

# Revisiting code reusability



**We introduced reusability reports, an article type to highlight code reusability, almost two years ago. On the basis of the results and positive feedback from authors and referees, we remain enthusiastic about the format.**

**M**odern day research articles often come with artefacts – data, code and methods – that other researchers can examine and build on. Sharing such digital artefacts makes the most impact and can accelerate scientific progress when authors follow the FAIR guidelines for datasets<sup>1</sup> and software<sup>2</sup>, which focus on Findability, Accessibility, Interoperability and Reusability.

Our [editorial policies](#) encourage high standards in code sharing. Essential elements, which can also be found in the FAIR4RS (FAIR for research software) guidelines<sup>2</sup>, are a code repository with clear instructions for installing and running the code, and with a logical structure of folders with data, code and other files. There should be a license to explain terms for use and redistribution. The code repository should be publicly accessible upon publication of the paper, and we ask authors to create a digital object identifier (DOI), which ensures that there is a permanent version of the code associated with the paper. Ideally, the software is containerized, so that others can easily run the code, in a cloud-based platform, without having to download various dependencies. We, and other *Nature* titles, have partnered with [Code Ocean](#), a platform for setting up code containers also called ‘code capsules’, to facilitate [peer review of code](#) in executable form before it is published. An alternative cloud-based platform for executable code is [Google Colab](#).

We are particularly interested in the reusability of code as many of our papers involve innovative developments and

implementations of machine learning models in specific scientific applications. Often, computational methods that prove useful to solve one scientific problem can also be applied to problems in related or even distant areas. Authors are therefore encouraged to share details of their methods in a reproducible and reusable way, so that it is straightforward for other researchers to implement the approach.

To highlight the value of reusable code, we introduced a new article type about two years ago called a reusability report<sup>3</sup>. For this format, we invite researchers to try out code that accompanies a recently accepted or published research article from another group in *Nature Machine Intelligence*, by running it, applying it to new data or by tweaking or extending it. We have since published several reusability reports, with the latest [example](#) in this issue.

We have been impressed by how reusability report authors have stepped up to the challenge, coming up with creative ideas to test and reuse previously published code in interesting ways. The topics range from applying a deep generative approach for drug discovery in a new chemical domain<sup>4</sup>, to varying the type of graph-based approach<sup>5</sup> in genomic networks, to comparing [quantum-inspired approaches in combinatorial optimization problems](#). In one case, a method for categorizing organic reactions was tested on proprietary pharmaceutical data<sup>6</sup>, which otherwise would not have been available for testing. In other cases, the efficiency of the original code was improved in the course of the computational work undertaken for a reusability report<sup>7</sup>.

A reusability report is typically around 1,500–2,000 words with one or two figures. Like the paper it is linked to, it should have detailed data and code availability statements. The article begins without an abstract, and has a link below the title to the already published paper. The text first briefly summarizes the previous work and its code, and then explains

what tests and experiments with new data have been undertaken for the reusability report. After the results and discussion sections, the article should end with an outlook for possible future directions and ideas or advice for using and extending the code.

So far, we have invited reusability reports linked to a selected number of papers that share good quality code and seem promising in terms of applicability beyond the paper. The feedback from authors of the reusability reports, as well as from authors of the original *Nature Machine Intelligence* articles, has been overwhelmingly positive, describing the format as intriguing and an exciting or useful direction. Often, the invited author needs time to consider what tests and experiments can be done and whether they can find suitable data. We gladly discuss such plans with the author, and the timeline is flexible.

Communication is important; we let authors of accepted or published papers know when we have commissioned a reusability report linked to their paper, and we ask who can be contacted for technical questions about the code. They will also be sent the final version before a reusability report gets published. Reusability reports are peer reviewed and count as research articles.

We plan to continue the format, mainly by commissioning articles as we have done, but we are also open to receiving proposals for reusability reports.

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## References

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