Advancing CyberGIS pedagogy for urban planning practice and research: existing gaps and future potentials

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Since its inception as a spatial decision making tool, Geographic Information Systems (GIS) have been widely applied in urban and regional analysis (Bardon, Elliott, & Stothers, 1984; Campbell, 1994; Han & Kim, 1989). The integration of multiple decision criteria and collaborative decision making processes have remade the discipline of urban planning, opening new avenues for the use of GIS (Nedović-Budić, 1998). GIS has become an indispensable component of planning support systems with various applications that cut across the different stages, levels, sectors, and functions of urban planning (Yeh, 1999). Besides serving as an effective medium for public participation (Carver, 2003; Talen, 2000), GIS is commonly used for database management, visualization, spatial analysis, and spatial modeling in urban planning (Levine & Landis, 1989; Marble & Amundson, 1988; Webster, 1994). However, the application of GIS and related technologies by urban planning practitioners has not kept pace with the advancement of GIS science. Despite developments in the late 1960s, the prohibitive cost of hardware and limited capabilities of the software limited the ability of planning agencies to widely leverage this technology until early 1980s (Yeh, 1999). Also, currently the conventional GIS software, primarily based on closed and monolithic architectures have limited capability for managing very large spatial data and for sophisticated spatial analysis/modeling (SAM) and visualization (Shaowen Wang et al., 2013).

CyberGIS, as a cyberinfrastructure (CI)-based GIS has emerged as a fundamentally new GIS modality, leading to widespread scientific breakthroughs, wider scope for utilizing big data, and broad societal impacts (S. Wang, Wilkins-Diehr, & Nyerges, 2012; Shaowen Wang et al., 2013; Wright & Wang, 2011). It represents a holistic approach to combining data-intensive and computational sciences for geographic problem solving (Shaowen Wang, 2010; Shaowen Wang et al., 2013), which can significantly improve urban planning decision making processes. But consistent with the earlier trends, CyberGIS has yet to be extensively adopted by planning practitioners and researchers. While the earlier slow adoption of GIS in urban planning is understandable considering cost, data availability, and software capability, it is unfortunate that the rapid growth in cyberinfrastructure and pervasive access to the internet have not translated into more widespread adoption of CyberGIS in urban planning. The inadequacy of education materials on urban planning applications of CyberGIS and a lack of planning professionals trained in CyberGIS are two of the main contributors to this disconnect. Through the CyberGIS Fellows program we initiated the process to fill this gap and already have developed some learning modules targeted towards urban planning professionals and researchers. This position paper relates our experiences and identifies the potentials for further pedagogical advancement to facilitate the adoption of CyberGIS capabilities in urban planning practice and research.

Through the CyberGIS Fellows program we developed education materials on CyberGIS to augment existing GIS curricula of the Department of Geography and Geographic Information Science and the Department of Urban and Regional Planning at the University of Illinois at Urbana-Champaign. We delivered the lecture and lab materials to three GIS courses, GEOG 379: Intro to GIS, UP 418: GIS for Planners, and UP 519: Advanced Applications of GIS. The first
two courses is primarily intended for new GIS users and introduces basic concepts and techniques of GIS widely used in multiple disciplines. The third course (UP 519) primarily focuses on advanced applications of GIS for research and policy analysis in urban planning. Previously these courses relied upon stand-alone GIS software (ArcGIS, GeoDa, and R) that did not provide an opportunity to expose students to CyberGIS capabilities, so our participation in the CyberGIS Fellow program was centered around developing lecture and lab materials for these GIS courses. Given the aims and audiences of these three courses we developed education materials separately that focus on CyberGIS application in spatial analysis and data visualization (GEOG 379 and UP 418), and advanced GIS application using cyberinfrastructure in urban planning (UP 519).

We identified several key barriers while delivering our learning modules and have articulated some recommendations for advancement in the CyberGIS curriculum that can further facilitate CyberGIS application in urban planning practice and research. Broadly, they can be situated under three groupings: accessibility, data availability/acquisition, and demonstration (case study).

Accessibility: Despite significant progress in the research arena, CyberGIS tools are yet to have easily accessible Graphical User Interfaces (GUIs) which can be quickly grasped by those with little or no prior GIS experience. We used the CyberGIS Gateway developed by NSF CyberGIS project for our introductory GIS classes and found the students easily navigated this interface. For advanced GIS applications however, which are usually performed by planning practitioners and researchers, this kind of CyberGIS environment needs to incorporate more GIS tools with better data integration capabilities.

Data availability/acquisition: Although the big data deluge is now widely acknowledged and has entered popular discourse, there are very few tools or techniques that can enable a new GIS user to quickly acquire big data for urban and regional analysis. There is a need to develop more learning materials that outline the process of data acquisition and data curation/cleaning targeted towards the GIS users without much of a programming background. This will also help to accelerate the adoption of CyberGIS tools by planning practitioners.

Demonstration (case study): In order to expand the use of CyberGIS capabilities to a wider community of planning practitioners and researchers we need to develop some problem-specific case studies demonstrating how this cutting edge technology can be applied for more efficient decision making and planning support. Ideally, these resources will also help practitioners to see how they can adopt and deploy these tools and techniques in their particular work context.

CyberGIS is opening new frontiers of technological capabilities for efficient and collaborative decision making processes that fit well with the work of urban planning practitioners and researchers. The CyberGIS community needs to be more aware of the needs of this substantial pool of GIS users and work on developing more learning tools that may help us better connect with the broader planning community.

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References:


