USC Dornsife
Dana and David Dornsife
College of Letters, Arts and Sciences
Spatial Sciences Institute

SSCI 588, Remote Sensing for GIS

Syllabus

Units: 4

Term — Day — Time: Spring, 2021, Online

Location: Online

Instructor: Andrew Marx, Ph.D
Office: Remote
Regular Office Hours: Monday and Wednesday 11 am-noon PT via Zoom – please contact me in advance to ensure I will be online. Also available most days and times by appointment via email.
Contact Info: marxa@usc.edu
Zoom: Provided via Blackboard

Library Help: Andy Rutkowski
Office: VKC 36B
Office Hours: Thurs 10 am-12 pm PT
Contact Info: arutkows@usc.edu
Zoom: Provided via Blackboard

IT Help: Richard Tsung
Office: AHF 145D
Office Hours: By appointment
Contact Info: spatial_support@usc.edu, 213-821-4415

Course Scope and Purpose

This course is a required course for the Geospatial Intelligence Graduate Certificate and an elective course for the Geographic Information Science & Technology (GIST) and Geospatial Leadership Graduate Certificates as well as the GIST M.S. degree programs. This course explores some of the ways in which remote sensing systems provide geospatial information that is relevant, accurate, timely, accessible, available in an appropriate format, and cost-effective. Recent developments in Earth observation such as imaging radar, LiDAR and hyperspectral sensors are increasing the wealth of information that can be generated from remotely sensed data sources. As a consequence, numerous new GIS applications that rely on advanced remotely sensed data sources have emerged at local, regional and global scales.

This a graduate level course, so you should expect this class to be both academically robust and intellectually challenging. As graduate students you are expected to engage with the information you are learning and to explore the heady cauldron of ideas, opinion, and analysis that describe our collective effort to thoroughly interrogate the subject at hand. Learning arises from active engagement with the knowledge found in our reading materials and with one another. As in any graduate-level class, the instructor's role is that of a guide who keeps you on this path of discovery and you will find that you will learn much from your fellow classmates. The challenge for us is to replicate such an academic experience within the milieu of "online learning".

All course materials will be organized through Blackboard. The main theoretical concepts will be provided through course notes and assigned readings. Hands-on practical exercises will use various software products accessible over the Internet. Assignments will give students an opportunity to internalize and apply the concepts and theory learned from readings. Some assignments require student interaction, all will benefit from it.

Learning Objectives

When you have completed this course, you will be able to:

- Explain the principles of remote sensing and the technical characteristics and constraints of Earth Observation missions.
- Design, implement and critically evaluate methods of digital image processing ranging from preprocessing to image classification, field data collection and accuracy assessment.
- Generate geographical information by processing digital remotely sensed data and critically evaluate its use for human security and/or environmental applications.
- Critically evaluate the opportunities and available methods for integrating remote sensing and GIS.

Prerequisite(s): None

Co-Requisite (s): None
Concurrent Enrollment: None
Recommended Preparation: SSCI 581: Concepts for Spatial Thinking

Class Conduct

Harassment, sexual misconduct, interpersonal violence, and stalking are not tolerated by the university. All faculty and most staff are considered Responsible Employees by the university and must forward all information they receive about these types of situations to the Title IX Coordinator. The Title IX Coordinator is responsible for assisting students with supportive accommodations, including academic accommodations, as well as investigating these incidents if the reporting student wants an investigation. The Title IX office is also responsible for coordinating supportive measures for transgender and nonbinary students such as faculty notifications, and more. If you need supportive accommodations you may contact the Title IX Coordinator directly (titleix@usc.edu or 213-821-8298) without sharing any personal information with me. If you would like to speak with a confidential counselor, Relationship and Sexual Violence Prevention Services (RSVP) provides 24/7 confidential support for students (213-740-9355 (WELL); press 0 after hours)

Course Structure

This is a distance learning course, so most of our interactions will be asynchronous (not at the same time). All materials to be handed in will be submitted via the Blackboard Assessment link. I will also create multiple Blackboard discussion forums throughout the semester that we will use for the aforementioned assignments and so we can discuss issues and comments on the course assignments, exercises and projects as the need arises.

In addition, I will send via e-mail through Blackboard any notices that are time sensitive. Please be sure that you read as soon as possible all e-mail sent from Blackboard or from me. Check now to make sure that mail sent from both the USC blackboard accounts and my private domain (marxa@usc.edu) does not go into your junk mail!

While I am usually online and will probably respond to e-mails from students relatively quickly, I will endeavor to respond to all e-mail within 24 hours of receipt, aiming for no more than 48 hours delay. In the rare case when I expect to be offline for more than 60 hours, I will post an announcement on the Blackboard site.

That said, it is each student's responsibility to stay informed about what is going on in our course. In addition to e-mail about time-sensitive topics, any important announcements will be posted on the Announcement page in Blackboard. Be sure to check these each time you log onto Blackboard.

Workload – This is a four credit, one semester course. Students should expect to spend 12-15 hours per week completing the work in this course.

Technological and Communication Requirements

We have several technologies that will facilitate our course work and our interactions, despite our dispersed locations. In addition to below, every student must have the following technology requirements:

- A computer with a fast Internet connection.
- A functional webcam and a microphone for use whenever a presentation or meeting is scheduled.
- An up-to-date web browser to access the Server

Blackboard – All course materials and correspondence will be posted on the course Blackboard site. As a registered student, you will find this course will show up in your available classes no later than 12:00 noon, PST on the first day of classes. It is here that the day-to-day flow of the course will be recorded.

Discussion boards – On the Blackboard site, we will post a number of discussion threads related to various course topics. These threads are very important in terms of providing support to each other while working on class exercises to share hints and helpful tips, as you would do in a classroom setting. I will check the discussion threads periodically and offer occasional comments. Please send your course instructor an email directly if you have a question or concern that requires my immediate attention.

Live meetings and presentations – We will use a browser-based service called Zoom to create synchronous, interactive sessions. With voice and webcam capabilities, Zoom can be used to share presentations and even our desktops between two or more people.

Individual meetings – We generally use Zoom for individual meetings.

SSI server and tech support – This course will utilize the SSI Servers to provide you with your own virtual desktop. If you are unable to connect to the server or experience any type of technical issues, send an email to SSI Tech Support at spatial_support@usc.edu and make sure to copy (cc) me on the email. SSI Tech Support is available Monday through Friday, 9:00 a.m.to 5:00 p.m. PST. A variety of geospatial software platforms (ArcGIS, e-Cognition, Idrisi, etc.) are provided online via the SSI Server; hence, you do not need to install it on your own computer.

Required Readings and Supplementary Materials

Textbooks – There are two required texts for this course. The first book by Campbell can be purchased from the USC Bookstore or online outlets such as Amazon and the second book by Warner and Campagna can be purchased from either the USC Bookstore or Clark Labs (http://www.clarklabs.org/). We will need the Campbell book from the first day of classes and the second book by Warner and Campagna very soon thereafter.

- Campbell, J.B., 2011. *Introduction to Remote Sensing,* 5th edition. New York, Guilford Press.
- Warner, T.A. and Campagna, D.J., 2017. *Remote Sensing with IDRISI®: A Beginner's Guide.* Hong Kong, GeoCarto International.

These textbooks will be supplemented with Course Notes and a mixture of readings from academic journals, professional reports, and authoritative websites.

Supplementary readings will be assigned from various sources including:

- Boyd, D.S. and Danson, F.M. (2005) Satellite remote sensing of forest resources: Three decades of research development. *Progress in Physical Geography* 29: 1-26.
- Burnett, C. and Blaschke, T. (2003) A multi-scale segmentation/object relationship modeling methodology for landscape analysis. *Ecological Modelling* 168: 233-249.
- Gilliespie, T.W., Chu, J., Frankenberg, E., and Thomas, D. (2007) Assessment and prediction of natural hazards from satellite imagery. *Progress in Physical Geography* 31: 459470.
- Lees, B. (2008) Remote sensing. In Wilson, J.P. and Fotheringham, A.S. (eds) *Handbook of Geographic Information Science.* Oxford, Blackwell Publishing: 49-60.
- Pasquarella, V. J., Holden, C. E., Kaufman, L., & Woodcock, C. E. (2016). From imagery to ecology: leveraging time series of all available Landsat observations to map and monitor ecosystem state and dynamics. *Remote Sensing in Ecology and Conservation*, *2*(3), 152-170.
- Price, J.C. (1994) How unique are spectral signatures? *Remote Sensing of Environment* 49: 181-186.
- Rashed, T., Weeks, J.R., and Gadalla, M.S. (2001) Revealing the anatomy of cities through spectral mixture analysis of multispectral satellite imagery: A case study of the Greater Cairo region, Egypt. *Geocarto Intnernational* 16: 5-16.
- Rochon, Gilbert L., Joseph E. Quansah, Souleymane Fall, Bereket Araya, Larry L. Biehl, Thierno Thiam, Sohaib Ghani, Lova Rakotomalala, Hildred S. Rochon, Angel Torres Valcarcel, Bertin Hilaire Mbongo, Jinha Jung, Darion Grant, Wonkook Kim, Abdur Rahman M. Maud, and Chetan Maringanti. (2010) Remote Sensing, Public Health & Disaster Mitigation. *Geospatial Technologies in Environmental Management*, Geotechnologies and the Environment 3: 187-209.
- Strahler, A.H., Woodcock, C.E., and Smith, J.A. (1986) On the nature of models in remote sensing. *Remote Sensing of Environment* 20: 121-139.
- Townshend, J.R.G., Huang, C., Kalluri, S.N.V., DeFries, R.S., and Liang, S. (2000) Beware of per-pixel characterization of land cover. *International Journal of Remote Sensing* 21: 839-843.

Description and Assessment of Assignments

Your grade in this course will be determined on the basis of several different assessment tools:

Resume Assignment – 1 worth 2 points. We require all current students to post and maintain a public resume, short biography and recent photo on our shared GIST Student Community Blackboard site. With your permission, your photo and resume will be posted to the Spatial Sciences Institute website and your resume will be included in the GIST Resume Book. The latter is compiled annually and along with our web presence used to promote our programs and more importantly, your skills, experience, and professional aspirations.

Reading Assignments – 7 worth a total of 21 points – Each student is required to complete seven reading assignments for this class. The reading assignments will focus on the theory portion of the course as presented in the weekly readings. The objective of the reading is to help you evaluate and integrate the information you have acquired from the course readings. Some of these will involve discussions and collaborative work and some will be individual efforts. In the event you complete more than seven reading assignments, I will use your seven highest scores to calculate your course grade.

IDRISI® Tutorials - 9 worth a total of 27 points – These will be scheduled throughout the semester and will require you to work through individual chapters of the Warner and Campagna (2014) workbook during the weeks they are assigned. To demonstrate that you have completed each chapter, you will turn in a quick copy of some digital output or brief text answers from the final part of the exercise such as a .jpg of the map produced at the final step.

Exercises – 2 worth a total of 10 points –To demonstrate your understanding of the basic concepts and skills learned in the class, you will complete two exercises that will integrate key concepts and ideas and take some independent thought.

Final Project

To integrate your learning of all the material covered in the course, in the final project you will design, undertake and report on an individually chosen remote sensing project. The three project components will be due at different times during the term to build gradually on the material presented in the course. The three components of the Project are:

Research Report 1 - 10 points. The first report will provide you with an opportunity to describe the data capture options and challenges for a project of your choice from a list of projects spanning a variety of application domains.

Presentation - 10 points. This assignment will require some independent thought and synthesis and allow you to explore a case study of your choice. The results will be presented via Zoom

during the final exam period of the course with the help of a PowerPoint slideshow, open to all students in the course.

Research Report 2 - 20 points. The second report will build on the data capture part of the course and provide students an opportunity to integrate all that they have learned in the semester in a specific application.

Grading Breakdown

Careful planning and a serious, consistent commitment will be required for you to successfully navigate the various deliverables in this and other GIST courses. The table below summarizes the SSCI 588 course assignments and their point distribution:

Assignments	Number	Points Per Assignment	Total Points
Weekly Assignments			
Exercises	2	5	10
IDRISI Tutorials	9	3	27
Reading Assignments	7	3	21
Resume Assignment	1	2	2
Project Components			
First Research Report	1	10	10
Presentation	1	10	10
Second Research Report	1	20	20
Totals	**22**	**-**	**100**

Assignment Submission Policy

Assignments will be submitted for grading via Blackboard using the due dates specified in the Course Schedule below.

It is important to note from the outset that: (1) you are expected to complete and upload all assignments before the deadlines detailed in the Course Schedule; (2) late postings and assignments will be docked one grade and no grade will be given for postings or assignments turned in more than one week late; and (3) no written work will be accepted for grading after 5:00 p.m. PT on the last day of classes. Any exceptions to these turn-in assignments are only made by me in coordination with individual students.

- All assignments will be penalized 2 points up to FOUR days late. No points will be given for submissions more than FOUR days late.
- Note that all assignments worth 2 points will receive 0 points if submitted late.

Schedule

	Topic	Readings and Assignments	Deliverables/ Due Dates
Week 1* 1/18 *Monday, 1/18 is university	**Remote Sensing Principles:** Examination of the history and modern-day scope of remote sensing.	Campbell 1, 2	Resume Assignment
Week 2 1/25	**Image Acquisition – Passive Sensors:** Examination of the fundamentals involved in image acquisition, digital photographic sensor systems, the role and importance of digital data, the typical steps that would be involved in transforming these digital data into information (i.e. image interpretation), and the various Earth observation missions launched thus far.	Campbell 3, 4, 5, 6	Reading Assignment # 1 IDRISI Tutorial # 1
Week 3 2/1	**Image Acquisition – Active Sensors:** Examination of the various contributions provided by microwave, LiDAR as well as the role of image resolution in projects when integrating remote sensing and GIS.	Campbell 7, 8, 9	Reading Assignment # 2
Week 4 2/8	**Image Resolution, Part I:** Introduction to and examination of the importance of the different components of resolution: spatial, spectral, radiometric and temporal.	Campbell 10	Reading Assignment # 3 IDRISI Tutorial # 2
Week 5* 2/15 *Monday, 2/15 is a university holiday	**Image Resolution, Part II:** Continuation of the examination of the importance of the different components of resolution: spatial, spectral, radiometric and temporal.	Campbell 10	Reading Assignment # 4 IDRISI Tutorial # 3 Exercise # 1
Week 6 2/22	**Analysis – Preprocessing:** Examination of the typical remote sensing for GIS workflow that starts with one or more forms of preprocessing (i.e. feature extraction, radiometric, and geometric corrections).	Campbell 11	Reading Assignment # 5 IDRISI Tutorial # 4

Week 7 3/1	**Image Classification, Part I:** Continuation of the examination of the typical remote sensing for GIS workflow that includes with the process of assigning pixels to classes using one or more forms of digital image classification.	Campbell 12	Reading Assignment # 6 IDRISI Tutorial # 5
Week 8 3/8	**Image Classification, Part II:** Continuation of the examination of the typical remote sensing for GIS workflow that includes with the process of assigning pixels to classes using one or more forms of digital image classification.	Campbell 12	Reading Assignment # 7 Report # 1
Week 9 3/15	**Field Data & Accuracy Assessment:** Conclusion of the typical remote sensing for GIS workflow that is completed with the collection and use of field data for model calibration and accuracy assessment.	Campbell 13, 14	Reading Assignment # 8 IDRISI Tutorial # 6
Week 10 3/22	**Hyperspectral Remote Sensing:** Evaluation of the merits of the using hyperspectral data to evaluate images and the products that result from them.	Campbell 15	Reading Assignment # 9 IDRISI Tutorial # 7
Week 11 3/29	**Integrating GIS and Remote Sensing, Part I:** Conclusion of the course involves looking at the various ways in which GIS and remote sensing have been integrated and used to characterize natural as well as human phenomena at a variety of scales ranging from individual humans and land parcels to neighborhoods, cities, regions, continents, hemispheres and nowadays, to the entire globe.	Notes	IDRISI Tutorial # 8 Presentation
Week 12 4/5	**Integrating GIS and Remote Sensing, Part II:** Continuation of the evaluation of integrating remote sensing and GIS.	Notes	Reading Assignment # 10
Week 13 4/12	**Gallery of Applications:** Demonstration of the many applications of Remote Sensing and GIS – Part I.	Campbell 17, 18	IDRISI Tutorial # 9 Exercise # 2

