GEOG3160–Web GIS: Applications and Developments
Fall Quarter, 2019

Class Time: Tuesday and Thursday 14:00 -15:50
Class Date: September 9, 2019 – November 21, 2019
Classroom: BW125

Instructor: Jing Li
Office: Boettcher Center West 106
Phone: 303-871-4687
Email: Jing.Li145@du.edu
Office hours: Tuesday and Thursday 11:00-13:00

Teaching Assistant:
Email:
Office hours:

1. Course Description:
   With the development of internet technologies, the architecture of Geographic Information System (GIS) has evolved from the centralized desktop architecture to the distributed web architecture. Numerous web GIS applications are available (e.g., Google Map, Earth Explorer, and National Map). A web GIS application allows GIS analysts to access, manipulate, and visualize geospatial data from the web without the installation of GIS software. To facilitate the development of web GIS applications, geospatial technology vendors have provided application programming interfaces (APIs) through which GIS professionals can build customized web applications.

   This is an upper-level undergraduate, to graduate-level course in GIS that introduces fundamental Web GIS concepts, applications and development kits. This course focuses on the concepts and the development of web based GIS applications using industry-relevant geospatial APIs and core web technologies of HTML, CSS, and JavaScript.

   Concepts and techniques to be covered in this course include:
   - Web GIS concepts: system architecture, components, and workflow
   - Web programming languages: Hypertext Transfer Markup Language (HTML), Cascading Style Sheet (CSS) and JavaScript
   - Web mapping tools: ArcGIS online, Leaflet and their APIs

2. Learning Goals:
   Upon the completion of the course, students are able to:
   - Understand the typical architecture, the core components and the main workflow of Web GIS systems;
   - Understand web based GIS data exchange standards (e.g., GeoJSON) and manipulate data;
   - Comprehend the basic syntax of HTML and JavaScript and use HTML and JavaScript to build dynamic content/behavior of a web page;
• Develop web based mapping products using commercial (ArcGIS online) and open source (e.g., Leaflet) online mapping tools or libraries;
• (Graduate Students) Configure and deploy geospatial web servers using open source server packages;

3. Prerequisite:
It is expected that students have taken GEOG 2100 - Introduction to Geographic Information Systems, and GEOG3130 Advanced GIS course or one programming course.

This course involves writing scripts with JavaScript. Students should be familiar with programming concepts such as variables, loops, decision structures, error handling, and objects.

4. Textbooks, Readings and Online Resources
Required:

Additional reading materials will be distributed through Canvas. Most lectures include assigned readings should be completed before the lecture.

Resources:
HTML: https://www.w3schools.com/html/
JavaScript: https://www.w3schools.com/js/default.asp
Leaflet: https://leafletjs.com/
Esri Leaflet: http://esri.github.io/esri-leaflet/

5. Course Assessment:

<table>
<thead>
<tr>
<th></th>
<th>Undergraduate</th>
<th>Graduate</th>
</tr>
</thead>
<tbody>
<tr>
<td>Weekly exercises</td>
<td>20%</td>
<td>20%</td>
</tr>
<tr>
<td>Assignments</td>
<td>40% (8*5%)</td>
<td>40% (8*5%)</td>
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<tr>
<td>Online tests</td>
<td>10% (2*5%)</td>
<td>10% (2*5%)</td>
</tr>
<tr>
<td>Web GIS Server Project</td>
<td>NA</td>
<td>10%</td>
</tr>
<tr>
<td>Final Project</td>
<td>30%</td>
<td>20%</td>
</tr>
<tr>
<td>Total</td>
<td>100%</td>
<td>100%</td>
</tr>
</tbody>
</table>

Grading criteria:
93-100% A
90-92.99% A-
87-89.99% B+
83-86.99% B
80-82.99% B-
77-79.99% C+
73-76.99% C
70-72.99% C-
67-69.99% D+
63-66.99% D
Weekly exercises: You will acquire hands-on experience through a series of exercises. A portion of the class time will be dedicated to the exercises.

Tests on fundamental JavaScript and HTML: HTML and JavaScript are fundamental languages. You will go to the websites: [https://www.w3schools.com/js/js_quiz.asp](https://www.w3schools.com/js/js_quiz.asp) and [https://www.w3schools.com/html/html_quiz.asp](https://www.w3schools.com/html/html_quiz.asp) to take the two tests.

Assignments: Take home assignments will be given to reinforce the technical skills learnt in the class. Graduate students are expected to complete additional questions as specified in the assignment instructions.

Web GIS Server Project: Graduate students will configure a web data server using open source server applications (e.g., GeoServer), host geospatial data, and produce OGC compliant web services. A presentation that describes the development should be given to the class.

