GIST 58: REMOTE SENSING & DIGITAL IMAGE PROCESSING

Foothill College Course Outline of Record

Heading	Value
Units:	3
Hours:	2 lecture, 3 laboratory per week (60 total per quarter)
Advisory:	Not open to students with credit in GEOG 58.
Degree & Credit Status:	Degree-Applicable Credit Course
Foothill GE:	Non-GE
Transferable:	CSU
Grade Type:	Letter Grade (Request for Pass/No Pass)
Repeatability:	Not Repeatable

Student Learning Outcomes

- Define remote sensing.
- Discuss the applications of remote sensing with Geographic Information Systems (GIS)
- Discuss the physical basis for remote sensing in terms of the electromagnetic spectrum.

Description

Physical basis of remote sensing. Aerial photography and high resolution multi-band imaging. Satellite multi-band optical remote sensing. Other forms of remote sensing (RADAR, SAR, LIDAR). Applications of remote sensing.

Course Objectives

The student will be able to:
A. define remote sensing.
B. discuss the applications of remotes sensing with Geographic Information Systems (GIS).
C. discuss the physical basis for remote sensing in terms of the electromagnetic spectrum.
D. evaluate three remote sensing platforms and discuss their applications.

Course Content

A. Remote sensing overview
1. Definition of remote sensing
2. Remote sensing assumptions
3. Advantages of using remote sensing
4. Correlating remotely sensed data with ground data
B. Physical basis for remote sensing
1. The electromagnetic spectrum
a. Overview
b. Visible (short) wavelengths
c. Near-infrared wavelenghs
d. Mid-infrared wavelengths
e. Thermal wavelengths
f. Microwave (long) wavelengths
g. Spectral bands
2. Atmospheric effects
a. Overview of interaction between radiation and targets
b. Reflected, emitted and absorbed radiation
c. Description of energy path
d. Atmospheric scattering and absorption
3. Reflectance of terrain materials, transmission of water (optical)
a. Spectral signatures across wavelengths
b. Comparison of spectral patterns
c. Changes of signatures over time and space
4. Microwave remote sensing (SAR, RADAR and thermal)
a. RADAR geometry
b. Backscatter
c. Interpreting surface cover
d. Advantages and disadvantages
C. Multi-band image interpretation
1. How multi-band image display works
a. Image bands vs. software/computer color guns
b. Additive color
c. Image pixel values and color
2. False color imagery
3. Histogram interpretation
a. Overview of histograms
b. Relationship between image bands and histograms
c. Relationship between image objects and histogram
4. Image classification
a. Land use vs. land cover
b. Classification systems
c. Classification criteria
d. Informational vs. spectral classes
e. Unsupervised classification
1. Clustering
2. Interpreting and editing clusters
3. Field verification
f. Supervised classification
1. Training areas
2. Training signatures
g. Accuracy assessment
D. Aerial photography and high-resolution multi-band imaging
1. Methods of interpretation
a. Manual vs. digital
2. Aircraft scanner equipment
a. CCDs and digital cameras
b. Spectral and spatial resolution
3. Orthorectification and georeferencing
a. Types of correction
b. Effects of topographic relief displacement
c. Digital image rectification process overview
d. Ground control points
e. Transformation matrix and root mean square error
f. Resampling
4. Interpretation techniques
a. Air photo manual interpretation and delineation
b. Satellite imagery
E. Satellite remote sensing
1. Overview of remote sensing equipment
2. Remote sensing platforms and data acquisition
a. Satellite orbits (geostationary, near-polar)
b. Passive vs. active systems
c. Whisk broom vs. push broom systems
d. Sensors from NOAA, NASA, SPOT, commercial satellites and aircraft
e. Data acquisition from NASA DAACs, USGS MRLC, websites with free data

3. Data applications
a. Weather
b. Disaster assessment
c. Vegetation monitoring
d. Urban growth
e. Ocean health
f. Public health
4. Integration with GIS systems
a. Digital filters for imagery
b. Converting raster layers to vector
F. Lab content
1. Introduction to Idrisi
a. Display imagery
b. Pan, zoom
2. Histograms
a. Manual exercise
b. Exercise using Idrisi
3. Exploring reflectance values and creating color composites
a. Spectral response of land cover types
b. Creating spectral graphs
c. Natural color and false color composites
4. Geometric correction
a. Image re-projection
b. Acquire GPS points
c. Assess transformation error
d. Resample image
5. Image classification
a. Manual image interpretation
b. Manual unsupervised classification
c. Digital unsupervised classification
d. Image interpretation

Lab Content

A. Introduction to remote sensing software
1. Display imagery
2. Pan, zoom
B. Histograms
1. Manual exercise
2. Exercise using remote sensing software
C. Exploring reflectance values and creating color composites
1. Spectral response of land cover types
2. Creating spectral graphs
3. Natural color and false color composites
D. Geometric correction
1. Image re-projection
2. Acquire GPS points
3. Assess transformation error
4. Resample image
E. Image classification
1. Manual image interpretation
2. Manual unsupervised classification
3. Digital unsupervised classification
4. Image interpretation

Special Facilities and/or Equipment

For practical exercises: PC computer facilities and industry standard remote sensing software. Computer laboratory will also need internet access.

Method(s) of Evaluation

A. Laboratory projects
B. Final exam or final project and oral presentation

Method(s) of Instruction

A. Lecture presentations and classroom discussion.
B. Demonstrations and hands-on exercises.
C. Reading assignments.

Representative Text(s) and Other Materials

Lillesand, Thomas M., Ralph Kiefer, and Jonathan Chipman. Remote Sensing and Image Interpretation. 7th ed. New York: 2 John Wiley & Sons, 2015.

Types and/or Examples of Required Reading, Writing, and Outside of Class Assignments

A. Reading assignments: Weekly reading assignments from text and outside sources ranging from 30-60 pages per week.

B. Lecture: Weekly lecture covering subject matter from text assignment with extended topic information. Class discussion is encouraged.

C. Hands-on exercises and demonstrations: Weekly computer exercises. Each exercise covers assigned reading and lecture topics.

Discipline(s)

Geography, Drafting, Environmental Technologies, Forestry/Natural Resources