Research Software Visible, Citable and Sustained

ARDC Research Software Program

24 November 2021
ResBaz QLD

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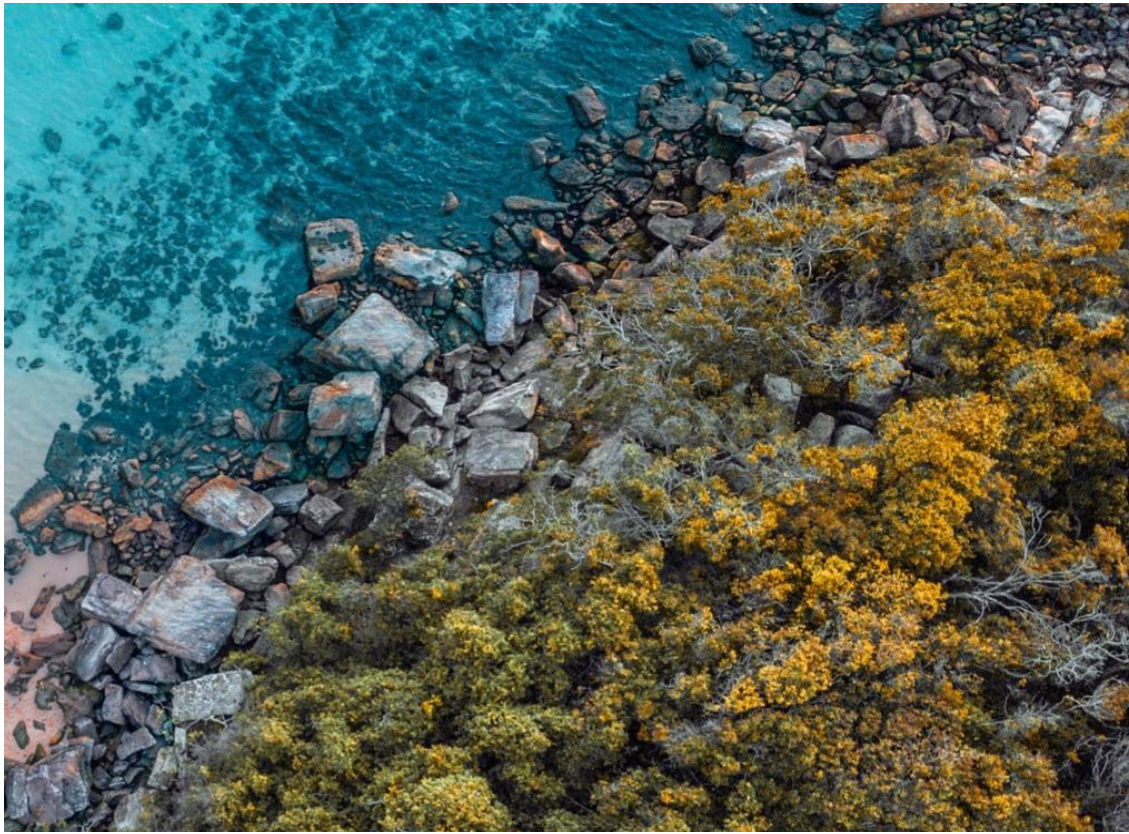
Australian Research Data Commons

DOI: 10.5281/zenodo.5720704

ACKNOWLEDGEMENT OF COUNTRY

We acknowledge and celebrate the First Australians on whose traditional lands we meet, and we pay our respect to their elders past, present and emerging.



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An Australian Government Initiative

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ardc.edu.au

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ARDC RESEARCH SOFTWARE PROGRAM

Cultural change
for recognising research
software as a first-class
output of research

Research Software
Visible
Citable
Sustained

Image from Scriberia
for The Turing Way
community

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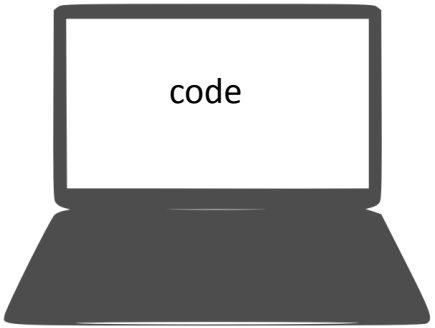
RESEARCH SOFTWARE

Software that is created with a clear research purpose in mind or during the research process. Includes code, algorithms, scripts, computational workflows, and executables.



