A practical approach to overcoming barriers to teaching CyberGIS-related science and skillsets in undergraduate and graduate curricula

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Introduction

I have been a faculty member of the Spatial Sciences Institute University of Southern California since its inception, and I have been teaching online graduate classes for many years in Web GIS and desktop GIS programming which includes basic programming skills in HTML, JavaScript, J query, CSS, and Python in the latter (Swift et al. 2015). We also offer a Mobile GIS graduate class which covers Java programming (Swift and Pultar, 2014). I do not have a formal education nor other training experience in big data science, cyberinfrastructure, and high-performance computing. Nevertheless, I am enthusiastic about learning about these domains myself, and, in turn, devising creative ways to teach these topics to undergraduates and graduates. In this position paper, I suggest straightforward, practical mechanics for delivering teaching materials to students and learning materials to faculty to support CyberGIS-related studies in our undergraduate and graduate curricula.

If a target audience for the current phase of curriculum development in the CyberGIS-related domains include faculty like myself, and perhaps those with even less background in teaching similar scientific and technical skills, then I believe it is critical to both educate faculty as well as develop teaching materials. Basic teaching materials must be readily accessible from sources that are widely acknowledged as high in quality, consistency and currency. Nonetheless, the following suggests a practical approach to introducing CyberGIS concepts and research across disciplines and is not intended as a replacement for traditional computer science curricula augmented with big data science, cyberinfrastructure, and high-performance computing learning opportunities.

A practical approach to overcoming current barriers to teaching and learning

One of the biggest barriers to teaching these advanced sciences and skill sets lies in the lack of accessibility to resources for faculty to learn about these topics as well as to teach them. Although excellent opportunities are provided such as workshops at conferences and recorded online seminars, these are one-offs and only available to those who have the means to travel to the workshops and attend live seminars. Attending live seminars depends on time zones and schedules, and there is often a delay in access to recordings not always archived or maintained for significant links of time.

Today, there are many virtual or online venues including software vendors, university-based organizations and consortiums, open source collaboratives and commercial online learning platforms that provide extensive resources for teachers and students in numerous disciplines, including a myriad of programming and computing skills. As a practical approach to bridging this gap, I suggest considering two commercial online learning resources as examples of pathways to the development and delivery high-quality cyberinfrastructure and high-performance computing instructional materials that would be readily available to instructors and students. The targets are interdisciplinary academic programs and (as a complement to) traditional computer science curricula that already have trained faculty in place.
Delivering Instructional materials to faculty and students

One example of a well-recognized online teaching materials which many universities currently subscribe to is Lynda.com (http://www.lynda.com). This resource offers suites of courses geared towards academia, providing thousands of video courses (including transcripts and downloadable exercise data) in multiple domains, seemingly updated annually. Lynda.com has become a popular resource for higher education instructors for introductory to advanced learning materials in programming languages, Web design, 3-animation, mobile application development, cloud computing, and computer operating system development, etc. I propose that beginner, intermediate and advanced level courses related to CyberGIS be developed and deployed using Lynda.com or a similar readily accessible online learning platform. These courses could be geared toward undergraduate and graduate-level work. For example, there is an existing framework called “Foundations of IT security”, which includes many courses in cyber security, and six “Cloud” courses covering Google cloud computing. At present, there are no CyberGIS-related offerings in Lynda.com or other similar systems, to the best of my knowledge.

Learning Opportunities for Faculty

At universities with curricula that already offer or would like to develop new courses to support the integration of these new topics for undergraduates as well as graduates, faculty may represent a variety of disciplines not including a computer science background. An example of widely recognized online learning platform which could be used to bridge this gap is the Online Learning Consortium (OLC), an organization focused on professional development in a variety of fields. Faculty can voluntarily take workshops that provide instruction aimed at improving the quality and breadth of teaching experience. Such professional development activity is strongly encouraged in many universities and counts towards promotion, in particular in teaching tracks. I propose that a series of workshops be proposed as a “Mastery Series” in CyberGIS. For example, just a few years ago OLC launched the “Mobile Learning Mastery Series” which focuses on “...research, teaching and assessment of mobile learning environment” (http://onlinelearningconsortium.org). Perhaps it is only a matter of time before such a Mastery Series in CyberGIS is developed for the OLC, given the popularity of this research. Or, i.e., OLC could simply be used as an example of a way to deliver comprehensive learning materials to interdisciplinary faculty.

Generating new career tracks for students and faculty concentrations

Although commercialization of instruction may be-be unappealing, if access to learning and instructional materials in CyberGIS opens up, universities, as well as individual curricula across disciplines, may become more familiar with the importance of these topics. I believe that making basic supporting instructional materials suggested herein available via visible, accessible learning resources will facilitate the development of these as career tracks in higher education at both the undergraduate and graduate levels. Demands for students trained in the sciences of big data science, cyberinfrastructure, and high-performance computing will increase regardless, which is already leading to opportunities for new types of faculty appointments that include these focuses.

References:
