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

SSCI 587 (35715D and 35716D), Spatial Data Acquisition

Syllabus

Units: 4

Term Day Time: Spring, 2024
Tuesday and Thursday 3:00-4:50 pm

Location: AHF 145D and DEN@Dornsife

Instructor: Guoping Huang, D.Des.
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IT Help: Myron Medalla
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Course Scope and Purpose

This course provides students with the requisite knowledge and practical skills to source and evaluate data against recognized quality standards for use in GIS-based projects. It also helps students understand how to assess the quality of information output from those projects. It is a required course for the Geographic Information Science and Technology (GIST) M.S. and Graduate Certificate Programs and the Human Security and Geospatial Intelligence (HSGI) M.S. Program. We cover several topics, including:

Data Needs and Types – We start by focusing on the data challenge, defining data needs, fitness-for-use, and the role of conceptualization, entitation (recognition of an entity that can be studied as a system), and quantification in scientific research and management, and an introduction to some of the ways in which spatial and attribute data can be gathered and used to serve specific needs.

Data Capture and Estimation – We discuss the various ways digital data can be sourced, evaluated, and used in specific projects, as well as ways to interpolate attribute values at unsampled locations and/or times.

Remotely Sensed Data – We discuss the diverse ways in which data can be collected remotely using various platforms. We focus on Global Navigation Satellite Systems and Unmanned/Unoccupied Aerial Systems as valuable sources of spatial data.

Data Quality – We discuss data standards and how they are used to promote and/or preserve data quality. We also examine the various types and sources of error that we may encounter as a part of the data stream. We consider the various ways we can check for errors and cope with uncertainty when using GIS to help inform decisions about actions we may take in the real world.

New Spatial Data Capture – We explore the ways in which the Esri, Eos, and Trimble software ecosystems can be used along with field-based systems (GNSS and GPS receivers, unoccupied autonomous systems and a variety of sensors) to support spatial data acquisition, analysis, and visualization. A variety of readings and exercises in the first half of the class will help to support a field project conducted during a one-week field trip on Catalina Island in which students design, conduct, and present the results of their own spatial data collection projects using equipment provided by the Spatial Sciences Institute and/or their own devices.

Data Integration – We discuss and workshop the various processes through which data are prepared and integrated within a GIS. Project work builds on data acquisition throughout the term and culminates in integration and preliminary analyses.

Written Communication Skills – Since successful spatial scientists and geospatial intelligence specialists need cutting-edge spatial skills as well as effective communication competence to prosper in today's rapidly evolving world, faculty members from the USC Writing Program coach students on their writing skills in selected assignments during this course.

The class sessions and assigned readings will convey the main theoretical concepts, and the assignments will give students an opportunity to internalize and apply the concepts and theory learned from readings. Some assignments, and particularly those completed on Catalina Island, require student interaction, and all will benefit from it.

Learning Outcomes

On completion of this course, students should be able to:

- Describe fitness-for-purpose (i.e. use) criteria and apply them to the evaluation of geospatial data for specific applications.
- Discuss the conceptual foundations of unoccupied autonomous system (UAS)-derived imagery data.
- Describe and demonstrate the methods to collect and process UAS-derived imagery.
- Design and implement a strategy for capturing or sourcing geospatial data and any accompanying metadata.
- Assess the impact of national and international data standards on the sourcing and availability of geospatial data.
- Critically evaluate the potential impacts of data quality on spatial analysis and decision making.
- Demonstrate the ability to use one or more of the commonly utilized systems employed today for the capture of location-based data so you can acquire, organize, store, analyze, model, visualize, and share your own spatial data going forward.

Students may vary in their competency levels on these abilities. You can expect to acquire these abilities only if you honor all course policies, attend classes regularly, complete all assigned work in good faith and on time, and meet all other course expectations of you as a student.

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)

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 challenging. As a graduate student, 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 the 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 path of discovery and you will find that you will learn much from your fellow classmates. The main theoretical concepts will be provided through class presentations 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. Please note that in addition to the weekly workload, there is a required weeklong field excursion to the Philip K. Wrigley Marine Science Center on Catalina Island. Note: There is a required room and board fee for the Catalina trip of approximately $360 that is supplemental to the regular tuition cost.

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).

Technology and Communication Requirements

ArcGIS is provided online via the GIST Server; hence, you do not need to install it on your own computer. In addition, we will provide laptops with image processing software and a variety of GPS and related data capture devices for the Catalina field component. At their home workspaces, every student must have the following technology requirements:

- A computer with a fast Internet connection.
- A functional webcam and a microphone.
- An up-to date web browser to access the SSI server.

