UNIVERSITY OF ALASKA FAIRBANKS
eLearning & Distance Education
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TITLE: Remote Sensing Applications in Natural Resources Using ArcGIS

NUMBER: NRM641

CREDITS: 3

PREREQUISITES: Basic ArcGIS experience

LOCATION: Distance Delivery from Fairbanks campus

MEETING TIME: Spring Semester 2016

INSTRUCTOR: Dr. David Verbyla (email: dlverbyla@alaska.edu)

OFFICE LOCATION: ONEILL 368

OFFICE HOURS: TuW 1-2pm face to face, or phone/email
or email any time (I try to return emails within 24 hours of receiving them)

TELEPHONE: 907-474-5553

EMAIL ADDRESS: dlverbyla@alaska.edu

COURSE DESCRIPTION

This course is primarily for graduate students and GIS professionals who want to learn remote sensing applications in natural resource management using a variety of remotely sensed Alaska data ranging from high resolution LIDAR to statewide AVHRR data. The class will be taught using a sequence of weekly video sessions and weekly hands-on ArcGIS problems.

COURSE GOALS

1) **To learn basic image processing methods using ArcGIS including panchromatic and color image display, image fusion, image georeferencing, change detection methods, supervised and unsupervised classification, and accuracy assessment methods.**

2) **To learn about sensors especially applicable to vegetation applications in Alaska including color infrared aerial photography, LIDAR, IFSAR,Landsat, MODIS, and AVHRR sensors and data products.**

3) **To use ArcGIS to explore changes associated with climate warming in Alaska including greening of the arctic, browning of the boreal forest, mapping wildfire severity and hotspots, mapping shrinking lakes and coastal erosion, etc.**

STUDENT LEARNING OUTCOMES

After successfully completing this course you will:

Understand what spectral bands are most appropriate for a variety of remote sensing applications

Understand how to effectively display panchromatic, color, color infrared and false color imagery.

Understand how to merge panchromatic and multispectral bands and how to create fly in and fly-by animations.

Use unsupervised classification and supervised classification methods to create land cover maps.

Co-register and use historic remotely sensed imagery for change detection applications.

Use ground truth locations to quantitatively assess the accuracy of remote sensing classifications.

Process global AVHRR Normalized Difference Vegetation Index (NDVI) data to assess the greening of arctic Alaska and the browning of boreal Alaska.

Use MODIS NDVI data to assess NDVI response following the 2004 drought in interior Alaska.

Work with MODIS snow cover data to map 2012-2013 growing season length in Alaska.

Map and assess fire severity using Landsat-sensor Normalized Burn indices.

Derive weekly hotspot density rasters and wildfire polygons based on MODIS hotspot thermal anomaly product.

Produce a lightning density map from a 2013 lightning strike dataset.

Assess the accuracy and precision of LIDAR elevation estimates.

Use LIDAR to map tall tree locations and to map canopy closure distributions by forest type.

Apply your skills learned in this course to:

Map glacier recession based on historic remotely sensed imagery.

Visualize coastal erosion and reduced sea ice extent based on historic remotely sensed imagery.

Map projected flooding associated with projected sea level rise using LIDAR elevation estimates.

Map shrinking lakes based on historic remotely sensed imagery.

COURSE READINGS/MATERIALS

Online references including ArcGIS help for image processing tools, websites specific to sensors.

TECHNICAL REQUIREMENTS

This course uses ArcGIS software which is available for free to all UA students through http://www.alaska.edu/oit/restricted/ . ArcGIS is a MS windows based GIS and requires windows XP or higher.

The course also requires internet access for blackboard video sessions and quizzes (https://www.uaf.edu/bblearn/prod/). If you have slow internet access, I can send you the video sessions and data on a DVD.

INSTRUCTIONAL METHODS

Each week will be a series of video sessions with each session leading the student in a hands-on arcgis exercise. There will be a blackboard quiz at the end of each weekly session for the first ten weeks of the course. The final four weeks of the course will be four remote sensing applications where the student solves an Alaska landscape change problem associated with climate warming.

