties check Guidelines for the Assessment of Penalties, [www.adm.uwaterloo.ca/infosec/guidelines/penaltyguidelines.htm](http://www.adm.uwaterloo.ca/infosec/guidelines/penaltyguidelines.htm).

**Appeals:**

A decision made or penalty imposed under Policy 70 (Student Petitions and Grievances) (other than a petition) or Policy 71 (Student Discipline) may be appealed if there is a ground. A student who believes he/she has a ground for an appeal should refer to Policy 72 (Student Appeals) [www.adm.uwaterloo.ca/infosec/Policies/policy72.htm](http://www.adm.uwaterloo.ca/infosec/Policies/policy72.htm).

**Note for Students with Disabilities:**

The Office for Persons with Disabilities (OPD), located in Needles Hall, Room 1132, collaborates with all academic departments to arrange appropriate accommodations for students with disabilities without compromising the academic integrity of the curriculum. If you require academic accommodations to lessen the impact of your disability, please register with the OPD at the beginning of each academic term.