FAIR4RS Subgroup3. Research Software Definition
https://www.rd-alliance.org/groups/fair-research-software-fair4rs-wg

DOI: 10.5281/zenodo.5720704

FAIR RESEARCH SOFTWARE #FAIR4RS

FINDABLE

ACCESSIBLE

INTEROPERABLE

REUSABLE

https://www.rd-alliance.org/groups/fair-research-software-fair4rs-wg

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Perkel, J.M., 2021. Ten computer codes that transformed science. Nature, 589(7842), pp.344–348. Available at: *10.1038/d41586-021-00075-2*

Image by: Ignacio Arganda-Carreras/ImageJ

DOI: 10.5281/zenodo.5720704

“Research is now fundamentally connected to software”
“It permeates every aspect of the conduct of research.”

10.1038/d41586-021-00075-2

Neil Chue Hong, Director

SSI, Software Sustainability Institute

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What if you had a research problem that could be solved computationally?

What if that code that could solve your problem, already existed?

How would you learn about it?

Alice Allen, Chief Editor
ASCL.net Astrophysics Source Code Library

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RESEARCH SOFTWARE VISIBLE

TRUST

REUSE

ACCESSIBILITY

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RESEARCH SOFTWARE Increasingly VISIBLE & FINDABLE

No access to software	By individual arrangement	File download from online location	Retrievable from publicly-accessible code development repository e.g. BitBucket, GitHub, GitLab, or a generic registry Zenodo, Figshare	Retrievable from research software registry or archive. E.g. such as CRAN, PyPI or domain specific registries and repositories see this list
	- On your computer - internal repo - Private repo on public platform	- Personal or group website - FTP server		

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Barnes, N., 2010. Publish your computer code: it is good enough. Nature, 467(7317), pp.753–753. Available at: https://doi.org/10.1038/467753a.

LeVeque, R., 2012. Top Ten Reasons to Not Share Your Code (and why you should anyway) Available at: https://faculty.washington.edu/rjl/pubs/topten/topten.pdf

"We can all help our field mature by making the effort to share the code that supports our research."

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RESEARCH SOFTWARE CITABLE

ACADEMIC REPUTATION

METRICS

CAREER PROGRESSION

DOI: 10.5281/zenodo.5720704

Van Noorden, R., Maher, B. & Nuzzo, R., 2014. The top 100 papers. Nature, 514(7524), pp.550–553. Available at: *doi: 10.1038/514550a*

“the vast majority of the most-cited research of all time describe experimental methods or software that have become essential in their fields”.

Photo by Edvard Alexander Rølvaag on Unsplash

DOI: 10.5281/zenodo.5720704

Basic local alignment search tool https://doi.org/10.1016/S0022-2836(05)80360-2

SF Altschul, W Gish, W Miller, EW Myers… - Journal of molecular …, 1990 - Elsevier

A new approach to rapid sequence comparison, basic local alignment search tool (BLAST), directly approximates alignments that optimize a measure of local similarity, the maximal segment pair (MSP) score. Recent mathematical results on the stochastic properties of MSP …

☆ Save 99 Cite Cited by 96406 Related articles All 92 versions

Gapped **BLAST** and PSI-**BLAST**: a new generation of protein database search programs https://doi.org/10.1093/nar/25.17.3389

SF Altschul, TL Madden, AA Schäffer… - Nucleic acids …, 1997 - academic.oup.com

The **BLAST** programs are widely used tools for searching protein and DNA databases for sequence similarities. For protein comparisons, a variety of definitional, algorithmic and statistical refinements described here permits the execution time of the **BLAST** programs to …

☆ Save 99 Cite Cited by 80360 Related articles All 93 versions

DOI: 10.5281/zenodo.5720704

Image processing with **ImageJ**

MD Abràmoff, PJ Magalhães… - Biophotonics …, 2004 - dspace.library.uu.nl

Wayne Rasband of NIH has created **ImageJ**, an open source Java-written program that is now at version 1.31 and is used for many imaging applications, including those that that span the gamut from skin analysis to neuroscience. **ImageJ** is in the public domain and runs …

