Is Open Science the Same as Open Source Science?

Jesús Vegas[1]*, César Llamas[2], Carmen Hernández[1] and Manuel A González[2]

[1]*Department of Informatics, University of Valladolid, Spain*

[2]*Department of Applied Physics, University of Valladolid, Spain*

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*Corresponding author: : Jesús Vegas, Department of Informatics, University of Valladolid, Spain, Email: jvegas@infor.uva.es

Abstract

How open source hardware and software can help to level up open science into open research when used for both methods and tools in the research activities.

Introduction

Open Science is a hot topic in the research community, especially in the case of publicly funded research projects, when publication of the results in open access journals is mandatory. As a result of this, the great science dealing with the biggest problems and challenges of our time can benefit from huge datasets made publicly available. This is the case of, for example, astronomy, proteomics, biomedicine, genomics and biostatistics. To truly encompass this objective of open science, not only in big projects, but also in the small ones, the method and tools can be made, not only well known, but also available to the most extent of the research community. Then, the public scrutiny and reproducibility are attainable in the boarder terms, and can be applied as in the old well known scientific method. On par with the availability of results the method and tools must also be made public in order to gain the reproducibility quality of the research. But this reproducibility of the methods is limited by the availability of specific instrumentation for the rest of the researchers. Instead of it, the open source software and hardware technology could be used to achieve the former desirable properties of the science. This is what we call Open Source Science.

What does mean open?

The meaning of "open" is not a carved in stone term when dealing with open source software, for example. In fact, there are a lot of legally accepted meanings of this term as can be seen in the variety of existing software licenses. So this subject is still susceptible to the interpretation of the community. This is also true in the case of the open science, where there could be different legally accepted interpretations. The commonly accepted meaning of "open"

term, in both areas, is intended to reflect the idea of public disclosure of methods and results.

Although the decision to contribute, or not, to open science is forced by the conditions of the public science funding programs, this presents the same long-term motivations as in the case of open software ones. As is stated in [1], the open initiatives obtain more visibility to the relevant audience, increase the impact of effort on performance, and are more informative about the talent of the research.

From the civil servant point of view, to make open science it is enough to publish the results in an open access journal. Traditionally, sciences deal with the publication of research results, making them available to a community of specialists in the domain capable to un-derstand and judge the process and the results. The intention is to ensure the reproducibility of the experiments and corroborate the validity of the hypotheses. Nevertheless, following Nosek et al. [2], too often, publication requirements (whether actual or perceived) fail to encourage transparent, open, and reproducible science.

We think that this openness should be taken further, as is described in [3], where are presented the stages of the process of creating open source software as an iterative cyclic process suitable to be applied in science as well.

This openness can incorporate not only the hypothesis and results, but also the methods developed to obtain them up to the most possible extent.

In the case of those disciplines where the availability of datasets has a main role in the research, as in biostatistic and biometrics, the key to a successful challenge problem is the dataset collected to support the problem; the open character

of the process adds a new possibility of making science: the collaborative creation of the datasets. In those cases, the cooperation in the dataset creation produces a single dataset made of the union of samples obtained by several research initiatives, instead of independent datasets. This procedure is especially useful in the case of clinical studies where the low frequency of certain rare disease cases imposes the collaboration in the construction of aggregated datasets.

The human motion analysis (HMA) poses a complex research problem where the construction of well founded datasets is critical to vali-date the hypothesis, because a small change in the scenery could derive very different hypotheses and results. In this case, the proper compilation of the dataset is a critical part of the experimental setting. As reported in [4], there are a lot of examples of datasets about similar problems, which are composed of samples that in many cases are redundant, but that make impossible to combine them because they are obtained with very different acquisition platforms and conditions.

In Llamas C [5], we introduce a portable sensoring platform using wearable sensors, made of open source hardware and software, suitable for the creation of a broad class of collaborative datasets for human motion analysis. This open platform is intended originally to be used in gathering human gait data, imposing very few restrictions about the study. This makes it suitable for the construction of a very different kind of datasets. This feature, along with its openness, allows us to use it in a collaborative effort.

In this particular problem in the HMA domain, we were able to build our system using open source hardware and software up to the level of processor and sensor electronics. This way, the community of researchers can build their own instance of the platform and con-tribute with their samples to the dataset growth and take advance of the existing data and its public visibility. In other research settings, this maybe could not be attainable due to the available equipment is of proprietary nature or any other technological issues.

In our opinion in more general scenery to achieve an open and collaborative science, a new step must be taken in the direction of the use of common open platforms. The following recommendations try to capture this intention: To search, at the inception stage of every research project, for open source methods and tools suitable to meet the requirements of our research. To complement the lack of resources or the knowledge about how to incorporate into the project open source technology, both soft-ware and hardware, it must be done a search for partners capable to do it and establish a collaboration with them.

In the worst case, when the use of proprietary means or technology is unavoidable, an effort must be made in order to provide the most information possible about the system by making agreements with vendors. These recommendations, alongside with the publication of the open source project derived, can help to produce better open research, and the better open science; where the collaborative effort can increase the value of the previously made datasets, with new contributions in the long run.

Conclusion

Open research means much more than open science as usually stated by governments and funding organizations of the research projects [2]. Even more, in our opinion, when the research is made using an open platform combining both open source software and hardware, converts it really reproducible, collaborative and lasting.

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