If a student does not have access to any of these, please speak with the instructors at the start of the semester. And 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 – Discussion forums 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 publicly 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

The required textbook for this course is:

- Bolstad, P., and Manson, S. 2022. *GIS fundamentals: A first text on geographic information systems* (7th ed.). Lake Orion, MI: Elder Press.

This textbook, which is also used in *SSCI 581: Concepts for Spatial Thinking,* will be supplemented with class presentations and a mix of readings from academic journals, professional reports and authoritative websites.

Supplemental Readings – The following journal articles will be posted to D2L under the Course Readings:

- Acheson, E., Volpi, M., Purves, R.S. 2020. Machine learning for cross-gazetteer matching of natural features. *International Journal of Geographical Information Science, 34*(4), 708-734.
- Alvarez Leon, L.F., Quinn, S. 2019. The value of crowd-sourced street-level imagery: Examining the shifting property regimes of OpenStreetCam and Mapillary. *GeoJournal, 84,* 395-414.
- Arietta, S.M., Efros, A.A., Ramamoorthi, R., Agrawala, M. 2014. City forensics: Using visual elements to predict non-visual city attributes. *IEEE Transactions on Visualization and Computer Graphics, 20*(12), 2624-2633.
- Bader, M.D.M., Mooney, S.J., Rundle, A.G. 2016. Protecting personally identifiable information when using online geographic tools for public health research. *American Journal of Public Health, 106*(2), 206-208.
- Barrington-Leigh, C., Millard-Ball, A. 2017. The world's user-generated road map is more than 80% complete. *PloS ONE, 12*(8), e0180698.
- Bolstad, P.V., Gessler, P., Lillesand, T.M. 1990. Positional uncertainty in manually digitized map data. *International Journal of Geographic Information Systems, 4,* 399-412.
- Chrisman, N.R. 1984. The role of quality information in the long-term functioning of a geographic information system. *Cartographica,* 21, 79-87.

- Chrisman, N.R. 2017. Calculating in a round planet. *International Journal of Geographical Information Science, 31*, 637-657.
- Couclelis, H. 2021. Conceptual models of error and uncertainty. In J.P. Wilson (Ed.), *The geographic information science and technology body of knowledge* (1st Quarter 2021 ed.), https://doi.org/10.22224/gistbok/2021.1.3
- De Blasio, G., Quesada-Arencibia, A., García, C. R., et al. 2017. Study on an indoor positioning system for harsh environments based on Wi-Fi and Bluetooth low energy. *Sensors,* 17(6), 1299.
- Delmelle, E. 2009. Spatial sampling. In A.S. Fotheringham, P.A. Rogerson (Eds.), *The SAGE handbook of spatial analysis* (pp. 165-186). SAGE Publications.
- Dubayah, R.O., Drake, J.B. 2000. Lidar remote sensing for forestry. *Journal of Forestry, 98*(6), 44-46.
- Dwyer, J.L., Roy, D.P., Sauer, B., Jenkerson, C.B., Zhang, H.K., Lymburner, L. 2018. Analysis ready data: Enabling analysis of the Landsat archive. *Remote Sensing, 10*(9), 1363.
- Eitzel, M.V., Cappadonna, J.L., Santos-Lang, C., et al. 2017. Citizen science terminology matters: Exploring key terms. *Citizen Science: Theory and Practice, 2*(1), 1.
- El-Sheimy, N., Li, Y. 2021. Indoor navigation: State of the art and future trends. *Satellite Navigation, 2,* 7.
- Fisher, P., Comber, A., Wadsworth, R. 2010. What's in a name? Semantics, standards, and data quality. In R. Devillers, H. Goodchild (Eds.), *Spatial data quality: From process to decisions* (pp. 43-59). CRC Press.
- Fisher, P., Wood, J. 1998. What is a mountain? Or the Englishman who went up a Boolean geographical concept but realised it was fuzzy. *Geography, 83*(3), 247-256
- Fisher, P., Wood, J., Cheng, T. 2004. Where Is Helvellyn? Fuzziness of multi-scale landscape morphometry. *Transactions of the Institute of British Geographers, 29*(1), 106-128.
- Frank, A. U. 2010. Scale is introduced in spatial datasets by observation processes. In R. Devillers & H Goodchild (Eds.), Spatial data quality: From process to decisions (pp. 17-30). Boca Raton, FL, CRC Press.
- Frank, S. A. 2011. Measurement scale in maximum entropy models of species abundance. *Journal of Evolutionary Biology,* 24, 485-496.
- Gao, S., Rao, J., Kang, Y., et al. 2020. Association of mobile phone location data indications of travel and stay-at-home mandates with COVID-19 infection rates in the US. *JAMA Network Open, 3*(9), e2020485.
- Goldberg, D.W., Wilson, J.P., Knoblock, C.A. 2007. From text to geographic coordinates: The current state of geocoding. *URISA Journal, 19*(2), 33-46.
- Goodchild, M.F. 2000. Communicating the results of accuracy assessment: Metadata, digital libraries, and assessing fitness for use. In T.M. Mowrer, R.G. Congalton (Eds.),

Quantifying spatial uncertainty in natural resources: Theory and applications for GIS and remote sensing (pp. 3-15). Ann Arbor Press.

- Goodchild, M.F. 2011. Scale in GIS: An overview. *Geomorphology, 130,* 5-9.
- Goodchild, M.F. 2018. Reimagining the history of GIS. *Annals of GIS, 24*(1), 1-8.
- Grantham, H.S., Duncan, A., Evans, T.D., et al. 2020. Anthropogenic modification of forests means only 40% of remaining forests have high ecosystem integrity. *Nature Communications, 11,* 5978.
- Greenwood, F. 2015. How to make maps with drones. In K. Kakaes (Ed.), Drones and aerial observation: New technology for property rights, human rights, and global development (pp. 35-47). Washington, DC: New America.
- Hu, Y. 2018. Geo-text data and data-driven geospatial semantics. *Geography Compass*, 12(11), e12404.
- Hutchinson, M. F. 1989. A new procedure for gridding elevation and stream line data with automatic removal of spurious pits. *Journal of Hydrology,* 106, 211-232.
- Jankowska, M. M., Schipperijn, J., and Kerr, J. 2015. A framework for using GPS data in physical activity and sedentary behavior studies. *Exercise and Sport Sciences Reviews,* 43(1), 48-56.
- Jestico, B., Nelson, T., and Winters, M. 2016. Mapping ridership using crowdsourced cycling data. *Journal of Transport Geography,* 52, 90-97.
- Jeziorska, J. 2019. UAS for wetland mapping and hydrological modeling. *Remote Sensing,* 11, 1997.
- Johnson, C. E., and Barton, C. C. 2004. Where in the world are my field plots? Using GPS effectively in environmental field studies. *Frontiers in Ecology and the Environment,* 2, 475-482.
- Jones, R. R., DellaValle, C. T., Flory, A. R., et al. 2014. Accuracy of residential geocoding in the Agricultural Health Study. *International Journal of Health Geographics,* 13, 37.
- Kassie, D., Roudot, A., N. Dessay, N., et al. 2017. Development of a spatial sampling protocol using GIS to measure health disparities in Bobo-Dioulasso, Burkina Faso, a medium-sized African city. *International Journal of Health Geographics,* 16, 14.
- Kunhoth, J., Karkar, A., Al-Maadeed, S., et al. 2020. Indoor positioning and wayfinding systems: A survey. *Human-centric Computing and Information Sciences, 10,* 18.
- Larkin, A., Gu, X., Chen, L., et al. 2021. Predicting perceptions of the built environment using GIS, satellite and street view image approaches. *Landscape and Urban Planning, 216,* 104257.
- Lee, J. 2009. GIS-based geocoding methods for area-based addresses and 3D addresses in urban areas. *Environment and Planning B: Planning and Design,* 36(1), 86-106.
- Liang, Y., Gao, S., Cai, Y., et al. 2020. Calibrating the dynamic Huff model for business analysis using location big data. *Transactions in GIS, 24,* 681-703.