Blackboard Quiz Due Dates:

25-Jan-2016 5pm Week1 Image Display
01-Feb-2016 5pm Week2 Using Elevation With Image Displays
08-Feb-2016 5pm Week3 Spectral Regions
15-Feb-2016 5pm Week4 Image Georeferencing
22-Feb-2016 5pm Week5 Supervised Classification
29-Feb-2016 5pm Week6 Unsupervised Classification
08-Mar-2016 5pm Week7 AVHRR Sensor
Spring Break
22-Mar-2016 5pm Week8 MODIDS Sensor
29-Mar-2016 5pm Week9 Landsat Sensor
05-Apr-2016 5pm Week10 LIDAR Applications
12-Apr-2016 5pm Week11 Point Sensor Applications

Four Climate Warming Mini-Projects due by 5pm Friday 6-May-2016

COURSE SCHEDULE

Module 1: Image Processing Methods (January 14 – March 7, 2016).
In this module you will use ArcGIS to learn basic image processing methods. Each week you will learn via hands-on ArcGIS exercises lead via video sessions. I will assess your learning at the end of each video session and at the end of each week via blackboard quiz questions. We will start by creating test rasters from text files, learning about raster properties such as raster types, raster attribute tables, raster bands,etc. You will learn how to query and clip rasters, how to display 1-bit binary rasters, pseudocolor rasters, panchromatic and true color rasters. In week#2, you will learn how to use an elevation raster to improve raster display for cartographic applications and how to pan sharpen rasters. You will learn how to create animations using rasters including drop down, fly-by and temporal animations. In week# 3 you will learn about spectral regions used in remote sensing including the visible, near-infrared, short-wave infrared and thermal infrared spectral regions. You will also learn about tradeoffs between spectral, spatial, and temporal resolutions in remote sensing. In week#4 you will learn how to georeference remotely sensed images to a planar coordinate system so that image fit with your projected GIS data. You will also learn how to co-register a time series of imagery for change analysis applications. You will learn how to create land cover maps using supervised classification methods in week#5 and using unsupervised classification methods in week#6. In week#7, you will learn how to assess the positional and classification accuracy of images and how poor image co-registration could lead to biased estimates of land cover change.

Module 2: Sensors and sensor products (March 8 – April 18).
In this module, you will learn about remote sensing data from a variety of sensors ranging from global 8-km pixels to small area 1-m pixels. . I will assess your learning at the end of each video session and at the end of each week via blackboard quiz questions. We will start big…with global AVHRR data from North America and explore the greening of the arctic and browning of the boreal forest. Next we will look at an AVHRR product for Alaska that includes radiant temperature at 1km pixels. We will then investigate MODIS products for 2 weeks including 250-meter pixel NDVI and 1km pixel snow cover products as well as point locations representing thermal anomalies or hotspots. We will then develop a 2013 lightning density map for Alaska based on a ground-based network of detectors. Next you will learn about the Landsat sensors and applications including wildfire severity mapping. Finally you will learn about LIDAR and use LIDAR to map tall trees and percent canopy closure within a boreal forest.

Module 3: Climate Change Applications (April 19 – May 2).
This will be a project-based module where you will apply your newly acquired skills to remote sensing applications associated with historic and potential effects of climate change in Alaska. In the first application you will create pdf poster of shrinking sea ice extent in Arctic Alaska and associated coastal erosion. In the second project, you will create a temporal animation showing the change of the Columbia Glacier in Prince William Sound from the mid 1980s to present. In the third project, you will create a point feature class of lakes that completely dried between the 1980s and present for an area along the Copper River. The last project looks into the future, where you will map the area that would be flooded if sea level rises 50 cm by 2050. You will submit your GIS product for each of these projects for learning assessment.

COURSE POLICIES

Participation

You will use ArcGIS and follow along as I teach you new concepts in each video session. After each video session, I will assess your understanding using a question posted through the class blackboard website. Your understanding will also be assessed most weeks using a quiz posted through the class blackboard website.

You should post any sources of confusion and solutions through the class Google+ site to share learning among class participants.

Late Work Policy

Late work will not be accepted, since some weekly sessions assume you have mastered previous weekly sessions.

