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 2024, Mon, Wed, 1:00-2:50 pm

Location: AHF 145A and DEN@Dornsife

Instructor: Yi Qi, PhD
Office: AHF B55J
Office Hours: TBD
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Library Help: Andy Rutkowski
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Course Scope and Purpose

SSCI 588: *Remote Sensing for GIS* is a required course in the Spatial Data Management track of the Geographic Information Science and Technology (GIST) M.S., the Human Security and Geospatial Intelligence M.S., and the Remote Sensing for Earth Observation Graduate Certificate program. This class also counts as an elective in the Coding and Apps and Analytics track of the GIST M.S. and the GIST and Geospatial Intelligence Certificate 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 D2L. 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 or SSCI 576 Remote Sensing Applications and Emerging Technologies

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)

Diversity and Inclusion – It is my intent that students from all diverse backgrounds and perspectives be well served by this course, that students' learning needs be addressed both in and out of class, and that the diversity that students bring to this class be viewed as a resource, strength and benefit. It is my intent to present materials and activities that are respectful to everyone, and you are also expected to respect of others regardless of their race, ethnicity, gender identity and expressions, cultural beliefs, religion, sexual orientation, national origin, age, abilities, ideas and perspectives, or socioeconomic status. Your suggestions are encouraged and appreciated. Feel free to let me know ways to improve the effectiveness of the course for you personally or for other students.

Course Structure

As a graduate level course, you should expect this class to be both academically robust and intellectually and technically challenging. As a graduate student, you are expected to engage with the information and workflows you are learning as well as with one another. As in any graduate level class, the instructor's role is that of a guide who keeps you on path of discovery and you will find that you will learn much from your fellow classmates.

All course materials will be organized through D2L and will generally unfold on a weekly basis, with the week's material posted at the start of the week. The main theoretical

concepts will be provided through course notes and assigned readings, and at times recorded video presentations. Hands-on practical exercises will use various software products accessible over the Internet. Assignments will give you an opportunity to internalize and apply the concepts and theory learned from readings. Some assignments require student interaction; all will benefit from it.

Workload – This is a four credit, one semester graduate level course. Students should expect to spend 10-15 hours per week to complete the work in this class.

Course Content Distribution and Synchronous Session Recordings Policies

USC has policies that prohibit recording and distribution of any synchronous and asynchronous course content outside of the learning environment.

Recording a university class without the express permission of the instructor and announcement to the class, or unless conducted pursuant to an Office of Accessibility Services (OSAS) accommodation. Recording can inhibit free discussion in the future, and thus infringe on the academic freedom of other students as well as the instructor. (Living our Unifying Values: The USC Student Handbook, page 13).

Distribution or use of notes, recordings, exams, or other intellectual property, based on university classes or lectures without the express permission of the instructor for purposed other than individual or group study is prohibited. This includes but is not limited to providing materials for distribution by services publishing course materials. This restriction on unauthorized use also applies to all information, which has been distributed to students or in any way has been displayed for use in relationship to the class, whether obtained in class, via email, on the internet, or via any other media. (Living our Unifying Values: The USC Student Handbook, page 13).

Technological and Communication Requirements

We have several technologies that will facilitate our course work and our interactions, despite our dispersed locations. The remote sensing software and data required for course assignments will be accessed using computing resources provided by the Spatial Sciences Institute. ArcGIS and Drone2Map are provided online via the SSI Server; hence, you do not need to install it on your own computer. Instead, 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

If a student does not have access to any of these, please speak with the instructor at the start of the semester. Also, see the USC ITS Student Toolkit here: https://keepteaching.usc.edu/students/student-toolkit/

Desire2Learn (D2L) – This course will utilize the Desire2Learn (D2L) learning management system

which allows students to access course content, upload assignments, participate in discussion forms, among other learning experiences. The D2L platform provides flexibility in the learning experience where students can participate in the course residentially or remotely, synchronously (meeting together at the same time) or asynchronously (accessing videos and course content outside of class).

