Advanced GIS
School of City & Regional Planning, College of Design, Georgia Tech

Course Instructor

Rama Sivakumar (Siva)
Class Meeting @ Rm 358, College of Design - TTH 12:30 pm – 1:45 pm
Office Hours: By appointment – Virtual or @ Center for Spatial Planning
Analytics and Visualization (CSPAV), Rm 220 (760 Spring St @ Tech Square)
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Course Description

Primary objective for this course is to build on introductory GIS and expose students to various advanced GIS analysis, advance data management, analytics, and modeling using Esri ArcGIS Suite, Erdas Imagine, and Opensource QGIS suite of products.

The course will comprehensively explore various application extensions of ArcGIS software functionality to demonstrate advanced analysis capabilities. Industry practitioners from different domains will be invited to provide talks to students on wide ranging GIS projects.

Students will also be introduced to scripting and modeling GIS processes with local and cloud based GIS platforms for deriving GIS solutions.

Course Pre-Requisites

Students are expected to have taken CP6514 Introduction to GIS or an equivalent course in order to be successful in this course. Students are expected to have a good understanding of basic principles of GIS, basic data manipulation skills, familiarity with projection concepts, skills in performing basic analysis with geo-processing tools, and knowledge about obtain spatial data from online data repositories.

Course Goals and Learning Objectives

1. Build on introductory GIS concepts and explore in depth several advanced GIS techniques with extension application modules using variety of software environments. The course will primarily use ArcGIS Pro. In addition, the
course will also use ArcMap, Erdas, Imagine, and QGIS software applications for exercises.

2. Introduce developing automated GIS workflows and performing analysis using programming techniques.

3. Explore network solvers, linear referencing, and dynamic segmentation concepts.

4. Understand spatial data interoperability techniques for data manipulation to create, aggregate, analyze, and manipulate spatial data utilizing a variety of geo-processing techniques.

5. Learn to develop applications for field work.

6. Explore machine learning algorithms for predictions.

7. Apply advanced skills learned in the course to a practical problem through a final group project.

This course will be mostly lab exercise driven to provide maximum hands on time, question and answer sessions, discussions, and assigned readings.

**Course Outline**

This course will follow a general outline as below. For details refer to additional course schedule document accompanying the syllabus. Instructor, at his discretion may make changes to course outline during the semester depending on the pace of the course.

Course Overview & GIS Skills Refresher

Resolving Logical Consistencies in Spatial Data - Topology Validation

Modeling Relative Positions and Measures with Linear Referencing

Analyzing and Solving Network Problems

Programming GIS - Python Primer

Spatial Data Management with ArcPy

Pythonic API for Scripting and Automating GIS

Repeatable Workflow and Modeling GIS Processes

Spatial Analysis with R

Advanced Analysis with Remotely Sensed Data

Imagery Processing Techniques (Imagine)
Developing GIS for Field Deployment

Exploring Machine Learning Techniques for Predictions

**Learning Environment and Software Availability**

ArcGIS Pro 2.8x, ArcGIS Desktop 10.8x, Erda Imagine 2022, and QGIS 3.16 software is installed on all College of Design computer labs and clusters. Esri ArcGIS Suite of software has been distributed widely to other campus departments including OIT maintained labs. Please contact me if your home unit needs this software for your labs. ArcGIS software suite is available only on windows platform. If you work on a Mac platform, you can take advantage of the CoD virtual lab machines to run ArcGIS remotely from [https://mycloud.gatech.edu](https://mycloud.gatech.edu).

In addition to lab computers, students will have an opportunity to install ArcGIS Pro, and Erda Imagine 2022 software applications on personally owned computer hardware. License files and authorization codes will be distributed to class participants by the instructor.

ArcGIS Online accounts will be provided to students to complete certain assignments and project work.

**Course Materials**

There is no set text book for this course. Software documentation and other web resources will be primarily relied on for exercises. You may use the text used in Intro to GIS class by Maribeth Price “Mastering ArcGIS Pro – First Edition”. McGraw Hill ISBN: 978-1-260-58733-3

Additional References:
- Instructed provided resources and references.
- ArcGIS online resources from ESRI.
- Materials from ESRI publications.
- Journal articles.
- Industry and trade publications.