Academic Integrity

As described by UAF, scholastic dishonesty constitutes a violation of the university rules and regulations and is punishable according to the procedures outlined by UAF. Scholastic dishonesty includes, but is not limited to, cheating on an exam, plagiarism, and collusion. Cheating includes providing answers to or taking answers from another student. Plagiarism includes use of another author's words or arguments without attribution. Collusion includes unauthorized collaboration with another person in preparing written work for fulfillment of any course requirement. Scholastic dishonesty is punishable by removal from the course and a grade of "F." For more information go to Student Code of Conduct. (http://www.uaf.edu/catalog/catalog_08-09/academics/regs3.html#Student_Conduct)

HOW TO SUBMIT ASSIGNMENTS

Weekly quizzes will be available through blackboard (https://www.uaf.edu/bblearn/prod/) and four projects will be submitted using Google Docs.

HOW TO CHECK YOUR GRADE

Check your grade by clicking on the 'My Grades' link in the left side menu of the Blackboard course shell. A green icon indicates that the assignment has not been graded. Please read all instructor feedback provided on graded assignments.

HOW TO GET HELP

We will have a Google+ site for posting of questions and answers to share among students in this class.

I will be available to help you Monday through Thursdays noon-1pm via phone, Google+, (or in person if your at the UAF campus). I will try to answer any of your email questions within 24 hours.

EVALUATION POLICIES

Course grade will be based on total points earned based on ten highest of 11 blackboard quizzes (@10 points each) and four application projects (@25 points each). Late submissions will not be accepted.

Total Points	**Grade:**
>180	**A**
160 – 180	**B**
150 – 160	**C**
140 – 150	**D**
< 140 points	**F**

EFFORT AND STUDENT INVOLVEMENT

Instruction:45% primarily via weekly video sessions
Assignments:45% weekly ArcGIS work and four project-based assignments

Pacing Expectations

Although actual hours spent each week will vary between individuals, students should expect to spend an average of 9 hours per week on this course.

EXPLANATION OF W, NB, I GRADES

Withdrawals

Successful, Timely Completion of this Course Starting and establishing your progress through this course early can help to encourage your successful completion of the course. Toward this end, this course adheres to the following UAF eLearning & Distance Education procedures:

1. The first contact assignment is due one week after the first day of instruction. *Failure to submit this assignment within the first two weeks of the course could result in withdrawal from the course.*
2. The first content assignment is due one week after the first day of instruction. *Failure to submit this assignment within the first two weeks of the course could result in withdrawal from the course.*
3. *Failure to submit the first three content assignments by the deadline for faculty-initiated withdrawals (the ninth Friday after the first day of classes) could result* ***in instructor initiated withdrawal from the course (W)****.*

No Basis Grades

This course adheres to the UAF eLearning Procedure regarding the granting of NB Grades The NB grade is for use only in situations in which the instructor has No Basis upon which to assign a grade. In general, the NB grade will not be granted.

Incompletes

Your instructor follows the University of Alaska Fairbanks Incomplete Grade Policy.
"The letter "I" (Incomplete) is a temporary grade used to indicate that the student has satisfactorily completed (C or better) the majority of work in a course but for personal reasons beyond the student's control, such as sickness, he has not been able to complete the course during the regular semester. Negligence or indifference are not acceptable reasons for an "I" grade."

SUPPORT SERVICES

UAF eLearning Student Services helps students with registration and course schedules, provides information about lessons and student records, assists with the examination process, and answers general questions. Our Academic Advisor can help students communicate with instructors, locate helpful resources, and maximize their distance learning experience. Contact the UAF eLearning Student Services staff at 907- 479-3444 or toll free 1-800-277-8060 or contact staff directly – for directory listing see: http://distance.uaf.edu/staff/ .

UAF Help Desk

Click here (http://www.alaska.edu/oit/) to see about current network outages and news.
Reach the Help Desk at:
· e-mail at helpdesk@alaska.edu
· fax at (907)-450-8312
phone in the Fairbanks area is 450-8300 and outside of Fairbanks is 1-800-478-8226

DISABILITIES SERVICES

The **UAF Office of Disability Services** operates in conjunction with CDE. Disability Services, a part of UAF's Center for Health and Counseling, provides academic accommodations to enrolled students who are identified as being eligible for these services.

If you believe you are eligible, please visit their web site (http://www.uaf.edu/apache/disability/) or contact a student affairs staff person at your nearest local campus. You can also contact Disability Services on the Fairbanks Campus by phone, 907-474-7043, or by e-mail (fydso@uaf.edu).