GG 460 Geological Remote Sensing (Spring)

Lectures (TTh) and *Labs (F)*

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Week	***Lab*** or Lecture (SLO*)
Week 1	Class Organization, Overview and Examples of Remote Sensing (1) The nature of light (generation and propagation of radiation; 1, 3, 5) ***ENVI familiarization, Contrast Enhancements, Band Combinations, Subsampling (2)***
Week 2	The passage of light from source to the sensor (how much radiation is available for us to measure, and the composition of that radiation; 1, 3, 5) The reflection of light from the target (interaction of radiation with matter; 1, 3, 5) ***Digital Image Processing I: Spatial Resolution and Spatial Filters (2)***
Week 3	Data Collection I: Satellite Platforms and Orbits (1, 3, 5 Data Collection II: Signal Collection, Data Depth, Image File Types (1, 3, 5) ***Digital Image Processing II: Band Ratios, NDVI, Density Slices (2)***
Week 4	Image Co-Registration, Resampling, Geo-coding, and UTM (1, 3, 5) The spectral reflectance properties of some common targets (the spectral fingerprints of Earth surface materials; 1, 3, 5) ***Digital Image Processing III: Resampling, Co-Registration, Geo-Registration (2)***
Week 5	How well do remote sensing data capture real-world variability, spatially, spectrally, radiometrically, and temporally? (1, 3, 5) Thermal remote sensing I: basic physics (heat, temperature, energy, and blackbody Radiation; 1, 3, 5) ***Digital Image Processing IV: Reflected and Emitted Energy (2)***
Week 6	Thermal Infrared II: useful parameters that can be derived from thermal infrared data (emissivity, temperature; 1, 3, 5) The effect of the atmosphere on the quality of a remotely sensed measurement (1, 3, 5) ***Digital Image Processing V: Scatter Plots (2)***
Week 7	Intro to GPS (1, 3, 5) Using a hand-held GPS, in-class exercise (2) ***GPS Mapping (2)***
Week 8	Image Classification (1, 2, 3, 5) **MID-TERM EXAM #1** ***Digital Image Processing VI: Image Classification (2)***
Week 9	Principal Components (1, 2, 3, 5) Introduction to Synthetic Aperture Radar (SAR) (1, 3, 5) ***Digital Image Processing VII: Principal Components, Decorrelation Stretches (2)***
Week 10	Geological applications of SAR data (1, 3, 5) Hyperspectral remote sensing (1, 3, 5) ***Digital Image Processing VIII: Pan-sharpening, Hyperspectral Data (Scott gone; 2)***

Week 11	***SPRING BREAK !!!!!***
Week 12	Detecting wildfires and volcanic eruptions from space (1, 2, 3, 5) Digital Elevation Models and Interferometric SAR (InSAR) (1, 3, 5) ***Distribute Data Sets for Big Island project, Intro. to Hawaiian Volcanic Products (1)***
Week 13	Large-scale Topographic Change from InSAR (1, 3, 5) Small-scale Topographic Change from InSAR (1, 3, 5) ***Work on Big Island project***
Week 14	Air Photos, parallax, distortion (1, 3, 5) **MID-TERM EXAM #2** ***Work on Big Island project anyway***
Week 15	Components of a space mission (how spacecraft work to support remote sensing Missions; 1, 2, 5) *Computer Graphics Packages, Vector vs. Raster, Image Compression (1, 2, 3, 5)* ***Digital Image Processing IX: DEMs, Cross-Sections, and Perspective Views (2)***
Week 16	High spatial resolution data, orthorectification (1, 2, 3, 5) no class, but Preliminary Big Island projects due (start of Big Island field trip) (4) **Big Island Field Trip (1, 3, 5)**
Week 17	no class – work on final projects **FINAL PROJECT DUE AT 4:00 PM! (4)** NO EXCEPTIONS!!!!

This course is partially supported by the Hawai'i Space Grant Consortium and the Dept. of Geology & Geophysics; computer support kindly provided by Pat Townsend, Sharon Stahl, and Ross Ishida

Labs are due at the beginning of the following lab – no late labs will be accepted, sorry.
The Big Island project is due twice. The first version, which will require the most work, is due on Thursday May 1 (before we get on the plane). No late final projects will be accepted, sorry.

Grading:		
	homework	5%
	midterms	15% each
	lab assignments	40%
	Big Island project	25%

Useful Textbooks:

Jensen JR (2000), Remote Sensing of the Environment. Prentice Hall, Inc., New Jersey, 544 pp.
Drury SA (1986), Image Interpretation in Geology. Allen & Unwin, London, 243 pp.
Avery TE, Berlin GL (1992) Fundamentals of Remote Sensing and Airphoto Interpretation Macmillan Pub. Co., New York, 472 pp.
Ray RR (1960), Aerial photographs in geologic interpretation and mapping. US Geol Surv Prof Pap 373:230 pp.

Remote Sensing Journals:

International Journal of Remote Sensing
Remote Sensing of the Environment
IEEE Transactions on Geoscience and Remote Sensing

***SLOs - Student Learning Objectives**

The Geology & Geophysics Dept. has decided that the following Student Learning Objectives are key goals for any G&G student:

1. Students can explain the relevance of geology and geophysics to human needs, including those appropriate to Hawaiʻi, and be able to discuss issues related to geology and its impact on society and planet Earth.
2. Students can apply technical knowledge of relevant computer applications, laboratory methods, and field methods to solve real-world problems in geology and geophysics.
3. Students use the scientific method to define, critically analyze, and solve a problem in earth science.
4. Students can reconstruct, clearly and ethically, geological knowledge in both oral presentations and written reports.
5. Students can evaluate, interpret, and summarize the basic principles of geology and geophysics, including the fundamental tenets of the sub-disciplines, and their context in relationship to other core sciences, to explain complex phenomena in geology and geophysics.

If you have a disability and related access needs the Department will make every effort to assist and support you. For confidential services students are encouraged to contact the Office for Students with Disabilities (known as “Kōkua”) located on the ground floor (Room 013) of the Queen Lili'uokalani Center for Student Services.