Challenges of Trustable AI and Added-Value on Health
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Global Good Open Source Software Development in Response to the COVID-19 Pandemic – Perspectives from SORMAS Implementation in Europe

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Abstract. In recent years, software has evolved from being static, closed source, proprietary products to being dynamic, open source, ecosystems contributing to the global good. To this end, the open source software (OSS) solution and global good, Surveillance Outbreak Response Management and Analysis System (SORMAS), rapidly adjusted to the demands of the Coronavirus disease 2019 (COVID-19) outbreak by introducing a COVID-19 module. This allowed countries that were already making use of the software as part of their public health surveillance infrastructure to make use of the new module in order to respond to the pandemic. New countries in continental Europe, most notably Germany, Switzerland, Liechtenstein and France subsequently chose to adopt the software for public health surveillance purposes for the first time during 2020, requiring additional adaptations to meet local needs. As a result, in this paper, we aim to gain a better understanding of how rapidly SORMAS was adapted to meet global needs by analyzing the SORMAS COVID-19 module introduction timeline, as well as the overall development activity of the software during 2020 and 2021 in response to the pandemic. Favorable initial feature response times in combination with development scale-up possibilities speak to some of the potential advantages of implementing global good OSS tools such as SORMAS for public health surveillance, in response to an emergency. Overall, SORMAS serves as proof of concept for developing a global good OSS solution on an international scale.

Keywords. Open Source Software, Software Ecosystem, Digital Transformation, Health Informatics, COVID-19, Europe

1. Introduction

In recent years, software has evolved from being static, closed source, proprietary products to being dynamic, open source, ecosystems contributing to the global good.

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The ever changing, independent development of source code and associated components on open source platforms may exhibit a close resemblance to that of a virus – constantly mutating in order to adjust to its environment and host requirements. Recognizing the benefits of implementing open source software (OSS) solutions in the context of public health becomes particularly important in this case, given the flexibility, interoperability and resource savings characteristics that these solutions may offer [1, 2].

To this end, the digital public health OSS solution and global good, Surveillance Outbreak Response Management and Analysis System (SORMAS), rapidly adjusted to the demands of the Coronavirus disease 2019 (COVID-19) outbreak by introducing a COVID-19 disease module [3]. This allowed countries that were already making use of the software as part of their public health surveillance infrastructure (for diseases other than COVID-19) to make use of the new module in order to respond to the pandemic.

Despite SORMAS being primarily programmed in Europe [3], the countries making use of the software at the time of introducing the COVID-19 module were of an international nature (i.e. outside of Europe) [4]. During 2020 however, European countries, including the likes of Germany [3], Switzerland (including Liechtenstein) [5] and France [6], adopted the software for public health purposes for the first time.

Armed with the knowledge that open source global goods can be adapted to meet local needs during a disaster response [7], in this paper, we aim to gain a better understanding of how rapidly SORMAS was adapted to meet not only European, but also international needs. As a result, in this paper, we aim to gain a better understanding of how rapidly SORMAS was adapted to meet global needs by analyzing the SORMAS COVID-19 module introduction timeline, as well as the overall development activity of the software during 2020 and 2021 in response to the pandemic. We delve into the details of the chosen methods next.

2. Methods

From a functional perspective, SORMAS is a public health surveillance tool used to capture data on cases and contacts of over 20 types of infectious diseases. It offers a range of features and functionalities that include (at the time of writing) a dashboard with an overall system statistical overview, task management, person search, case and contact management (including follow-up), event management, sample management and immunization (including vaccination) capturing.

Due to the open source nature of the project, the software is continuously evolving based on user needs, influence and feedback, with a new version of the software being published roughly every 3-6 weeks under the GPL v.3 license. Management and documentation of the SORMAS source code repositories, backlogs and specifications happens on the open source platform GitHub (https://github.com/hzi-braunschweig). In the SORMAS-Docker sub-project (https://github.com/hzi-braunschweig/SORMAS-Docker and https://hub.docker.com/orgs/hzibraunschweig), prefabricated container images are provided that serve as basis for a majority of SORMAS installations.

Our research consists of two main parts including (1) identifying when the COVID-19 module was introduced to the SORMAS source code and (2) the analysis of the source code contributions (commits) to the SORMAS GitHub repository over the project's open source lifetime (till the end of 2021).

For part 1, we identify how rapidly the COVID-19 module was introduced to the software by analyzing the GitHub user story creation date and comparing it to the release

date of the version it was made available in. For part 2, we use git-bars, a utility that employs git log to render simple git commit activity bars on the terminal [8]. Commit activity is group and analyzed by year and month. This gives an overview of the development activities on the repository at two different levels of granularity, allowing identification of average development trends, as well as notable deviations from this. We discuss the obtained results next.

3. Results

3.1. SORMAS COVID-19 Module

The creation of the first COVID-19 module feature request on the SORMAS GitHub repository took place on 2020-01-24 [9]. Implementation of the feature followed and introduction of the new module was on 2020-01-29 as part of the SORMAS version 1.32.0 release [10]. Within a week of specification, the COVID-19 module was thus developed and ready for deployment to SORMAS instances all over the world.

3.2. SORMAS Repository Analysis

We utilized the open source tool "git-bars" in January of 2022 to retrospectively analyze and visualize the SORMAS GitHub repository commit activity. For the timeframe from 2016-05 (date that SORMAS was first published open source on GitHub) to 2021-12, a total of 18534 commits to the project source code were recorded. When expressing this value in terms of years by running the command ">git-bars -p year", the result of 18534 commits, grouped over a 6 year timeframe is delivered, as is visible in Figure 1.