SSI Server and Tech Support – This course utilizes the SSI Server which is a virtual desktop giving access to many different professional software. If you are unable to connect to the server or experience any type of technical issues, send an email using your USC account to SSI Tech Support at spatial_support@usc.edu, making sure to copy (cc) me on the email.

Communications – All assignments given and all materials to be handed in will be submitted via D2L. The instructor will also create and monitor discussion forums through which students can discuss issues and assignments as needed. Students should read all email sent from D2L or from course instructor(s) as soon as possible. Also, students who do not regularly use their USC email accounts should double-check to be sure that mail sent from both the D2L accounts and the instructor's account (noted above) to your USC account is forwarded to an address used regularly and does not go into junk mail. The instructor will endeavor to respond to all email within 24 hours of receipt, aiming for no more than 72 hours delay. In the rare case that an instructor is off-line for an extended periodof time, an announcement will be posted to the class D2L site. Due to the synchronous and asynchronous nature of this course, it is each student's responsibility to stay informed and connected with others in our course. In addition to email, students are expectedto login to D2L regularly to check for announcements.

Discussion forums – On the D2L site, I will post a series of discussion threads relevant to various sections of the course. Discussions provide a key means for student-to-student discussion and collaboration that can replicate the face-to-face contact you may have experienced in traditional classrooms. Here students can provide support to each other while working on your assignments, sharing hints and helpful tips, as you would in a classroom laboratory. Please post your questions about assignments there, as you would ask them publically in the classroom. I monitor the discussion threads and offer comments when necessary, but more importantly, consider the discussion board a key way to connect with your classmates and share your discoveries.

Required Readings and Supplementary Materials

Textbooks – There is two required text for this course. The first book by Campbell can be purchased from the USC Bookstore or online outlets such as Amazon. The second book by Parece and McGee can be purchased on Amazon either as a paperback or a Kindle version.

- Campbell, J.B., 2011. *Introduction to Remote Sensing, 5th edition*. New York, Guilford Press.
- Parece, T.E. and McGee, J.A. *Remote Sensing with ArcGIS Pro: 2nd Edition*.

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, G. L., J. E. Quansah, S. Fall, B. Araya, L. L. Biehl, T. Thiam, S. Ghani, L. Rakotomalala, H. S. Rochon, A. T. Valcarcel, B. H. Mbongo, J. Jung, D. Grant, W. Kim, A. R. M. Maud, and C. 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 – 6 worth a total of 18 points – Each student is required to complete ten 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.

Exercises - 6 worth a total of 60 points – These will be scheduled throughout the semester and will require you to work through individual chapters of the Parece and McGee (2023) 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.

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:

First Research Report - 5 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.

Second Research Report - 10 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.

Presentation - 5 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.

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	6	10	60
Reading Assignments	6	3	18
Resume Assignment	1	2	2
Project Components			

First Research Report	1	5	5
Second Research Report	1	10	10
Oral Presentation	1	5	5
Totals	**16**		**100**

Grading Scale

Assignments in this and other SSCI courses, are graded on the letter grade scale where A is exemplary, B is very good, C is satisfactory, D is unsatisfactory, and F needs improvement. Final grades use the same letter grade scale with C being the minimum passing grade for credit at the graduate level. The grading scale follows:

A	> 93 points		B-	80-82 points		D+	67-69 points
A-	90-92 points		C+	77-79 points		D	63-66 points
B+	87-89 points		C	73-76 points		D-	60-62 points
B	83-86 points		C-	70-72 points		F	<60 points

Assignment Submission Policy

Unless otherwise noted, all assignments must be submitted via D2L by 11:59 pm Pacific Time (PT) on due dates specified in the Course Schedule below. Your attention to on-time assignment submission is essential if I am to meet my goal to return comments on your submitted assignments before the next one is due. Sometimes this is impossible, so I will post a notice on anticipated delays if needed.

