

**Geography 3231B**  
**Advanced Topics in Remote Sensing**  
**Winter 2015**  
**Course Outline**

First class: Monday, Jan. 5, 11:30 am - 1:30 pm, P&AB-34  
Lectures: Thursday, 2:30-4:30 pm, SSC - 1316A  
Labs: Monday, 11:30 am -1:30 pm, SSC - 1425

***Instructor Information***

Dr. Jinfei Wang  
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Office: SSC. 2402.  
Office hour: TBD

***Course Description:***

Themes to be considered may include: advanced computer analysis of digital satellite and airborne data (optical, infrared and radar), advanced image classification methods, texture analysis, change detection, automatic linear feature extraction, structural pattern recognition and remote sensing applications. Remote sensing software (PCI Geomatica) will be used.

**Prerequisite:** Geography 2230a/b.

2 Lecture hours, 2 laboratory hours, 0.5 course.

***Prerequisite checking - the student's responsibility:***

You are responsible for ensuring that you have successfully completed all course prerequisites, and that you have not taken an anti-requisite course. Lack of prerequisites may not be used as a basis for appeal. "Unless you have either the prerequisites for this course or written special permission from your Dean to enroll in it, you may be removed from this course and it will be deleted from your record. This decision may not be appealed. You will receive no adjustment to your fees in the event that you are dropped from a course for failing to have the necessary prerequisites."

***Course Materials***

**Recommended Textbooks:**

Jensen, J.R., 2005, "Introductory Digital Image Processing – A Remote Sensing Perspective", 3<sup>rd</sup> Edition, Prentice Hall. (ISBN 978-0-13-145361-6).

Jensen, J.R., 2007, "Remote Sensing of the Environment: An Earth Resource Perspective", 2<sup>nd</sup> Edition, Prentice Hall. (ISBN 978-0-13-188950-7).

Lillesand, T.M., Kiefer, R.W. and Chipman, J.W., 2008, "Remote Sensing and Image Interpretation", 6<sup>th</sup> Edition, John Wiley & Sons. (ISBN 978-0-470-05245-7).

Richards, A. J., 2013, "Remote Sensing Digital Image Analysis: An Introduction", 5<sup>th</sup> edition, Springer. (ISBN 978-3-642-30061-5 , ISBN 978-3-642-30062-2 (eBook)).

### **Methods of Evaluation:**

Lecture / lab / tutorial attendance and participation	10%
Lab assignments	15%
term paper and presentations	45%
Midterm test (March 12, 2015: 2:30 - 4:30 pm, SSC 1316A)	30%

### **Course Requirements:**

You are advised to read the academic calendar to familiarize yourself with the University's regulations and procedures.

1. Attendance and participation: All students are required to attend all the lectures and labs. Attendance may be taken randomly during any lecture and lab session. Participation includes in class discussion and exercises.
2. Test: All students are required to take the midterm test. Non-programmable scientific calculators are permitted. No other electronic devices are permitted. No other written aids are allowed. No make-up test will be given unless under extreme circumstances. If you consider that you have grounds to write the midterm test on an alternate date, you must obtain permission from the Dean's office and provide sufficient documentation. In addition, you must inform the instructor at least 2 days in advance before the midterm test.
3. Lab assignments and the term paper:  
You must attend all labs. You should observe all the due dates for the lab assignments and the term paper. Plagiarism or copying is unacceptable. Please follow the instructions for the term paper. The penalty of a late assignment and late term paper is  $2^n$  percent of the maximum mark for the assignment, where  $n$  = number of days late. (i.e., If you are late one day, 2% off; two days, 4% off; three days, 8% off; four days, 16% off; five days, 32% off; six days, 64% off; seven days, 100% off).
4. This course requires certain level of mathematics and statistics. It emphasizes on computer algorithms and digital image processing techniques, which will be introduced in lectures and labs, and tested in the midterm test.
5. Required computer storage devices: One or two USB memory key, or a portable hard drive for storing data and results. I suggest that you double backup your work on two

USBs, in case one USB has problems. Please note: do not insert your USB with the data from the Windows system to a Mac computer, since this may cause errors on your data.

6. Print credits: You will be given a limited number of free print credits for this course. If you need, you may purchase more credits for printing using the B/W laser printer(s) and colour laser(s) printer in the GIS lab. So make sure you check your print balance often.

**Academic Offences:**

Scholastic offences are taken seriously and students are directed to read the appropriate policy, specifically, the definition of what constitutes a Scholastic Offence, at the following Web site: <http://www.uwo.ca/univsec/handbook/appeals/scholoff.pdf> .