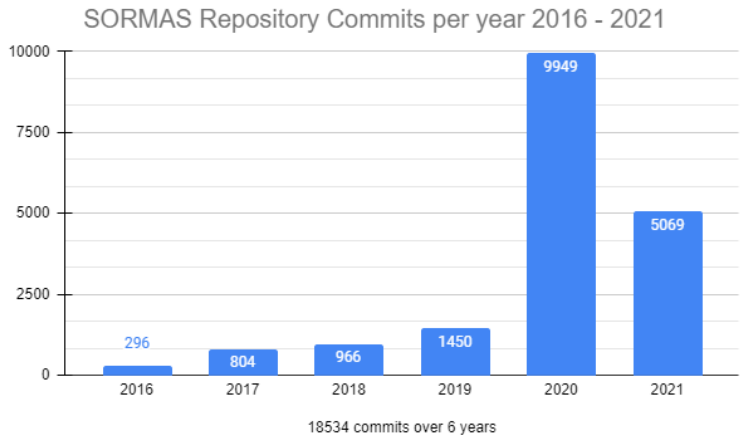

Figure 1. SORMAS GitHub repository commit activity grouped by year (2016 - 2021).

From the results presented in Figure 1, it is possible to see not only the most commits happening in the year 2020, but also the exponential growth during 2020 when compared to previous years. When analyzing the repository on a monthly level by running the command ">git-bars -p month", results indicate 18534 commits over 68 months as summarized in Figure 2.

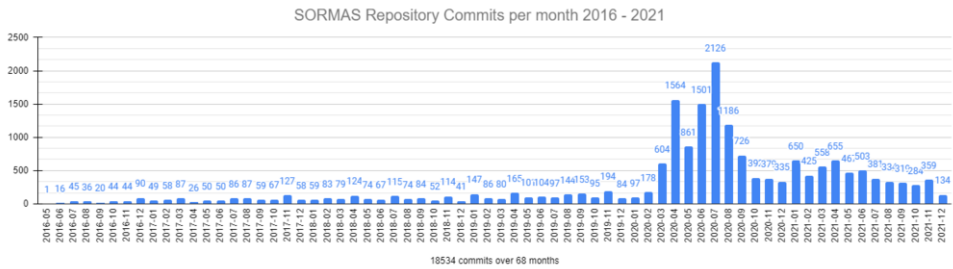

Figure 2. SORMAS GitHub repository commit activity grouped by month (2016 - 2021).

From the results presented in Figure 2, an increase in monthly commit activity is clearly visible in 2020-03, with 604 commits compared to the 178 commits in the preceding month. During the collective preceding timeframe of the software's open source lifetime (2016-05 – 2020-02) commits never exceeded 200 per month. In 2020-03, however, it is possible to observe a substantial increase (threefold) in commits, with commit activity only sinking below the 200 mark again in 2021-12. During the timeframe 2020-03 – 2021-11 (21 months), the overall commit activity of SORMAS was therefore notably higher than previously (2016-05 – 2020-02, 46 months).

4. Discussion

The first cases of COVID-19 were recorded in December 2019 and in March 2020, the World Health Organization (WHO) declared the COVID-19 outbreak a pandemic [11, 12]. SORMAS introduced the COVID-19 disease module by the end of January 2020 making the software ready to respond to the pandemic a month before the WHO officially made its declaration. The favorable new disease module introduction time of under 2 weeks from specification to implementation, thus contributed greatly to establishing the relevance of the software for pandemic response.

The notable increase in SORMAS repository commits, starting in 2020-03, align with the pandemic declaration of the WHO during the same month. It is thus arguable that the increase in commit activity is directly related to the COVID-19 pandemic and subsequent further development of the module in SORMAS. It is, however, important to note that not all commit activity is necessarily only related to the development of the COVID-19 module as SORMAS contains over 40 diseases (aggregate and case-based combined). Despite not being able to say that all commits are for the development of the COVID-19 module exclusively, the introduction of the module most certainly plays a major role in the increased development activity of the software, implying that the COVID-19 pandemic had a direct impact on the increased development activity of the software during 2020 and 2021.

First time adjustment and implementation of the software for use in Germany during Q2 of 2020, as well as Switzerland (including Liechtenstein) and France during Q3 of 2020, certainly also contributed to the above average commit activity during the 2020 timeframe as adjustments were made to the module to accommodate local needs. As a result, by the end of 2021, an estimated 150/375 local health authorities in Germany, 8/18 regions in France, and 13/26 cantons in Switzerland, as well as Liechtenstein, were

either actively using SORMAS, or were in the process of starting to use SORMAS, with at least the COVID-19 module active. Further assessments of SORMAS pertaining to management and in-country use (concerning for example user acceptance, efficiency, data quality, testing etc.), fall outside the scope of this paper and are left to future work.

5. Conclusion

SORMAS serves as proof of concept for developing a global good OSS solution for public health surveillance, and to our knowledge, is one of the first OSS solutions for public health deployed concurrently for usage in multiple European countries (i.e. Germany, Switzerland and Liechtenstein, as well as France during 2020), in addition to other countries around the world. The software demonstrates that open source global goods can rapidly be adapted to meet not only local needs in an emergency [7], but arguably also global needs. Overall, favorable initial feature response time in combination with development scale-up possibilities, speak to the potential advantages of implementing OSS tools such as SORMAS for public health.

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