- Lippitt, C. D. 2020. Georeferencing and georectification. In J. P. Wilson (Ed.), *The Geographic information science and technology body of knowledge* (3rd Quarter 2020 ed.), https://doi.org/10.22224/gistbok/2020.3.3
- Liu, Y. Y., Maidment, D. R., Tarboton, D. G., et al. 2018. A CyberGIS integration and computation framework for high-resolution continental-scale flood inundation mapping. *Journal of the American Water Resources Association,* 54, 770-784.
- Mahdianpari, M., Granger, J. E., Mohmmadimanesh, F., et al. 2021. Smart solutions for smart cities: Urban wetland mapping using very high resolution satellite imagery and airborne LiDAR data in the City of St. John's, NL, Canada. *Journal of Environmental Management,* 280, 111676.
- Murrieta-Flores, P., Baron, A., Gregory, I. N., Hardie, A., and Rayson P. 2015. Automatically analyzing large texts in a GIS environment: The Registrar General's reports and cholera in the 19th Century. *Transactions in GIS,* 19(2), 296-320.
- Onsrud, H. J. 2010. Liability for spatial data quality. In R. Devillers and H. Goodchild (Eds.), *Spatial data quality: From process to decisions* (pp. 3-16). Boca Raton, FL: CRC Press.
- Pasquarella, V. J., Holden, C. E., Kaufman, L., and 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, 152-170.
- Porter, C., Atkinson, P., and Gregory, I. N. 2015. Geographical text analysis: A new approach to understanding nineteenth-century mortality. *Health and Place, 36,* 25-34.
- Priestnall, G., Jaafar, J., and Duncan, A. 2000. Extracting urban features from LiDAR digital surface models. *Computers, Environment and Urban Systems. 24*(2), 65-78.
- Rakha, R. T., and Gorodetsky, A. 2018. Review of Unmanned Aerial System (UAS) applications in the built environment: Towards automated building inspection procedures using drones. *Automation in Construction,* 93, 252-264.
- Reynard, D., 2018. Five classes of geospatial data and the barriers to using them. *Geography Compass,* 12(4), e12364.
- Robinson, L., Newell, J. P., and Marzluff, J. M. 2005. Twenty-five years of sprawl in the Seattle region: Growth management responses and implications for conservation. *Landscape and Urban Planning, 71,* 51-72.
- Rundle, A. G., Bader, M. D. M., and Mooney S. J. (2022). Disclosure of personal identifying information in studies of neighborhood contexts and patient outcomes. *Journal of Medical Internet Research,* forthcoming.
- Shi, Y., Matsunaga, T., Yamaguchi, Y., et al. 2018. Long-term trends and spatial patterns of satellite-retrieved PM2.5 concentration in South and Southeast Asia from 1999 to 2014. *Science of the Total Environment, 615,* 177-186.
- Singh, I. 2016. *The future of earth observation is in small satellites.* Retrieved from https://www.geospatialworld.net/article/earth-observation-small-satellites-industry/

- Smith, A. N. H., Anderson, M. J., and Pawley, M. D. M. 2017. Could ecologists be more random? Straightforward alternatives to haphazard spatial sampling. *Ecography,* 40(11), 1251-1255.
- Smith, T., Rheinwalt, A., and Bookhagen, B. 2019. Determining the optimal grid resolution for topographic analysis on an airborne LiDAR dataset. *Earth Surface Dynamics, 7,* 475-489.
- Smith, A.N.H., Anderson, M.J., Pawley, M.D.M. 2017. Could ecologists be more random? Straightforward alternatives to haphazard spatial sampling. *Ecography, 40*(11), 1251-1255.
- Smith, T., Rheinwalt, A., Bookhagen, B. 2019. Determining the optimal grid resolution for topographic analysis on an airborne LiDAR dataset. *Earth Surface Dynamics, 7,* 475-489.
- Sola-Guirado, R. R., Castillo-Ruiz, F. J., Jiménez-Jiménez, F., et al. 2017. Olive actual "on year" yield forecast tool based on the tree canopy geometry using UAS Imagery. *Sensors, 17*(8), 1743.
- Southall, H., Mostern, R., and Berman, M. L. 2011. On historical gazetteers. *International Journal of Humanities and Arts Computing,* 5(2), 127-145.
- Spielman, S.E., Folch, D.C. 2015. Reducing uncertainty in the American Community Survey through data-driven regionalization. *PLoS ONE, 10*(2), e0115626.
- Spielman, S.E., Folch, D., Nagle, N. 2014. Patterns and causes of uncertainty in the American Community Survey. *Applied Geography, 46,* 147-157.
- Spielman, S.E., Singleton, A. 2015. Studying neighborhoods using uncertain data from the American Community Survey: A contextual approach. *Annals of the Association of American Geographers, 105*(5) 2015, 1003-1025.
- Stefanidis, A., Crooks, A., and Radzikowski, J. 2013. Harvesting ambient geospatial information from social media feeds. *GeoJournal, 78,* 319-338.
- Stockwell, S., and Gallo, S. 2017. Citizen science and wildlife conservation: lessons from 34 years of the Maine loon count. *Maine Policy Review, 26*(2), 25-32.
- Strominger, J., Anthopolos, R., and Miranda, M. L. 2016. Implications of construction method and spatial scale on measures of the built environment. *International Journal of Health Geographics,* 15, 15.
- Tenkanen, H., Di Minin, E., Heikinheimo, V., et al. 2017. Instagram, Flickr, or Twitter: Assessing the usability of social media data for visitor monitoring in protected areas. *Scientific Reports,* 7, 17615.
- Thatcher, C.A., Lukas, V., Stoker, J.M. 2020. *The 3D Elevation Program and energy for the nation: Energy infrastructure and high quality three-dimensional elevation data* (Fact Sheet 2019-3051). Reston, VA: U.S. Geological Survey.
- Toutin, T. 2004. Review article: Geometric processing of remote sensing images: models, algorithms and methods. *International Journal of Remote Sensing*. 25 (no.10):pp.1893-1924.