**Academic Integrity**

Georgia Tech aims to cultivate a community based on trust, academic integrity, and honor. Students are expected to act according to the highest ethical standards. For information on Georgia Tech’s Academic Honor Code, please visit [http://www.catalog.gatech.edu/rules/18b.php](http://www.catalog.gatech.edu/rules/18b.php) and [http://www.catalog.gatech.edu/genregulations/honorcode.php](http://www.catalog.gatech.edu/genregulations/honorcode.php).
Any student suspected of cheating or plagiarizing on a quiz, exam, or assignment will be reported to the Office of Student Integrity, who will investigate the incident and identify the appropriate penalty for violations.

**Accommodations for Individuals with Disabilities**

If you are a student with learning needs that require special accommodation, contact the Office of Disability Services (often referred to as ADAPTS) at (404)89-2563 or [https://disabilityservices.gatech.edu/](https://disabilityservices.gatech.edu/), as soon as possible, to make an appointment to discuss your special needs and to obtain an accommodations letter. Please also e-mail me as soon as possible in order to set up a time to discuss your learning needs.

**Student-Faculty Expectations**

At Georgia Tech we believe that it is important to continually strive for an atmosphere of mutual respect, acknowledgement, and responsibility between faculty members and the student body. See [https://catalog.gatech.edu/rules/22](https://catalog.gatech.edu/rules/22) for an articulation of some basic expectations – that you can have of me, and that I have of you. In the end, simple respect for knowledge, hard work, and cordial interactions will help build the environment we seek. Therefore, I encourage you to remain committed to the ideals of Georgia Tech, while in this class.

**Use of Mobile Devices and social media tools in the Classroom**

To ensure a conducive learning environment use of mobile phones, browsing of Internet not related to class discussions, and use of social media tools are strictly not allowed during class.

**Course Grading:**

This course is a hands-on class. Students are expected to attend all classes and labs, participate in class discussions, complete the required readings, homework assignments, and complete a final project. Unless otherwise specified, all exercises are to be completed individually.

- A = 90-100%; B = 80-89%; C = 70-79%; D = 60-69%; F = <60%

**Attendance and Course Participation (5%)**

**Lab Exercise Completion (10%)**

**Homework Assignments (5 x 7% = 35%)** – You will be assigned Five assignments over the course of the semester. You will have approximately 2
weeks to complete each homework assignment. Students are expected to
adhere to posted submission deadlines. Late submissions, if approved by the
instructor will result in a penalty of 10% of grade per class.

**In Class Written Exam (2 x 15% = 30%)** – In class written exam will test
your conceptual knowledge of course materials. Exam will be a combination
of multiple choice, fill-in-the-blank, short descriptions, reasoning type of
questions.

**Final Team Project (20%)** - Team projects based on instructor approved
topic, project outline and deliverable timeline. Instructor may choose to
assign specific project topics as well.

**Attendance and Course Participation (5%)** – Students are expected to
contribute to class discussions throughout the semester. A maximum of three
absences are allowed for the semester without penalty.

**Course content delivery**

Canvas learning portal website is the primary method for content
dissemination. All assignments and exam must be uploaded to the Canvas
learning portal.

**Submission Requirements**

Please upload electronic copies of all assignments on to Canvas learning
portal website. **Each assignment must be submitted as a SINGLE PDF file**
unless instructed otherwise. It is your responsibility to collate your
answers/results into a SINGLE PDF before submitting.

**Extensions, Late Assignments, & Re-Scheduled/Missed Exams**

Late submissions of assigned work are not accepted. However, according to
Georgia Tech institute policies some exceptions are made for “approved
Institute activities” (e.g. field trips and athletic events, see
https://catalog.gatech.edu/rules/4 for more information). Discuss your
situation with course instructor prior to deadlines.

**Email to instructor**

Feel free to send an email to me with questions related to class. **Your email
subject line must start with [CP6521-S21].** I will be filtering my emails
based on the subject line so that I don’t overlook your emails. I will respond
within 24 hours of your email. But, I will most likely respond much sooner.

**COVID-19 Protocols**

(Last Modified: January 10, 2022)
All required and recommended protocols established by Georgia Tech and CDC will be strictly followed. Masks are strongly encouraged.

**College of Design Faculty Statement on Diversity, Equity, and Inclusion**

The College of Design (COD) community of faculty, staff, and students aspires to create and nurture an environment that is supportive of all backgrounds where different views and ideas are respected and encouraged. In all our pursuits, we commit to justice, diversity, equity, and inclusion with regard to race, national origin, language, age, sexual orientation, gender, religion, and ability. Moreover, we will encourage intellectual inquiry and respectful exchange that cements our dedication to these principles.