

GEOPHYSICS 5336: DIGITAL IMAGE PROCESSING

University of Texas at El Paso

**Department of Geological Sciences
Fall Semester 2008**

Instructors:

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Class Website:

<http://www.geo.utep.edu/pub/hurtado/5336>

Check the class website often for updates and announcements. The website is a key part of the class and will be the venue for a lot of important class business.

Class Meetings:

Lectures: Mon. and Fri., 11:30 am-12:20 pm (Geology 302)
Lab/Lecture: Thurs., 12:30-3:20 pm (4th Floor Computer Lab)
Office Hours (JMH): Wed., 11 am-3 pm, or by appointment (Geology 319)
Office Hours (BK): Mon.-Wed., 3-4 pm, or by appointment (Geology 317)

Text:

John R. Jensen, 2004, *Introductory Digital Image Processing, A Remote Sensing Perspective (3rd ed.)*, Prentice Hall: Upper Saddle River, NJ, 544 p.
(ISBN-13: 978-0131453616)

Handouts and supplemental materials from a variety of sources will be provided throughout the semester. We will discuss some journal articles in class. In addition, the web and the Matlab® and ENVI® documentation will be critical resources during the semester.

Grading:

Lab assignments (60%); final project (imagery, software, paper, and presentation) (30%); lecture and lab participation (10%).

Lab work will be assigned and due on Thursdays. Note that most assignments will be turned in electronically (or as otherwise instructed). Storage space, data, and software will be made available to you on the Geology department computer system. Therefore, you will all need accounts to access to the UTEP open-lab PCs on the 4th floor. Contact the instructors or the system administrator, Carlos Montana (montana@geo.utep.edu), if you do not have access already.

The final project is intended to be a serious scientific product that could (eventually) be published. If you have your own research interest, feel free to talk

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to me and pursue it. **All of you must choose a topic by the third week of the semester. An outline/abstract will be due around midterms. The completed project, including paper and oral presentation, is due the last week of class.**

Policies:

Show up, show up on time, and show up prepared! Do each reading assignment before attending class, and come to class meetings with questions about what you read and about material from the previous class meeting. Attendance and class participation in both lecture and lab are required. **We reserve the right to drop you from the course if you have excessive absences. Please contact the instructors about any concerns, schedule conflicts, missed work, etc. ASAP and, whenever possible, in advance.** Valid excuses include illness, absence with the instructor's prior approval, official University business, etc., but **all require documentation**. Unless other arrangements with the instructors are made, **late work will not be accepted and make-up exams and assignments will not be given.**

While **collaboration on assignments is encouraged**, the intent is to foster problem-solving skills and mastery of the subject matter, not just a quick way to get "answers". **All work is expected to be your own!** The University guidelines for acceptable student conduct are very specific and will be strictly followed. Please read the guidelines (see <http://studentaffairs.utep.edu/dos>), and contact the Dean of Students or the instructors if you have any concerns.

Expectations:

The goal of this course is for you to attain a firm understanding of the processing of remotely-sensed digital images in the context the Earth and environmental sciences. You will learn how, why, and when to apply digital image processing techniques in order to produce image products of value in answering scientific questions in your own research. The emphasis in this course will be on applications and basic concepts, but there will be mathematical treatments of topics in statistical analysis, Fourier analysis, photogrammetry, and interferometry, among other topics. Students will be given access to state-of-the-art computer facilities and instruction on how to use the popular image processing software ENVI®. Students can expect to gain proficiency in basic Matlab® programming in the course of the laboratory work. There will be considerable emphasis on independent work towards a term project. Students are expected to be active participants in the class and laboratory discussions and will be asked to make presentations in class. In particular, the results of term projects will be presented orally.

Course Outline:

Note that the details of our schedule are likely to change as the semester progresses. Please be flexible, and let the instructors know if you have any concerns or suggestions.

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Week	Meeting Dates (MRF)	Lecture Topics (MF)	Reading Assignments	Lab Assignment (R) (ML = Matlab; E = ENVI)
Week 1	Aug. 25, 28, 29	Introduction; Review of Remote Sensing M – Jose; F – Jose	Jensen Ch. 1-5 Handouts	Lab 1: Introduction to Matlab and ENVI (ML/E) Jose & Bridget
Week 2	Sept. 4, 5 No class M	Digital Images; Image Math & Statistics; Software F – Bridget	Jensen Ch. 1-5 Handouts	Thursday lecture; No lab Bridget
Week 3	Sept. 8, 11, 12 BK gone 9/8	Image Pre-processing (Geometric) M – Jose; F – Jose	Jensen Ch. 7 Handouts	Lab 2: Geometric Processing (ML) Jose & Bridget
Week 4	Sept. 15, 18, 19	Image Pre-processing (Radiometric) M – Jose; F – Jose	Jensen Ch. 6 Handouts	Lab 3: Radiometric Correction (E) Project topic due (Friday) Jose & Bridget
Week 5	Sept. 22, 25, 26 BK gone 9/22	Spatial-Domain Filtering M – Jose; F – Bridget	Jensen Ch. 8 Handouts	Lab 4: Filtering (ML/E) Jose & Bridget
Week 6	Sept. 29, Oct. 2, 3	Frequency-Domain Enhancement M – Bridget; F – Bridget	Jensen Ch. 8 Handouts	Lab 5: Frequency domain processing (ML/E) Jose & Bridget
Week 7	Oct. 10 No class MR; GSA JMH gone all week	Image Data Sources & Characteristics F – Bridget	Jensen Ch. 2 Handouts	No lab Project abstract/outline due (Friday)
Week 8	Oct. 13,16, 17 Earth Sci Week	Image Enhancement M – Jose; F – Jose	Jensen Ch. 5, 8, 11 Handouts	Lab 6: Image Enhancement 1 (ML) Jose & Bridget
Week 9	Oct. 20, 23, 24	Image Transforms M – Jose; F – Bridget	Jensen Ch. 5, 8, 11 Handouts	Lab 7: Image Enhancement 2 (ML) Jose & Bridget
Week 10	Oct. 27, 30, 31 BK gone 10/27,30	Principal Components Analysis M – Jose; F – Jose	Jensen Ch. 4, 8 Handouts	Lab 8: Principal Components Analysis (ML) Jose
Week 11	Nov. 3, 6, 7 JMH gone 11/5-7	Change Detection M – Bridget; F – Bridget	Jensen Ch. 12 Handouts	Lab 9: Change Detection (ML) Bridget
Week 12	Nov. 10, 13, 14	Classification M – Jose; F – Jose	Jensen Ch. 9-11, 13 Handouts	Lab 10: Classification (E) Jose & Bridget
Week 13	Nov. 17, 20, 21	Applications and Case Studies M – Bridget; F – Bridget	Handouts	Thursday lecture; No lab Bridget
Week 14	Nov. 24 No class RF	Visualization M – Bridget	Jensen Ch. 3, 5 Handouts	No lab
Week 15	Dec. 1, 3 No class F	Student Final Projects	N/A	Project Presentations (in class) Project Papers (due by Dec. 10)

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