- Vergopolan, N., Chaney, N. W., Pan, M., et al. 2021. SMAP-HydroBlocks, a 30-m satellite-based soil moisture dataset for the conterminous US. *Scientific Data,* 8, 264.
- Verplanke, J., McCall, M. K., Uberhuaga, C., Rambaldi, G., & Haklay, M. 2016. A shared perspective for PGIS and VGI. *The Cartographic Journal, 53*(4), 308-317.
- Waagen, J. 2019. New technology and archaeological practice: Improving the primary archaeological recording process in excavation by means of UAS photogrammetry. *Journal of Archaeological Science,* 101, 11-20.
- Wang, J., Liu, J., Zhuan, D., et al. 2002. Spatial sampling design for monitoring the area of cultivated land. *International Journal of Remote Sensing,* 23(2), 263-284.
- Whitehead, K., and Hugenholtz, C. H. 2014. Remote sensing of the environment with small unmanned aircraft systems (UASs), Part 1: A review of progress and challenges. *Journal of Unmanned Vehicle Systems,* 2, 69-85.
- Wirola, L., Laine, T.A., Syrjärinne, J. 2010. Mass-market requirements for indoor positioning and indoor navigation. *2010 International Conference on Indoor Positioning and Indoor Navigation,* Zurich, Switzerland (pp. 1-7). IEEE.
- Yi, L., J.P. Wilson, T.B. Mason, R. Habre, and S. Wang. 2019. Methodologies for assessing contextual exposure to the built environment in physical activity studies: A systematic review. *Health and Place*. 60 (102226).
- Yi, L., Y. Xu, S.P. Eckel, et al. 2022. Time-activity and daily mobility patterns during pregnancy and early postpartum – evidence from the MADRES cohort. *Spatial and Spatio-temporal Epidemiology*. 41 (100502).
- Zandbergen, P. A. 2008. A comparison of address point, parcel and street geocoding techniques. *Computers, Environment and Urban Systems,* 32, 214-232.
- Zandbergen, P.A. 2009. Accuracy of iPhone locations: A comparison of assisted GPS, WiFi and cellular positioning. *Transactions in GIS, 13*(s1), 5-26.
- Zhang, S., C.D. Lippett, S.M. Bogus, A.C. Loerch, and J.O. Strum. 2016. The accuracy of aerial triangulation products automatically generated from hyper-spatial resolution digital aerial photography. *Remote Sensing Letters*. 7 (2):pp.160-169.
- Zhao, Q., Wen, H., Lin, Z., et al. 2020. On the accuracy of measured proximity of bluetooth-based contact tracing apps. In N. Park, S. Kun, S. Foresti, et al. (Eds.), *Security and privacy in communication systems* (pp. 49-60). Cham, Switzerland: Springer.

The following supplemental materials will be posted to D2L for Project Assignments:

- Chuang, W.-C., Boone, C.G., Locke, D.H., et al. 2017. Tree canopy change and neighborhood stability: A comparative analysis of Washington, D.C. and Baltimore, MD. *Urban Forestry & Urban Greening,* 27, 363-372.
- Donovan, G.H., Gatziolis, D., Derrien, M.L., et al. 2022. Shortcomings of the normalized difference vegetation index as an exposure metric. *Nature Plants,* 8, 617-622.

