

Remote Sensing Applications in Natural Resources Using ArcGIS

NRM641 CRN 35760

<https://elearning.uaf.edu/courses-code-keep/course-details-17-18/?crn=35760>

CREDITS: 3

PREREQUISITES: Basic ArcMap experience

LOCATION: Distance Delivery from Fairbanks campus

MEETING TIME: Spring Semester 2018 Jan. 16 – May 1

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

OFFICE LOCATION: ONEILL 368

OFFICE HOURS: Tues/Weds 1-2pm face to face, google hangout, 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 ArcMap including panchromatic pseudocolor, and color image display, 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 hyperspectral data, 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.

Supported by



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Week:	ArcMap Display and Classification Methods:
January 16 -19	Raster Display in ArcMap: <ul style="list-style-type: none"> • Raster Surprises in ArcGIS • Querying and Clipping Rasters • One Bit Binary and Psuedocolor Images • 8-bit Panchromatic Images • True Color Image Display
January 22-26	Image-based pdf posters and animations in ArcMap: <ul style="list-style-type: none"> • Hillshade Rasters • Hillshade Sharpening • Drop-Down Animations • Fly-By Animations • Temporal Animations
Jan 29 – Feb 2	Exploring Spectral Regions Using ArcMap: <ul style="list-style-type: none"> • Visible Spectral Regions • Near Infrared Spectral Region • SWIR Spectral Region • Thermal Spectral Region • Hyperspectral Remote Sensing • Analysis of Spectral Responses
Feb 5 - 9	Georeferencing With ArcMap: <ul style="list-style-type: none"> • Linear Georeferencing Model • Arcmap Georeferencing Toolbar • Co-Registration of Historic Imagery • Georeferencing Photographs • Artificial Change Due to Co-Registration Error
Feb 12 - 16	Supervised Classification <ul style="list-style-type: none"> • Maximum Likelihood Classifier • Supervised Classification in ArcMap • Image Segmentation • Point-Based Classification Accuracy Assessment
Feb 19 - 23	Unsupervised Classification <ul style="list-style-type: none"> • Spectral Clustering • Spectral Clustering in ArcMap • Using ArcMap to Fix Mixed Spectral Classes • Raster-Based Classification Accuracy Assessment

	Sensor Applications
Feb 26 – Mar 2	AVHRR Sensor Applications: <ul style="list-style-type: none"> • The Advanced Very High Resolution Radiometer • Processing GIMMS-NDVI Rasters • 20-Year Change in Peak Summer NDVI By Ecoregion • Working with 1-KM AVHRR Alaska Products
Mar 5 - 8	MODIS Sensor Applications <ul style="list-style-type: none"> • MODIS Land Products • Assessing MODIS NDVI Reliability • Assessing eMODIS NDVI Reliability • Working With 250-m NDVI Tiles in Alaska • 500-m Snow Product in Alaska
Mar 12 -16	Spring Break (no classes)
Mar 19 - 22	Landsat Sensor Applications: <ul style="list-style-type: none"> • Landsat Sensors • Mapping Burned Areas • Mapping Arctic Greening • Mapping Aspen Defoliation • Mapping Radiant Temperature
Mar 26 – Mar 30	IFSAR and LIDAR Applications: <ul style="list-style-type: none"> • Working With IFSAR Data • Assessing LIDAR Precision and Accuracy • Using LIDAR to Locate Tall Trees • Using LIDAR to Map Percent Forest Canopy Closure
April 2 -5	Point Sensor Applications: <ul style="list-style-type: none"> • Creating Density Maps From Point Locations • Mapping Hotspot Polygons • Interpolating Depth Points • Lightning Detections and Weather Station Data
April 9 – May 1	Student Climate Warming Mini-Projects (4 of 8) <ul style="list-style-type: none"> • Mapping Lake Area Change in a Warming Boreal Climate • 25-Year Trend in Annual Maximum NDVI • 35-Years of Declining Sea Ice Extent • Mapping Glacier Recession in the Alaska Range • Mapping Coastal Erosion in a Warming Arctic • Decadal Arctic NDVI and Summer Warmth Index • Winter Warming, Canopy Icing, and White Spruce Mortality • Declining Sea Ice Concentration and Autumn Warming at Barrow

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 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://classes.alaska.edu>). If you have slow internet access, I can send you the video sessions and data on a DVD.

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.

Late Work Policy

Late work will not be accepted, since some weekly sessions assume you have mastered previous weekly sessions. Blackboard quizzes expire at 5pm on the Monday of due date.

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

EXPLANATION OF NB/I/W GRADES

This course adheres to the UAF 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.*

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."

Successful, timely completion of this course depends on committing yourself early and maintaining your effort. To this end, this course adheres to the following UAF eLearning Procedures:

1. The first contact assignment (Introduction) 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 (Lesson 1) 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 (Assignments 1, 2 and 3) 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).*

INSTRUCTOR RESPONSE TIME

I try to return emails within 24 hours of receiving them

HOW TO CHECK YOUR GRADE

To check your grades in <https://classes.alaska.edu>, click on the My Grades link in the sidebar menu. All the assignments and their due dates are listed. If the score is for a test or quiz, click on the check mark or your score to see results and feedback.

EFFORT AND STUDENT INVOLVEMENT

Instruction:45% primarily via weekly video sessions

Assignments:45% weekly ArcGIS work and four project-based assignments

EXPECTATION OF STUDENT EFFORT

Students should expect to spend 10-12 hours per week on this class. Students need to complete the weekly blackboard assignments by their due dates. I can supply you with a class DVD containing the first eleven weeks of the course video sessions and data if you prefer instead of using blackboard to view the video 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://uaf.edu/usa/student-resources/conduct>)

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 907.455.2060 or toll free 1.800.277.8060 or contact staff directly – for directory listing see: <http://elearning.uaf.edu/contact>

UAF Help Desk

Go to <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: 907.450.8312
- phone: 450.8300 (in the Fairbanks area) or 1.800.478.8226 (outside of Fairbanks)

DISABILITIES SERVICES

The **UAF Office of Disability Services** operates in conjunction with UAF eLearning. 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/disability/>) or contact a student affairs staff person at your local campus. You can also contact Disability Services on the Fairbanks campus by phone, 907.474.5655, or by e-mail (uaf-disabilityservices@alaska.edu).

TITLE IX PROTECTION

University of Alaska Board of Regents have clearly stated in BOR Policy that discrimination, harassment and violence will not be tolerated on any campus of the University of Alaska. If you believe you are experiencing discrimination or any form of harassment including sexual harassment/misconduct/assault, you are encouraged to report that behavior. If you report to a faculty member or any university employee, they must notify the UAF Title IX Coordinator about the basic facts of the incident.

Your choices for reporting include:

1. You may access confidential counseling by contacting the UAF Health & Counseling Center at 474-7043;
2. You may access support and file a Title IX report by contacting the UAF Title IX Coordinator at 474-6600;
3. You may file a criminal complaint by contacting the University Police Department at 474-7721.