Week 14 4/19	**Gallery of Applications:** Demonstration of the many applications of Remote Sensing and GIS – Part II.	Campbell 19, 20	
Week 15 4/26 *Friday, 4/30 is the last day of class	**Gallery of Applications:** Demonstration of the many applications of Remote Sensing and GIS – Part III.	Campbell 21	Report # 2
Final Exams 5/5-5/12	**Final Course Project Presentation**	None	Final Project Presentation

Statement on Academic Conduct and Support Systems

Academic Conduct

Plagiarism – presenting someone else's ideas as your own, either verbatim or recast in your own words – is a serious academic offense with serious consequences. Please familiarize yourself with the discussion of plagiarism in *SCampus* in Part B, Section 11, "Behavior Violating University Standards" policy.usc.edu/scampus-part-b. Other forms of academic dishonesty are equally unacceptable. See additional information in *SCampus* and university policies on scientific misconduct, http://policy.usc.edu/scientific-misconduct.

Support Systems

Counseling and Mental Health– (213) 740-9355 – 24/7 on call
engemannshc.usc.edu/counseling
Free and confidential mental health treatment for students, including short-term psychotherapy, group counseling, stress fitness workshops, and crisis intervention.

National Suicide Prevention Lifeline – 1 (800) 273-8255 – 24/7 on call
www.suicidepreventionlifeline.org
Free and confidential emotional support to people in suicidal crisis or emotional distress 24 hours a day, 7 days a week.

Relationship and Sexual Violence Prevention Services (RSVP) – (213) 740-9355(WELL), press "0" after hours – 24/7 on call
studenthealth.usc.edu/sexual-assault
Free and confidential therapy services, workshops, and training for situations related to gender-based harm.

Office of Equity and Diversity (OED) – (213) 740-5086 |Title IX Compliance – (213) 821-8298
equity.usc.edu, titleix.usc.edu
Information about how to get help or help someone affected by harassment or discrimination, rights of protected classes, reporting options, and additional resources for students, faculty, staff, visitors, and applicants.

Reporting Incidents of Bias or Harassment– (213) 740-5086 or (213) 821-8298
usc-advocate.symplicity.com/care_report
Avenue to report incidents of bias, hate crimes, and microaggressions to the Office of Equity and Diversity | Title IX for appropriate investigation, supportive measures, and response.

The Office of Disability Services and Programs – (213) 740-0776
dsp.usc.edu
Support and accommodations for students with disabilities. Services include assistance in providing readers/notetakers/interpreters, special accommodations for test taking needs, assistance with architectural barriers, assistive technology, and support for individual needs.

USC Campus Support and Intervention – (213) 821-4710
uscsa.usc.edu
Assists students and families in resolving complex personal, financial, and academic issues adversely affecting their success as a student.

Diversity at USC – (213) 740-2101
diversity.usc.edu
Information on events, programs and training, the Provost's Diversity and Inclusion Council, Diversity Liaisons for each academic school, chronology, participation, and various resources for students.

USC Emergency - UPC: (213) 740-4321, HSC: (323) 442-1000 – 24/7 on call
dps.usc.edu, emergency.usc.edu
Emergency assistance and avenue to report a crime. Latest updates regarding safety, including ways in which instruction will be continued if an officially declared emergency makes travel to campus infeasible.

USC Department of Public Safety – - UPC: (213) 740-6000, HSC: (323) 442-120 – 24/7 on call
dps.usc.edu
Non-emergency assistance or information.

Resources for Online Students
The Course Blackboard page and the GIST Community Blackboard page have many resources available for distance students enrolled in our graduate programs. In addition, all registered students can access electronic library resources through the link https://libraries.usc.edu/.

Also, the USC Libraries have many important resources available for distance students through the link: https://libraries.usc.edu/faculty-students/distance-learners. These include instructional videos, remote access to university resources, and other key contact information for distance students.