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NIH Image to **ImageJ**: 25 years of image analysis

https://dx.doi.org/10.1038%2Fnmeth.2089

CA Schneider, WS Rasband, KW Eliceiri - Nature methods, 2012 - nature.com

… A driving design criterion of both NIH Image and **ImageJ** was to keep the program simple with no complex user interfaces. Upon opening **ImageJ**, just a single toolbar appears, and it is from this straightforward interface that all of the capabilities of **ImageJ** can be found and used …

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[PDF] **Scikit-learn**: Machine learning in Python

F Pedregosa, G Varoquaux, A Gramfort… - the Journal of machine …, 2011 - jmlr.org

Scikit-learn is a Python module integrating a wide range of state-of-the-art machine learning algorithms for medium-scale supervised and unsupervised problems. This package focuses on bringing machine learning to non-specialists using a general-purpose high-level …

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ggplot2 https://doi.org/10.1002/wics.147

H Wickham - Wiley Interdisciplinary Reviews: Computational …, 2011 - Wiley Online Library

… This article discusses **ggplot2**, an open source **R package**, based on a grammatical theory of graphics. The underlying theory has been discussed in depth elsewhere so this article illustrates some of the consequences of the theory for creating new graphics, the importance of …

☆ Save 99 Cite Cited by 36055 Related articles All 17 versions »

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A software citation should include a method for identification that is machine actionable, globally unique, interoperable, and recognised by a community and preferably by general public researchers.

https://www.force11.org/software-citation-principles

Image by stux from Pixabay

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RESEARCH SOFTWARE CITABLE

No access to software	By individual arrangement - On your computer - internal repo - Private repo on public platform	File download from online location - Personal or group website - FTP server	Retrievable from publicly-accessible code development repository e.g. BitBucket, GitHub, GitLab, or a generic registry Zenodo, Figshare	Retrievable from research software registry or archive. E.g. such as CRAN, PyPI or domain specific registries and repositories see this list

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Citation File Format (CFF)

CITATION.cff files are plain text files with human- and machine-readable citation information for software (and datasets). People who write code can include them in their repositories to let others know how to correctly cite their software.

https://citation-file-format.github.io/
https://codemeta.github.io/
https://blog.front-matter.io/posts/step-forward-for-software-citation
https://ardc.edu.au/resources/working-with-research-software/software-citation/

DOI: 10.5281/zenodo.5720704

Fenner, M., 2013. What Can Article-Level Metrics Do for You?. *PLoS Biology*, 11(10), p.e1001687. Available at: https://doi.org/10.1371/journal.pbio.1001687.

"Scientific impact is a multi-dimensional construct that can not be adequately measured by any single indicator."

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Checklist

Customise your repository

- ❑ Add your code to a public repository, version control
- ❑ Add a README (what is the software about and how to use it)
- ❑ Add a LICENCE (terms of use, change, contribute, redistribute)
- ❑ Register in a registry, add key words, PID
- ❑ Add a CITATION file

https://docs.github.com/en/repositories/managing-your-repositorys-settings-and-features/customizing-your-repository

Erdmann, Christopher, & Stall, Shelley. (2021, April 21). Software Citation Checklist. Zenodo. https://doi.org/10.5281/zenodo.4706164

https://fair-software.eu/

DOI: 10.5281/zenodo.5720704

RESEARCH SOFTWARE SUSTAINABLE

VALUED

IMPROVED

BUILD UPON

MATURITY

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Research Software needs to change over time.
It might depend on new software, need to become available on new platforms, fix bugs, new applications, new requests.

https://www.youtube.com/watch?v=1YODIJyX0t0
https://danielskatzblog.wordpress.com/2016/09/13/defining-software-sustainability/

Daniel Katz, Chief Scientist

NCSA, the National Center for Supercomputing Applications

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SOFTWARE SUSTAINABILITY

Grow a community

Diversity, Recognition, Amplification

Collaboration, Peer production, Common Goals

Image from Scriberia for The Turing Way community

Sharan, Malvika. (2021). Can we reimagine FAIR for building communities in open science?. https://doi.org/10.5281/zenodo.5518163 https://www.opensciencefair.eu/2021/keynote-speakers/keynote-malvika-sharan

Hannah Cohoon and Fan Du. https://www.youtube.com/watch?v=X4iB4FSOQ78

DOI: 10.5281/zenodo.5720704

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https://www.linkedin.com/in/pambio/

DOI: 10.5281/zenodo.5720704

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