**Academic Accommodation:**

For UWO Policy on Accommodation for Medical Illness and a downloadable SMC see: [http://www.uwo.ca/univsec/handbook/appeals/accommodation\\_medical.pdf](http://www.uwo.ca/univsec/handbook/appeals/accommodation_medical.pdf)

Downloadable Student Medical Certificate (SMC): <https://studentservices.uwo.ca> under the Medical Documentation heading

Students seeking academic accommodation on medical grounds for any missed tests, exams, participation components and/or assignments worth 10% or more of their final grade must apply to the Academic Counselling office of their home Faculty and provide documentation. Academic accommodation cannot be granted by the instructor or department.

**Western's commitment to accessibility:**

The University of Western Ontario is committed to achieving barrier free accessibility for persons studying, visiting and working at Western.

Please contact the course instructor if you require material in an alternate format or if you require any other arrangements to make this course more accessible to you. You may also wish to contact Services for Students with Disabilities (SSD) at 661-2111 x 82147 for any specific question regarding an accommodation.

**Additional information**

Please contact the course instructor if you require material in an alternate format or if you require any other arrangements to make this course more accessible to you. You may also wish to contact Services for Students with Disabilities (SSD) at 661-2111 x 82147 (<http://www.sdc.uwo.ca/>) for any specific question regarding an accommodation.

If you or someone you know is experiencing distress, there are several resources here at Western to assist you. Please visit <http://www.uwo.ca/uwocom/mentalhealth/> for more information on these resources and on mental health.

Registrarial Services: <http://www3.registrar.uwo.ca/index.cfm>  
Student Development Services: <http://www.sdc.uwo.ca/>

# **Topics and readings**

## **1. Introduction**

Readings: Jensen, Introductory Digital Image Processing, Chapters 1 & 2.

- Introduction to remote sensing image processing
- Types of digital remotely sensed data

## **2. Geometric Correction**

Readings: Jensen, Introductory Digital Image Processing, Chapter 7.

- Geometric correction
- Introduction to [OrthoEngine](#)

## **3. Data Fusion, Vegetation Indices and Texture Analysis**

Readings: Jensen, Introductory Digital Image Processing, Chapter 8.

- Data fusion
- Vegetation indices
- Texture analysis

## **4. Pixel-based image Classification**

Readings: Jensen, Introductory Digital Image Processing, Chapters 9 and 13.

- Supervised classification
- Unsupervised classification
- Accuracy assessment
- Using [Geomatica](#) for image classification and accuracy assessment

## **5. Atmospheric Correction**

Readings: Jensen, Introductory Digital Image Processing, Chapter 6.

## **6. Change Detection**

Readings: Jensen, Introductory Digital Image Processing, Chapter 12.

- Band differencing
- Post-Classification

## **7. Object-based classification**

Readings: Jensen, Introductory Digital Image Processing, Chapter 9.

## **8. Radar and LiDAR Analysis**

Readings: Jensen, Remote sensing of the Environment, Chapters 9 and 10.

- Radar analysis
- LiDAR analysis

## **9. Structural Pattern Recognition and Remote Sensing Applications**

- Road network extraction
- Geologic Lineament extraction
- Other types of remote sensing data
- Remote sensing research and case studies (Guest speakers)

## Geography 3231B Tentative Schedule (Winter 2015)

	Date of Monday	Lecture topics	Labs assigned Monday	Due dates Monday
Week 1	Jan.5	Introduction to the course; Topic 1; Topic 2	First class	
Week 2	Jan.12	Topic 2	Tutorial 1	
Week 3	Jan.19	Topic 3	Lab 1	
Week 4	Jan.26	Topic 4	Lab 1	
Week 5	Feb.2	Topic 4	Lab 2	Lab 1 due
Week 6	Feb.9	Topic 4	Lab 2	
Week 7	Feb.16	Reading week	-	-
Week 8	Feb.23	Topic 5; Tutorial 2	Lab 3	Lab 2 due
Week 9	Mar.2	Topic 6; Topic 7	Lab 3/Tutorial 2	
Week 10	Mar.9	Midterm test, March 12, 2015 (2:30 pm – 4:30 pm)		Lab 3 due
Week 11	Mar.16	Topic 8 / Presentation of proposals		
Week 12	Mar.23	Topic 9 / Guest speaker / Class discussion, Preparation for presentation and paper	Tutorial 3	
Week 13	March 30	Presentation of final projects		
Week 14	Apr.6	No lab		
Week 15		Final paper due - Thursday, April 16		

Last day of class: April 8

Lab 1 - Geometric Correction

Lab 2 - High resolution supervised classification with textures

Lab 3 - High resolution unsupervised classification with textures

Tutorial 1 - Download remotely sensed data from the internet

Tutorial 2 - Atmospheric correction and change detection

Tutorial 3 - Radar image analysis using PolSARPro