

# ***Digital Imaging and Applications***

## **ENGO 559**

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### **Introduction to the Course**

**Dept. of Geomatics Engineering;  
Schulich School of Engineering  
University of Calgary**

# Personnel Detail & Class Time Table

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**Instructor: Ruisheng Wang**  
**email: [ruiswang@ucalgary.ca](mailto:ruiswang@ucalgary.ca)**

**TA: Hailun Yan**  
**ph: (226) 978-3703, email: [hailun.yan@ucalgary.ca](mailto:hailun.yan@ucalgary.ca)**

**Lectures:**

**Video will be uploaded before lecture time**

**Lab Assignments: Th 2:00PM - 3:50PM**

**Hailun will be online for questions & help during the scheduled lab time**

**Zoom invitation link is on D2L course content section**

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## ● **Photogrammetry**

- **Photogrammetry is concerned with obtaining reliable and accurate measurements from noncontact imaging**

## ● **Computer Vision**

- **Computing properties of the 3-D world from one or more digital images**

## ● **Image Processing**

- **Concerns image properties and image-to-image transformation**

## ● **Relations**

- **Photogrammetry pursues higher levels of accuracies than computer vision, and not all of computer vision is related to measuring**
- **Taking a look at photogrammetric methods before designing a vision system carrying out measurements is always a good idea**
- **Most computer vision algorithms require some preliminary image processing**

# Calendar Information

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- **An introduction to digital image processing (IP) and computer vision (CV) concepts**
- **Methods and algorithms which will enable the students to implement IP/CV systems or use IP/CV software with emphasis on remote-sensing and photogrammetry applications and problem solving**
- **Course components include:**
  - ❖ **Cameras and Image formation, intensity transformation**
  - ❖ **Filtering in the spatial and frequency domain**
  - ❖ **Color image processing**
  - ❖ **Feature detection and matching**
  - ❖ **Image segmentation and alignment**
  - ❖ **multi-source image/data fusion**
  - ❖ **Deep learning basics**

# Learning Outcomes

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**At the end of the course, you will be able to:**

- Understand fundamental characteristics of digital image data
- Understand and implement filtering techniques in both spatial and frequency domains
- Understand and use image segmentation, feature detection and matching algorithms
- Application of certain image processing techniques for extracting and matching features from remote sensing images and other digital images

# Evaluation

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**Lab reports  
(4 reports)**

**30%**

**Midterm exam.  
6pm Mar 2 – 6 pm Mar 3**

**30%**

**Final exam.  
To be shcduled**

**40%**

**Total: 100%**

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**The midterm exam and final exam will be set up in D2L with an additional 50% time to account for issues that arise when taking the exam. Students will be given access to all assessments for a 24 h period. Once the assessment is started, assessment solutions must be submitted within the time limit listed below.**

**If issues arise during the midterm exam (e.g. problems uploading, internet problems, other problems), send an email to the Instructor at [ruiswang@ucalgary.ca](mailto:ruiswang@ucalgary.ca) as soon as possible with your exam solutions as an attachment (if possible) and a description of the issues that you have experienced.**

- There will be no grade deductions if the exam solutions are uploaded/submitted/mailed within the time limits listed below.**
- These time limits include a 50% time grace period for any issues that arise.**
- If issues during the exam are such that the midterm exam cannot be submitted within the time limit, weight from the midterm exam will be shifted to the final exam and labs.**

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**If a crisis/illness occurs during the final exam, the University's Academic Regulations on Examinations and Tests can be found at <https://www.ucalgary.ca/pubs/calendar/current/g.html>.**

**Midterm Exam**

**Start date/time: March 2, 6:00pm**

**Due date/time: March 3, 6:00pm**

**Exam length: 60 minutes**

**Time Extension: 50% - once started, the quiz solutions must be submitted within 90 minutes**

**Instructor availability: via email ([ruiswang@ucalgary.ca](mailto:ruiswang@ucalgary.ca)) March 2, 6:00pm – 7:00 pm**



# Lab Exercises

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Lab	Title
1	Fundamentals of image processing
2	Image filtering in spatial domain
3	Color image, frequency domain and feature points
4	Image segmentation and feature matching

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You have three-week time for each lab assignment

# Important Dates

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Date	Activities
13 Jan.	<ul style="list-style-type: none"><li>• First Lecture</li><li>• No lab in the first week</li></ul>
21 Jan.	<ul style="list-style-type: none"><li>• First lab exercise</li><li>• due by 11 Feb. 1:00pm (Thursday)</li></ul>
11 Feb .	<ul style="list-style-type: none"><li>• Second lab exercise</li><li>• due by 4 Mar. 1:00 pm (Thursday)</li></ul>
15-19 Feb.	<ul style="list-style-type: none"><li>• Reading week (no lectures)</li></ul>
4 Mar.	<ul style="list-style-type: none"><li>• Third lab exercise</li><li>• due by 25 Mar. 1:00pm (Thursday)</li></ul>
25 Mar.	<ul style="list-style-type: none"><li>• Fourth lab exercise</li><li>• due by 15 Apr. 1:00pm (Thursday)</li></ul>

