Advanced Remote Sensing Applications
Geography 5130/6130
Spring 2014

Instructor: Dr. Richard R. Forster (Rick)
Time and place: Mon., Wed. 3:00 to 4:20 PM (OSH 273)
Office Hours: Mon 4:30 -6:30 PM or by appointment OSH 270E
Phone: 581-3611
E-mail: rick.forster@geog.utah.edu

Reference material: Digital text and figures of lecture material, class handouts to include book sections and journal papers
Evaluation: Mid term 35%, Project 55% (Proposal 5%, Progress report 10%, Presentation 15%, Paper 25%), Classroom participation 10%

General Description:
This course builds on the remote sensing fundamentals presented in Geog 3110 and the image processing analysis/interpretation skills obtained in Geog 5110/6110. (An adequate background may also be obtained through prior remote sensing experience). This course will cover Advanced Remote Sensing Acquisition Methods and Advanced Image Processing Techniques through a combination of lectures and project-based learning.

Learning Objectives:
1. To understand the principals involved in the acquisition of remote sensing data using some of the latest sensor technology.
2. To utilize advanced image processing techniques as they apply to analysis of remote sensing images.
3. To become familiar with science applications of these data sets and analysis techniques.
4. To select the appropriate remote sensing data set(s) and image processing technique(s) for the corresponding science application.
5. To be able to answer scientific questions based on results of remote sensing and image processing analysis.
Lecture Topics:

1. Review of remote sensing basics
   1.1 Principals of remote sensing
   1.2 Common remote sensing satellites and sensors
   1.3 Image processing

2. Microwave Remote Sensing
   2.1 Sensor types
      2.1.1 Passive microwave remote sensing
      2.1.2 Scatterometers
      2.1.3 Synthetic Aperture Radar (SAR)
   2.2 Applications
      2.2.1 Interferometric SAR (InSAR)
         2.2.1.1 Generation of digital elevation models (DEM)
         2.2.1.2 Generation of displacement maps
      2.3.1 Earth science applications

3. Hyperspectral Remote Sensing
   3.1 Sensor types
      3.1.1 Advance Visible/Infrared Imaging Spectrometer (AVIRIS)
      3.1.2 Hyperion
      3.1.3 Next generation spaceborne hyperspectral sensors

4. LiDAR (LIght Detection And Ranging)
   4.1 Basics of operation
   4.2 Example data sets
      4.2.1 Airborne LiDAR (Examples from the Salt Lake Valley)
      4.2.2 Spaceborne LiDAR (Examples from the ICESAT)

5. Programming in IDL for remote sensing analysis
   5.1 Time series analysis
   5.2 Feature-tracking for displacement measurements
   5.3 Other interests of the class
Sample Snow and Ice Data sets
Passive Microwave North Slope of Alaska
Scatterometer North Slope of Alaska
SAR North Slope of Alaska
Bering Glacier TOPSAR
Bering Glacier SIR-C
Bering Glacier SRTM
Harding Icefield: Landsat TM, IKONOS

Sample Interferometric Synthetic Aperture Radar (InSAR) Data sets
Land subsidence in SW Utah agricultural fields due groundwater extraction for irrigation
Land subsidence in Salt Lake Valley due to groundwater extraction

Local data sets available in the Geog 5130 directory

<table>
<thead>
<tr>
<th></th>
<th>Salt Lake Valley</th>
<th>Great Salt Lake</th>
<th>Park City</th>
<th>Oquirrh Mountains.</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>geog5130library\ut_imagedata\SLV_images</td>
<td>geog5130library\ut_imagedata\GreatSaltLake\src_tm</td>
<td>geog5130library\envidata\park_city_sc0*.img</td>
<td>geog5130library\envidata\oquirrh\oquirrh_sc0*.img</td>
</tr>
<tr>
<td>TM</td>
<td>1986, 90, 96, 97(b1-5), 98, 99</td>
<td>1984, 87, 90, 93, 96</td>
<td></td>
<td></td>
</tr>
<tr>
<td>MSS</td>
<td>1979</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>SPOT</td>
<td>1990, 1995</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>AVIRIS</td>
<td>1999 -present (daily)</td>
<td>1999 -present (daily)</td>
<td>1999 -present (daily)</td>
<td>1999 -present (daily)</td>
</tr>
<tr>
<td>SAR</td>
<td>10/17/05</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>IKONOS</td>
<td>Salt Lake City</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
General Guidelines

1) Exams must be taken at the time specified unless a valid, documented excuse is provided before the date of the exam. For medically related conflicts this requires a written note from a doctor.

2) Regular class attendance is strongly recommended. Lectures are intended to supplement material in the readings. You are responsible for information provided in the lectures, as well as any announcements made in class.

3) Office hours are there to be used. These times can be used for additional instruction if you are having difficulty with the material or if you are interested in a topic and would like further information. I am also open to any suggestions or comments you have about the course; please don’t wait until the end-of-semester evaluation if you have any constructive comments on the course. If you have a conflict and cannot make the posted office hours, please make an appointment for another time.

4) An ”incomplete” will be given only in extreme cases when conditions beyond the student's control require an extended period of absence.

5) Extra credit work will not be accepted.

Disability Statement

The University of Utah seeks to provide equal access to its programs, services and activities for people with disabilities. If you will need accommodations in the class, reasonable prior notice needs to be given to the Center for Disability Services, 162 Olpin Union Building, 581-5020 (V/TDD). CDS will work with you and the instructor to make arrangements for accommodations.

All written information in this course can be made available in alternative format with prior notification to the Center for Disability Services.