Term project: You are expected to demonstrate your knowledge and skills learnt in the course through developing a web mapping application. The application should consist of the usage of open data sources, mapping and visualization functions, and interaction functions. To discuss the project topic with the instructor, you are expected to submit a project proposal by Week 8. To present the tools in the class, students are expected to deliver professional presentations in class.

6. Course Policies:

Academic integrity: Students are expected to follow the DU Honor Code. Posting, downloading, or otherwise using or disseminating class study guides, exercises, or exam questions found on the various online “study sites” is cheating. Additionally, disseminating class content online violates copyright. For further information, please visit the Office of Student Conduct’s website at [www.du.edu/honorcode](http://www.du.edu/honorcode).

Academic accommodations: All academic accommodations regarding disabilities must be arranged through the Disability Services Program (DSP) ([http://www.du.edu/disability/dsp](http://www.du.edu/disability/dsp) or 303.871.2455 / 2278 / 7432). Information is also available on line at [http://www.du.edu/disability/dsp](http://www.du.edu/disability/dsp); see the Handbook for Students with Disabilities.

Inclusive learning environments: In this class, we will work together to develop a learning community that is inclusive and respectful. Our diversity may be reflected by differences in race, culture, age, religion, sexual orientation, socioeconomic background, and myriad other social identities and life experiences. The goal of inclusiveness, in a diverse community, encourages and appreciates expressions of different ideas, opinions, and beliefs, so that conversations serve as opportunities for intellectual and personal enrichment.

Late submission policy: Students are expected to turn in assignments and project report before 6:00 PM on the due day. 5% of the maximum grades will be deducted per day.
Religious accommodations policy: University policy grants students excused absences from class or other organized activities or observance of religious holy days, unless the accommodation would create an undue hardship. You must notify me by the end of the first week of classes if you have any conflicts that may require an absence. It is then your responsibility to make arrangements with me in advance to make up any missed work or in-class material.

Student athletes: If you are a student-athlete, you should inform me of any class days to be missed due to DU sponsored varsity athletic events in which you are participating. Please provide me with an absence policy form by the end of the first week of class. You will be responsible for making up any missed lectures, assignments, and/or exams.
7. **Class Schedule (subject to change):**
You are responsible for keeping up with the readings, exam dates, and lectures. Any changes to this schedule will be announced in class and posted to the course page.

<table>
<thead>
<tr>
<th>Week</th>
<th>Topics</th>
<th>Reading</th>
<th>Assignment (A: Assignment; P: Project)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Course introduction; Introduction to Web GIS: components and architecture; ArcGIS online and story maps;</td>
<td>Chapter 1; Chapter 2;</td>
<td>A: Prepare and publish a web map with ArcGIS online</td>
</tr>
<tr>
<td>2</td>
<td>HTML: the Document Object Model (DOM), page structure, elements and actions; Interactive Development Environments (IDE); Using NetBeans as the IDE</td>
<td>HTML tutorial from W3CSchools</td>
<td>A: Design a basic HTML page</td>
</tr>
<tr>
<td>3</td>
<td>JavaScript: data types, variables and functions; JavaScript HTML DOM elements; jQuery HTML elements;</td>
<td>JavaScript tutorial from W3CSchools</td>
<td>A: Simple interactions using JavaScript in HTML</td>
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<tr>
<td>4</td>
<td>Web mapping applications and libraries; Leaflet: functions of maps and layers;</td>
<td>Chapter 10</td>
<td>A: Create a web map using Leaflet</td>
</tr>
<tr>
<td>5</td>
<td>Open data standards: JSON, XML; Geospatial data standards: GeoJSON, KML JavaScript: data access and manipulation;</td>
<td>JSON tutorial from W3CSchools</td>
<td>A: Access and manipulate web data with JavaScript</td>
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<td>6</td>
<td>Leaflet: data filtering and classification, the layer switcher and other controls; Esri Leaflet plugin</td>
<td></td>
<td>P: Web Server Project A: Interactive data visualization in Leaflet</td>
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<tr>
<td>7</td>
<td>HTML: styles, layouts and interactions; CSS; Google Chart: Create charts and figures;</td>
<td>CSS tutorial from W3CSchools</td>
<td>A: Adding charts to maps</td>
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<td>8</td>
<td>Web GIS server and service configuration; OGC web service specifications; Leaflet: Using geospatial web services</td>
<td>Chapter 5; Chapter 9</td>
<td>P: Term project proposal A: Configure and manage multiple layers in Leaflet</td>
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<tr>
<td>9</td>
<td>Work on the term project</td>
<td></td>
<td>P: Complete the HTML design</td>
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<tr>
<td>10</td>
<td>Project discussion and development</td>
<td></td>
<td>P: Complete the web mapping application</td>
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<tr>
<td>11</td>
<td>Project presentation</td>
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</table>