[Course information is subject to change]

GEOG 482/582: Satellite Image Classification & Change Detection

Contact Information: Geoffrey Duh (jduh@pdx.edu, 503-725-3159)
4 credits with lectures and lab components. Lab attendance is mandatory.

Course Objectives

This course focuses on advanced satellite image classification methods that can be used for thematic information extraction as well as digital change detection methods for measuring land use/ land cover change. The course includes computer exercises in advanced classification methods (e.g., Fuzzy and decision tree classification), radiometric normalization, and change detection using leading satellite image processing software packages including ERDAS Imagine and IDRISI Andes.

Readings

The course readings are a series of papers that will be distributed by the instructor as well as digital documents. The course will be taught in a seminar format. Each student will pick and read several journal papers and be a discussion leader to review and criticize these papers. The optional textbook can be used as a reference book for term project.

Optional textbook: Jensen, J. R. 2005. *Introductory Digital Image Processing* (3rd edition). Prentice Hall.

Grading

Discussion/Article Critique- Synopsis 40%
Labs 30%
Project/Portfolio 30%
(There will be no exams in this course.)

Attendance to this course is mandatory. If you miss more than two class periods then you will be penalized five percent of your final grade per absence. PLEASE DO NOT MISS CLASS. You are expected to take part in the discussions and if you are not in class then you cannot. If you are repeatedly late you will be given an absence.

Discussion/ Article Critique- Synopsis (40%)

The course will be taught in a seminar format, which means that students are not passive members of the class. Each student is expected to actively contribute to each class period. To facilitate an interactive discussion each student will lead journal article discussion **once** during the semester for which they will receive a grade. The discussion leader must do three things. First, s/he must thoroughly read the readings and **write a 1-2 page critique/synopsis**. The synopsis part should highlight the main points of the

readings and the critique part should identify strengths and weaknesses of the readings. Second, this person should **develop 4 discussion questions.** These questions, as well as the critique/synopsis, should be typed with answers and given to the instructor one day before the class. Third, this person is responsible for leading the classroom discussion along with the instructor. It is important that everyone in the class take part in these discussions. Therefore, class attendance and participation are mandatory.

Labs (30%)

You will conduct labs that will help you learn the methods necessary to do a project. The practical exercises provide a way to acquire skills using ERDAS Imagine and IDRISI Andes (i.e., Version 15) and to apply the course concepts to real data. The lab manual (ERDAS Tour Guide) and ERDAS Field Guide are available in Acrobat pdf format in the **I:\Students\Instructors\Geoffrey_Duh\ERDAS Imagine** folder.

Project/Portfolio (30%)

A satellite remote sensing project is required for all students. You can follow this link to find public remotely sensed data for your project. The project is intended to provide a deeper understanding of image classification and/or change detection through experience. You must submit an outline of your project in the 4th week and present the project during a scheduled time at the end of the term. Every project presentation must include the following sections: an Introduction, Data, Methods, Results, and Conclusions. **At the end of the course you must hand in a portfolio of all of your lab work and project** (including a digital copy of their powerpoint ppt). The portfolio should present the highlights of your labs and project. You must compile a one-page synopsis and a one-page images/pictures/maps for each lab (except for Lab 1) and a two-page (maximum) synopsis and a two-page (maximum) pictures for your project. These documents should be bound or stapled together with a cover page showing your name, course information, and date.

Course Schedule

Week	Lecture/Seminar	Lab/Project
1	Syllabus Lab 1. Journal articles search (Due by noon pm April 9) (10 points)	Course Overview & Review of Digital Image Analysis
2	Remote Sensing Applications (NASA Online Tutorial Section 3: vegetation Applications)	Lab 2. Knowledge-based classification
3	GIS in Action conference	Lab 2.
4	Change Detection (Readings Mas 1999 and Lu et al. 2004) Project Outline Due	Lab 3. Radiometric normalization

5	Journal Article Discussion	Lab 4. Change vector analysis
6	Multispectral and LiDAR remote sensing for vegetation mapping	Lab 5. Advanced classifier
7	Journal Article Discussion	Lab 3.
8	Journal Article Discussion	Portfolio/Project discussion
9	Journal Article Discussion	Students work on their project
10	Journal Article Discussion	Students work on their project
Final	Project presentations (during scheduled exam time) PORTFOLIO DUE	

Sample Journal Articles

Week 4. Change Detection I

Mas, J.-F. 1999. Monitoring land-cover changes: a comparison of change detection techniques. *International Journal of Remote Sensing*, 20 (1): 139-152.

Lu, D., Mausel, P., Brondizio, E., and Moran, E. 2004. Change Detection Techniques. *International Journal of Remote Sensing*, 25 (12): 2365-2401.

Week 5. Fuzzy/Subpixel Classification

Weng, Q.H., Lu, D.S., Liang, B.Q. Nov. 2006. Urban surface biophysical descriptors and land surface temperature variations. *Photogrammetric Engineering and Remote Sensing*, 72 (11): 1275-1286.

Okeke, F. and Karnieli, A. 2006. Methods for fuzzy classification and accuracy assessment of historical aerial photographs for vegetation change analyses. Part I: Algorithm development. *International Journal of Remote Sensing*, 27 (1–2): 153–176.

Binaghi, E. et al. 1999. A fuzzy set-based accuracy assessment of soft classification. *Pattern Recognition Letters*, 20: 935–948.

Week 6. No readings

Week 7. Radiometric Correction / Change Detection II

Paolini, L., Grings, F., Sobrino, J. A., Jiménez, M., Juan, C., and Karszenbaum, H. 2006. Radiometric Correction Effects in Landsat Multi-Date/Multi-Sensor Change Detection Studies. *International Journal of Remote Sensing*, 27 (3/4): 685-704.

Cohen WB, Spies TA, Alig RJ, et al. Characterizing 23 years (1972-95) of stand replacement disturbance in western Oregon forests with Landsat imagery. *Ecosystems*, 5(2): 122-137.

Week 8. Change Detection III

Millward, A.A, et al. 2006. Time-Series Analysis of Medium-Resolution, Multisensor Satellite Data for Identifying Landscape Change. *PE&RS*, 72(6): 653-663.

Petit, C.C. and Lambin, E.F. 2001. Integration of multi-source remote sensing data for land cover change detection. *International Journal of Geographical Information Science,* 15 (8): 785-803.

Week 9. Object-Based Classification

Gao, Y., Mas J. f., Maathuis, B. H. P., Zhang, X. M. and Van Dijk, P. M. 2006. Comparison of pixel-based and object-oriented image classification approaches - a case study in a coal fire area, Wuda, Inner Mongolia, China. *International Journal of Remote Sensing*, 27(18): 4039-4055.

Laliberte, A. S., Rango, A., Havstad, K. M., et al. 2004. Object-oriented image analysis for mapping shrub encroachment from 1937 to 2003 in southern New Mexico. *Remote Sensing of the Environment*, 93 (1-2): 198-210.

Week 10. Advanced Image Processing for Image Classification

Chen, C.-M., Hepner, G.F., Forster, R.R. 2003. Fusion of hyperspectral and radar data using the IHS transformation to enhance urban surface features. *ISPRS Journal of Photogrammetry & Remote Sensing*, 58(1/2): 19-30.