

The open source dynamics in geospatial research and education

1 Introduction

The open source revolution has breathed new life into the geospatial domain by means of the development of geospatial free and open source software (GFOSS). GFOSS has been extensively promoted by FOSS4G conferences, which evolved from meetings that gathered together interested GFOSS development “tribes” at a standard business conference. More in line with the academic side of FOSS4G events, the Open Source Geospatial Research and Education Symposium (OGRS) is a neutral forum dedicated to sharing knowledge, new solutions, methods, practices, ideas, and trends in the field of geospatial information through the development and the use of free and open source software in both research and education. The purpose is to gather communities whose main concerns are to find new solutions by sharing knowledge and methods free of software license limits. On this basis, a first edition took place in 2009 in Nantes (France). It brought together 130 participants who proposed 20 research contributions and 12 workshops related to current innovative projects from around the world. The main outcomes were published in the first OGRS proceedings “Geospatial Free and Open Source Software in the 21st Century” [1].

On the occasion of the second OGRS edition (Yverdon-les-Bains, Switzerland, 2012), 100 participants attended 22 talks and 10 short poster presentations, 8 workshops, and four keynote talks, by Helena Mitasova (NCSU, USA), Gérard Hégron (IRSTV, France), Sergio Rey (ASU, USA), and Robert Weibel (UNIZH, Switzerland). These contributions highlighted the power of open source geospatial solutions to enhance research activities. Indeed, openness favors the culture of knowledge sharing by means of code availability, transparency, malleability, modularity, and portability. These characteristics are likely to lead to the elaboration of understandable, reliable, and sustainable solutions. In parallel, as OGRS2012 also focused on open geo-educational aspects, the participants demonstrated how open source training is likely to offer pedagogical advantages to equip students with the skills and knowledge necessary to succeed in tomorrow’s geospatial labor market [2, 12].

In both research and education, there is still room for improvement as regards the way people use the characteristics of open source as a development or teaching model. Indeed, a new dynamics will be established if we shift our view of open source code from only a tool to do research to a new vision that considers the code as text and an object of research, as well as offering a new and better way to teach geographical information systems and analysis [11].

2 Research

Peer reviewing is one of the core processes of science. While the typical blind system helps to improve original submissions, there are opportunities for academic publishing to learn from open source practices (commits, bug reports, feature requests, documentation, etc.), which are entirely open and done in public view. But beyond, with greater significance, peer reviewing offers a good opportunity to illustrate how the characteristics of the open source model can favor simultaneously the acknowledgment of programming efforts, a high quality evaluation standard, but also reproducibility and transparency.

Code has to be considered as a full research object in geospatial development. It should be made available in full and examined as part of any contribution, like the article going with it. A good example is the Journal of Statistical Software¹. Created in 1996, it publishes articles and code on statistics and algorithms. The contents are freely available on-line, code snippets and source code being published along with the paper. An advantage of this approach is to prevent the propagation of “black boxes” [15]. The approach clearly also adds value to code by acknowledging programming efforts as scientific contributions. But publishing code along with a paper also results in the ability of subsequent research projects to build on this basis. This ability is even becoming a requirement for publicly funded research projects [7]. In addition, we may notice that code malleability provides the researcher with the opportunity to adapt the software to the scientific questions, instead of being constrained by the limiting functionalities of the software.

These are the necessary conditions to enable reproducibility, a core principle of science [10], which here requires sharing and documenting all data and source code used to obtain a result [3, 6]. Seeing the code as text rather than as a black box is even a mandatory configuration to make it possible to build common research platforms as Hégron suggests [5]. Indeed, he formulates a motivation according to the interdisciplinary and systemic context for sustainable urban planning, which requires a sustainable collaborative organization with transparency and reliance. He expects open source and open standards to favor that need.

In this context, the two papers included in the present special feature apply open source software to two totally different research domains. With the analysis of a landslide characterized by persistent rockfalls in Catalonia, Tonini et al. [13] use specific R packages to implement feature extraction (spatstat) and to label features (fpc) for rockfall detection from terrestrial LIDAR point clouds. Although this paper primarily illustrates the application of existing open source software as a tool, the custom development of specific algorithms in the R environment illustrates well the opportunity to efficiently insert new algorithms into existing code.

The second paper, Plumejeaud-Perreau et al. [9], develops a web application for the geovisualization of demographic and administrative data related to the history of French municipalities. Interestingly, they use an “open stack” to elaborate an architecture for the open dissemination of the collected information. An “open stack” is a combination of several open components, which are here open data, open code, and open standards. Another element of interest in this article is the porting of a tool able to compute ancient boundaries from Fortran to Python. This development provided users with an open-source plugin for QGIS, illustrating the ability to build on the results of others, while bringing a piece of code up to date.

¹jstatsoft.org

3 Education

There are two key freedoms inherent to open source software and practices that offer potential pedagogical wins for geospatial education. First, “free as in beer” allows students to indefinitely install software on computers without license limitations. A consequence of this unconstrained context is a greater degree of exploration and discovery by the students working by themselves and at their own pace. But there is still a long way to go before all the benefits are fully realized. Indeed, current demands and offerings are focusing on “buttonology” [2], which consists of learning how to use tools constrained by software licenses carefully negotiated over the years by universities. It raises then some important questions regarding the role of geospatial education. Is it not to train students to equip them with the skill sets and knowledge so that they are ready for, and can create, the future geospatial labor market? Therein, we can consider the second freedom, “free as in speech,” as able to empower the students by revealing the logic of particular algorithms and computational concepts. Open source code—as text—is available for reading, manipulating, and understanding [8]. The expected advantage is that students’ engagement with fundamental concepts is deepened in a way that is per se not possible with closed source software. In other words, students come to see geospatial methods not only as tools they can use in their own research, but as possible subjects for research.

The reality of the situation of open source and geographic education is currently rather mixed. It suggests that a certain level of training and education may be required before the benefits of open source software can be experienced by students. Especially, seeing code as text requires skills in programming that need to be anticipated within the curriculum. These skills may be taught by means of the integration of primer lessons about programming and open source tools (e.g. Git) for geospatial research together with formal lectures on a selection of spatial algorithms and their application to course projects. It did not escape our notice that the recent developments in so-called massively open and online courses (MOOCs) offer some interesting possibilities in this regard.

As part of the open education movement, initiated by the launching of the Open Access Initiative in 2001, MOOCs have enjoyed huge successes where in the past other similar initiatives have failed. In particular, government initiatives that funded the development of e-learning solutions for academic programs, including geospatial content [14], were implemented in various countries in the early 2000s. These initiatives did not enjoy the same levels of success as today’s MOOCs. Interestingly, Weibel et al. show how to become inspired by the open source dynamics, so as to adopt open content strategies that may help in improving the longevity of these projects. For example, the Geographic Information Technology Training Alliance (GITTA) is a large and multilingual e-learning project dedicated to the teaching of GIScience-related disciplines with content under Creative Commons license. This platform demonstrates that such an approach has helped to secure a long life for the materials created during the initial e-learning project phase.

4 Conclusion

The elements presented in this editorial constitute some of the challenges the OGRS community aims at taking up. They show how open source practices and culture are able to create a constructive dynamics between research and education. They also constitute

according to us the true value of open source: the potential to fundamentally enhance geographic information science [4].

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