- Elmes, A., Rogan, J., Williams, C., et al. 2017. Effects of urban tree canopy loss on land surface temperature magnitude and timing. *ISPRS Journal of Photogrammetry and Remote Sensing,* 128, 338-353.
- Greenwood, F. 2015. How to make maps with drones. In K. Kakaes (Ed.), *Drones and aerial observation: New technology for property rights, human rights, and global development* (pp. 35-47). New America.
- Herfort, B.S., Lautenback, J., Porto de Albuquerque, J., et al. 2021. The evolution of humanitarian mapping within the OpenStreetMap community. *Scientific Reports,* 11, 3037.
- Jeziorska, J. 2019. UAS for wetland mapping and hydrological modeling. *Remote Sensing,* 11, 1997.
- Klinkhardt, C., Woerle, T., Briem, L., et al. 2021. Using OpenStreetMap as a data source for attractiveness in travel demand models. *Transportation Research Record,* 2675(8), 294-303.
- McDonald, R.I., Biswas, T., Sachar, C., et al. 2021. The tree cover and temperature disparity in U.S. urbanized areas: Quantifying the association with income across 5,723 communities. *PLoS ONE,* 16(4), e0249715.
- Minghini, M., Frassinelli, F. 2019. OpenStreetMap history for intrinsic quality assessment: Is OSM up-to-date? *Open Geospatial Data, Software and Standards,* 4, 9.
- Rakha, R.T., Gorodetsky, A. 2018. Review of Unmanned Aerial System (UAS) applications in the built environment: Towards automated building inspection procedures using drones. *Automation in Construction, 93*, 252-264.
- Roman, D., Tarasova, T., Paniagua, J. 2019. MethOSM: A methodology for computing composite indicators derived from OpenStreetMap data. *Journal of Spatial Information Science,* 19, 3-27.
- Troy, A., Davis, S. 2016. The effects of urban forest canopy on microclimate and heat islands. USDA Forest Service. *USDA Forest Service Urban Forest Connections Webinar Series*. https://www.vibrantcitieslab.com/resources/urban-canopy-and-heat-islands/
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- Wolch, J., Byrne, J., Newell, J.P. 2014. Urban green space, public health, and environmental justice: The challenge of making cities 'just green enough.' *Landscape and Urban Planning,* 125, 234-244.
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Description and Assessment of Assignments

Assignments

There are different kinds of assignments throughout the semester that build competencies in data acquisition and evaluation, as well as written communication. These are described in the Assignments module in D2L. Due dates are shown in the Schedule below.

Resume Assignment – 1 worth 3 points. In addition to the submission via D2L, we require all current students to post and maintain a public resume, short biography, and recent photo on our shared SSI Student Community site. Please prepare your resume in the SSI template that will be provided to you. Unless you opt out, your resume will be included in the Spatial Science Institute Graduate Programs Resume Book. This resume book is compiled annually and, along with our web presence, is used to promote our programs, and more importantly, your skills, experience, and professional aspirations. This assignment is due at the end of the term so that you can incorporate your newly gain skills.

Writing Responses – 3 worth 6 points. In collaboration with the Writing Center, three instructional videos on writing will be provided. A short quiz at the end of each video will evaluate your understanding of the major points of the video.

Projects – 3 worth 45 points. The projects will be the major tool used to evaluate your learning in this course. These assignments will integrate key concepts and ideas require and require students to complete the basic types of data acquisition and integration asked of professional spatial analysts in real-world settings through independent thought. Prompts will list helpful information, such as software tutorials, for becoming familiar with ways that concepts learned in the course are implemented in various software packages. Each project has two deliverables: a workflow diagram and a written report that describes project goals, methods, data, and results. The workflow diagram is due one week prior to the final deliverable and is workshopped in an online forum or during a synchronous class session with classmates and the instructor.

Reading and Research Discussions – 3 worth 12 points. These assignments call on students to identify relevant research case studies employing the methodologies and concepts we cover in class and to discuss them with the instructor and their classmates during course meetings and in online discussion forums.

Summative Assignment – 1 worth 4 points. A final summative written assignment to be completed during the final examination period is required. In this assignment, you will reflect on the course learning outcomes and explain how the assigned work completed during the semester address these.

Catalina Field Component

For this part of the course, you will be divided into small teams to undertake your field work together. In addition to completing the data collection project, each team will deliver two oral presentations and a poster summarizing your project and results.

First Presentation – 1 worth 5 points. This 10-15 minute presentation will take place at the start of the week and will describe your team's proposed research project.

Second Presentation – 1 worth 13 points. This 15-20 minute presentation will take place at the end of the week and will summarize your team's methodology, results and findings.

Poster/Storymap – 1 worth 12 points. The poster will present a summary of your project and visualization of results. The posters must be submitted for grading to D2L before leaving the island.

Grading Breakdown

Careful planning and a serious, consistent commitment will be required for you to navigate the various deliverables in this course. The table below summarizes the SSCI 587 course assignments and their point distribution.

Assignment	**Number**	**Points Each**	**Points**
Resume Assignment	1	3	3
Writing Responses	3	2	6
Reading and Research Discussions	3	4	12
Projects	3	15	45
Summative Assignment	1	4	4
Catalina Island Excursion			
First Presentation	1	5	5
Second Presentation	1	13	13
Poster/Storymap	1	12	12
TOTALS	**14**	**--**	**100**

In addition, it is important to note from the outset that:

- You are expected to attend and participate in every class session and to complete and upload all assignments before the deadlines documented in the Course Schedule. The move of this SSCI 587 course to the DEN model means that you may participate in-person or remotely and synchronously or asynchronously – you will choose the modalities to best fit your own circumstances and therefore participate in each class session in one or other of the following combinations of these modalities (i.e., in-person and synchronous, remote and synchronous, or remote and asynchronous).
- I will deduct one letter grade for late postings and assignments, and no credit will be assigned for postings or assignments turned in more than one week late.

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

Assignments must be submitted via D2L by the due dates specified in the Course Schedule. Attention to on-time assignment submission is essential. The instructor will aim to return feedback before the next assignment is due.
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.
- Additionally, no written work will be accepted for grading after 5 p.m. PT on the last day of classes.

Course Schedule

Week	Topics	Assignments & Readings	Deliverables / Due Dates
Module 1 | Introduction and Spatial Data			
Week 1 1/8	**Introduction to Course** Introduction to class, expectations, and data acquisition	Resume Assignment	
	Fitness-for-use The representation of spatial phenomena and fitness-for-use	Chrisman (1984, 2017) Fisher and Wood (1998) Goodchild (2000) *Case study:* Fisher et al. (2004)	
Week 2 1/15* *Monday, 1/15 is university holiday	**Scale** The role and importance of scale	Frank (2010) Goodchild (2011) *Case Study:* Strominger et al. (2016) Writing Response #1 RRD 1	Resume Assignment

Week	Topics	Assignments & Readings	Deliverables / Due Dates
	Uncertainty and error Sources of error, data standards, data quality and uncertainty	Couclelis (2021) Fisher et al. (2010) Bolstad et al. (1990)	Writing Response #1
Week 3 1/22	**Digital World** What's New in the digital World?	Chrisman (2017) Goodchild (2018)	
	RRD 1 RRD 1 and Introduction to Project 1		RRD 1 (synchronously, in class; asynchronously, before and after class session
Module 2 | Administrative and Textual Data Sources			
Week 4 1/29	**Administrative Data** U.S. Census , American Community Survey, and IPUMS Demo	Spielman et al. (2014) Spielman & Folch (2015) Spielman & Singleton (2015) Writing Response #2	
	Geocoding The geocoding process and practice Demo	Goldberg et al. (2007) Zandbergen (2008) Jones et al. (2014) Bader et al. (2016)	Writing Response #2;
Week 5 2/5	Project 1 workflow Guest Talk: Mike Goodchild		Project 1 Workflow
	NLP Spatializing data using natural language processing	Southall et al. (2011) Murrieta-Flores et al. (2015) Porter et al. (2015) Hu (2018)	
Module 3 | Terrestrial and Non-Terrestrial Data Acquisition			
Week 6 2/12	**GNSS** Global Navigation Satellite Systems, Regional Navigation Systems and complementary systems for terrestrial data acquisition	Jankowska et al. (2015) Yi et al. (2019) Yi et al. (2022)	Project 1 Due
	Surveying & Field Data Collection Workshop Surveying, coordinates, and field data collection; workshop of ArcGIS FieldMaps and hosted feature layers	Johnson and Barton (2004) Lippitt (2020)	ArcGIS FieldMaps access
Week 7 2/19* *Monday, 2/19 is university holiday	**VGI** Citizen science, volunteered and ambient geographic information Demo	Stefanidis et al. (2013) Barrington-Leigh & Millard-Ball (2017) Stockwell and Gallo (2017) *RRD 2*	