Strict penalties apply for late assignments as follows:

- 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.
- Additionally, no written work will be accepted for grading after 5 pm PT on the last day of classes.

Any exceptions to these turn-in assignments are only made by me in coordination with individual students. An example of an exception would be a student's illness or injury that reasonably prohibits course involvement/participation.

Course Schedule

Week	Topic	Readings and Assignments	Deliverables/ Due Dates
Module 1: Principles in Remote Sensing			
Week 1 1/8	**Remote Sensing Principles:** Examination of the history and modern-day scope of remote sensing.	Campbell 1, 2	Resume Assignment
Week 2 1/15* *Monday, 1/15 is university holiday	**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
Week 3 1/22	**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	Exercise # 1
Week 4 1/29	**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 # 2
Week 5 2/5	**Image Resolution, Part II:** Continuation of the examination of the importance of the different components of resolution: spatial, spectral, radiometric and temporal.	Campbell 10	Exercise # 2
Module 2: Remote Sensing Image Analysis			

Week 6 2/12	**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 # 3
Week 7 2/19* *Monday, 2/19 is university holiday	**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	Exercise # 3
Week 8 2/26	**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 # 4
Week 9 3/4	**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	Exercise # 4 Report # 1
3/11 *3/11-3/17 is Spring Recess			
Week 10 3/18	**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 # 5
Module 3: Integrating GIS and Remote Sensing			

Week 11 3/25	**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	Exercise # 5
Week 12 41	**Integrating GIS and Remote Sensing, Part II:** Continuation of the evaluation of integrating remote sensing and GIS.	Notes	Reading Assignment # 6
Week 13 4/8	**Gallery of Applications:** Demonstration of the many applications of Remote Sensing and GIS – Part I.	Campbell 17, 18	Exercise # 6
Week 14 4/15	**Gallery of Applications:** Demonstration of the many applications of Remote Sensing and GIS – Part II.	Campbell 19, 20	
Week 15 4/22 Friday, 4/26 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 Project Presentation
Final Exams 5/1-5/8	Final Exam		

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 Research and Scholarship Misconduct.

Students and Disability Accommodations

USC welcomes students with disabilities into all of the University's educational programs. The Office of Student Accessibility Services (OSAS) is responsible for the determination of appropriate accommodations for students who encounter disability-related barriers. Once a student has completed the OSAS process (registration, initial appointment, and submitted documentation) and accommodations are determined to be reasonable and appropriate, a Letter of Accommodation (LOA) will be available to generate for each course. The LOA must be given to each course instructor by the student and followed up with a discussion. This should be done as early in the semester as possible as accommodations are not retroactive. More information can be found at osas.usc.edu. You may contact OSAS at (213) 740-0776 or via email at osasfrontdesk@usc.edu

Support Systems

Counseling and Mental Health - (213) 740-9355 – 24/7 on call
studenthealth.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
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 for Equity, Equal Opportunity, and Title IX (EEO-TIX) - (213) 740-5086
eeotix.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 for Equity,

Equal Opportunity, and Title for appropriate investigation, supportive measures, and response.

The Office of Student Accessibility Services (OSAS) - (213) 740-0776
osas.usc.edu
OSAS ensures equal access for students with disabilities through providing academic accommodations and auxiliary aids in accordance with federal laws and university policy.

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

Diversity, Equity, and Inclusion - (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.

Office of the Ombuds - (213) 821-9556 (UPC) / (323-442-0382 (HSC)
ombuds.usc.edu
A safe and confidential place to share your USC-related issues with a University Ombuds who will work with you to explore options or paths to manage your concern.

*Occupational Therapy Faculty Practice - (323) 442-33*40 or otfp@med.usc.edu
chan.usc.edu/otfp
Confidential Lifestyle Redesign services for USC students to support health promoting habits and routines that enhance quality of life and academic performance.

Resources for Online Students
The Course D2L 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.