# Late Submission Policy

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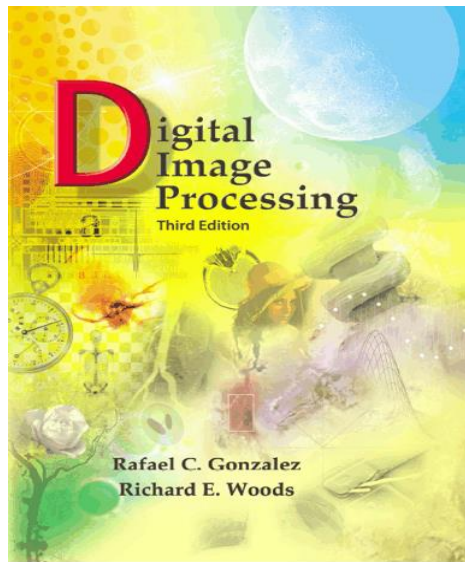
## Under normal circumstances

- 10% will be deducted for each of the following days
- After 7 days, there will be no marks

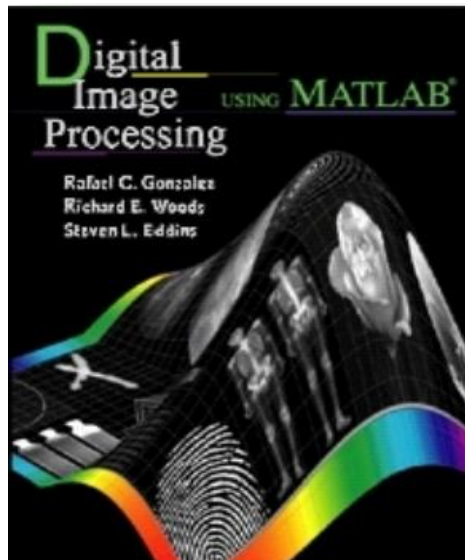
## Circumstances beyond control

- Let the instructor know your emergency at your earliest convenience

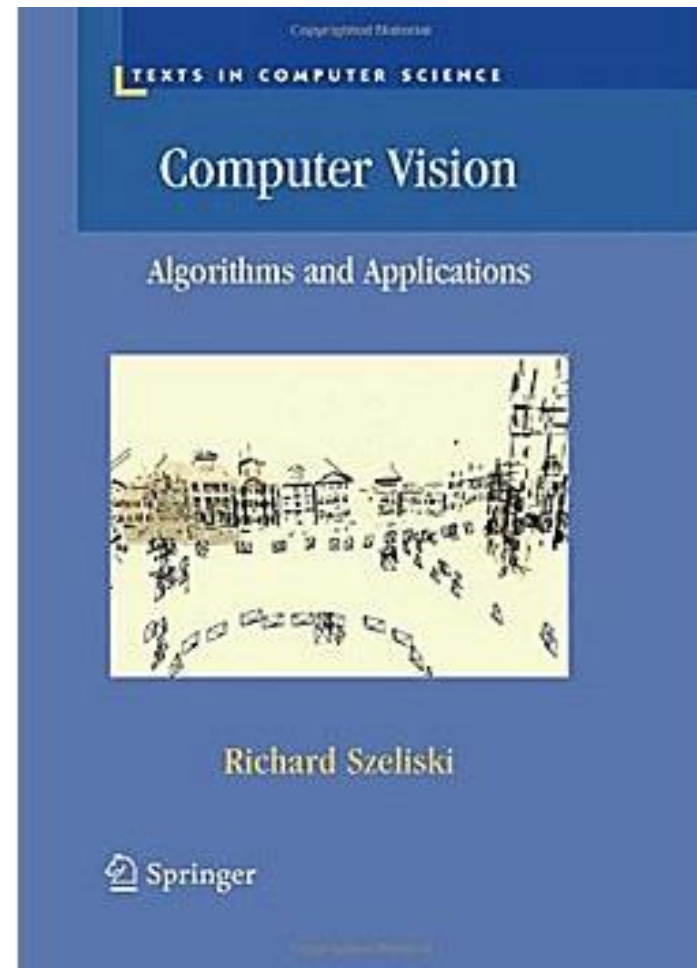
# Text Books



**Gonzalez, R.C,  
and Woods, R.E.  
(2008) Digital  
Image  
Processing, 3<sup>rd</sup>  
edition, Prentice  
Hall/Pearson**



**Gonzalez, R.C,  
Woods, R.E., and  
Eddins, S.L. (2004)  
Digital Image  
Processing using  
MATLAB, 1<sup>st</sup>  
edition, Prentice  
Hall/Pearson**



**available on line**