Week	Topics	Assignments & Readings	Deliverables / Due Dates
	VGI Introduction to Project 2		RRD 2 (synchronously, in class; asynchronously, before and after class session
Week 8 2/26	**Personal Location Data** Mobile phones and social media clicks	Jestico et al. (2016) Tenkanen et al. (2017) Gao et al. (2020 Liang et al. (2020)	
	UAV Unoccupied Aerial Systems: UAS platforms, sensors and products	Whitehead and Hugenholtz (2014) Toutin (2004) Zhang et al. (2016) Waagen (2019)	
Week 9 3/4	Project 2 workflow workshop		Project #2 Workflow
	Satellite Data Satellite imagery: Concepts and methods of remote sensing Demo	Robinson et al. (2005) Pasquarella et al. (2016) Dwyer et al (2018) Vergopolan et al (2021)	Project #2, **Due SUNDAY, 3/19**
*3/12-3/19 is Spring Recess			
Module 4 | Field Practicum			
Week 10 3/18* *3/11-17 is Spring Recess	Catalina Field Excursion		First Presentation, Tuesday Second Presentation, Sunday Poster, Sunday
Module 5 | Non-GNSS Data Acquisition / Spatial Sampling / Spatial Estimation			
Week 11 3/25	**LiDAR** Mapping the built and natural environment	Priestnall et al. (2000) Dubayah and Drake (2000) Smith et al. (2019) Thatcher et al. (2020)	
	Spatial Sampling **Spatial Estimation** Introduction to Project 3	Delmelle (2009) Smith et al. (2017) Kassie et al. (2017) For Project 3 (UAS): Greenwood (2015) Rakha and Gorodetsky (2018) Jeziorska (2019)	
Week 12 4/1	**Indoor mapping and positioning** How to measure and position indoor and without GNSS	Wirola et al. (2010) Kunhoth et al. (2020) El-Sheimy & Lu (2021)	Writing Response #3
	ArcGIS Indoor demo		

Week	Topics	Assignments & Readings	Deliverables / Due Dates
	Module 6 | Street View		
Week 13 4/8	**Street View Imagery** The benefits and utility of street view imagery such as Google Earth Imagery and others	Arietta et al (2014) Alvarez Leon & Quinn (2019) Larkin et al. (2021) Writing Response #3	
	Project # 3 workflow workshop		Project #3 Workflow
Week 14 4/15	Mapathon: humanitariam OSM projects		Project #3
	Mapathon: humanitariam OSM projects Data Validation and Reviewer		
Week 15 4/22	**RRD 3** RRD 3		RRD 3 (synchronously, in class; asynchronously, before and after class session
	Summary **Closing thoughts**		
	Summative Assignment – TBD		

Statement on Academic Conduct and Support Systems

Academic Integrity:

The University of Southern California is a learning community committed to developing successful scholars and researchers dedicated to the pursuit of knowledge and the dissemination of ideas. Academic misconduct, which includes any act of dishonesty in the production or submission of academic work, comprises the integrity of the person who commits the act and can impugn the perceived integrity of the entire university community. It stands in opposition to the university's mission to research, educate, and contribute productively to our community and the world.

All students are expected to submit assignments that represent their own original work, and that have been prepared specifically for the course or section for which they have been submitted. You may not submit work written by others or "recycle" work prepared for other courses without obtaining written permission from the instructor(s).

Other violations of academic integrity include, but are not limited to, cheating, plagiarism, fabrication (e.g., falsifying data), collusion, knowingly assisting others in acts of academic dishonesty, and any act that gains or is intended to gain an unfair academic advantage.

The impact of academic dishonesty is far-reaching and is considered a serious offense against the university. All incidences of academic misconduct will be reported to the Office of Academic Integrity and could result in outcomes such as failure on the assignment, failure in the course, suspension, or even expulsion from the university.

For more information about academic integrity see the student handbook or the Office of Academic Integrity's website, and university policies on Research and Scholarship Misconduct.

Please ask your instructor if you are unsure what constitutes unauthorized assistance on an exam or assignment, or what information requires citation and/or attribution.

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

Free and confidential mental health treatment for students, including short-term psychotherapy, group counseling, stress fitness workshops, and crisis intervention.

988 Suicide and Crisis Lifeline - 988 for both calls and text messages – 24/7 on call

The 988 Suicide and Crisis Lifeline (formerly known as the National Suicide Prevention Lifeline) provides free and confidential emotional support to people in suicidal crisis or emotional distress 24 hours a day, 7 days a week, across the United States. The Lifeline is comprised of a national network of over 200 local crisis centers, combining custom local care and resources with national standards and best practices. The new, shorter phone number makes it easier for people to remember and access mental health crisis services (though the previous 1 (800) 273-8255 number will continue to function indefinitely) and represents a continued commitment to those in crisis.

Relationship and Sexual Violence Prevention Services (RSVP) - (213) 740-9355(WELL) – 24/7 on call

Free and confidential therapy services, workshops, and training for situations related to gender- and power-based harm (including sexual assault, intimate partner violence, and stalking).

Office for Equity, Equal Opportunity, and Title IX (EEO-TIX) - (213) 740-5086

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

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 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) 740-0411

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

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

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) 442-1200 – 24/7 on call

Non-emergency assistance or information.

Office of the Ombuds - (213) 821-9556 (UPC) / (323-442-0382 (HSC)

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) 442-2850 or otfp@med.usc.edu

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 site and the SSI 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.