

Making FAIR Fair to the Researchers

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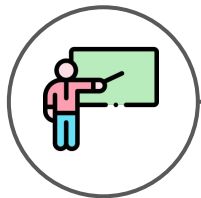
Research Professor



About This Presentation



20 min + Q&A



Share some lessons I have
learned for making FAIR more fair

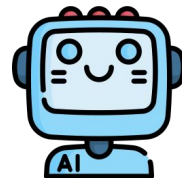


FAIR Principles

The FAIR Principles

Overview

The FAIR Principles (2016) provide instructions for **making research outcomes reusable** by humans and machines



The FAIR Principles

Adoption

The FAIR Principles have been **supported and adopted worldwide** by all stakeholders including researchers, publishers, and funders



Example: The new Data Sharing Policy of the National Institutes of Health (NIH) effective January 2023 requires all grant proposals to include a plan for making data FAIR

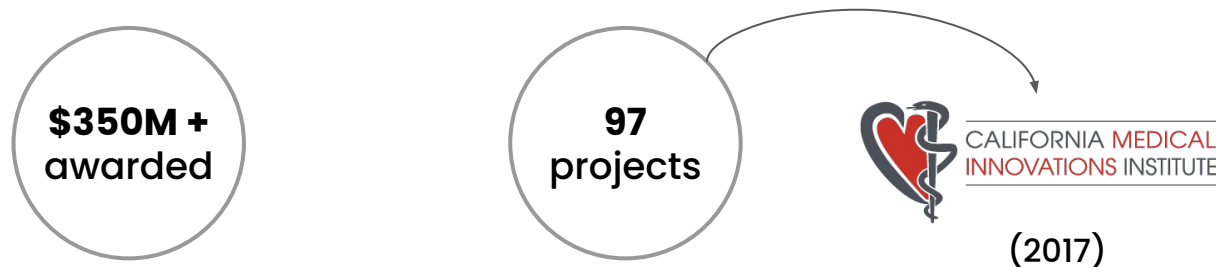


My Encounter with FAIR

My Encounter with FAIR

The NIH SPARC Program

SPARC is an NIH Common Fund Program aimed at accelerating the development of neuromodulation therapies (2015-2025)



My Encounter with FAIR

The NIH SPARC Program

SPARC imposes **strict guidelines to awardees for making data FAIR**

- Organize data into a standard folder structure
- Follow file and folder naming conventions
- Include metadata using standard file formats and vocabularies
- Upload dataset on the SPARC data platform Pennsieve
- And more!

I was put in charge of doing this for the SPARC data at our Institute

My Encounter with FAIR

Challenges



Difficult – I was not trained for this



Time-consuming – The guidelines are very extensive



Boring – I wanted to do research, publish papers!

My Encounter with FAIR

Solution: Automation

Idea: Automate the process of preparing and sharing SPARC data

2017:
Started developing
Python scripts for our
group's data



2018:
Presented the idea
at the SPARC
Hackathon



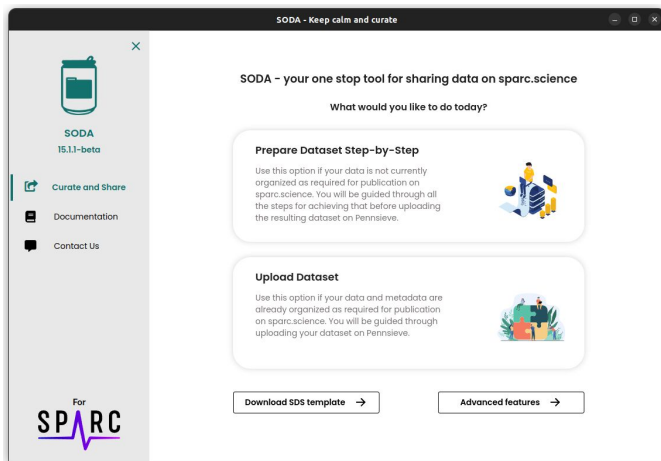
2019:
Received funding
from SPARC for
further development



My Encounter with FAIR

Software to Organize Data Automatically (SODA)

SODA is an open source and free desktop software that **simplifies the preparation and sharing** of datasets according to the SPARC guidelines



Like a tax filing tool but for filing FAIR SPARC datasets

My Encounter with FAIR

SODA Performance



Reduces time, errors, and difficulty



Has helped process 27+ TB of data (400k+ files) from 1000+ users (since 2021)

My Encounter with FAIR

SODA-inspired Tools

SODA has inspired many tools aimed at supporting researchers in making their data FAIR



Making immunology
related data FAIR
(NIAID)



Making clinical
research data FAIR
(NIH Bridge2AI)



Another team has
forked SODA to help
make neurophysiology
data FAIR
(NIH Brain Initiative)

My Encounter with FAIR

Lesson Learned #1

Tools that support researchers can help reduce researchers time and effort, and are needed to make FAIR more fair to them





FAIR Research Software

FAIR Research Software

Definition of Research Software

Any software created **during the research process**
or for a research purpose



Data analysis



Computational
model



AI/ML
model

FAIR Research Software

FAIR4RS Principles

FAIR Principles for Research Software (FAIR4RS Principles, 2022):
17 principles tailored for research software

F1. Software is assigned a globally unique and persistent identifier.
F1.1. Components of the software representing levels of granularity are assigned distinct identifiers.
F1.2. Different versions of the software are assigned distinct identifiers.
F2. Software is described with rich metadata.
F3. Metadata clearly and explicitly include the identifier of the software they describe.
F4. Metadata are FAIR, searchable and indexable.

(and more)

FAIR Research Software

Problem

The FAIR4RS Principles by design
do not provide actionable instructions

How do I assign a unique identifier?

How do I provide rich metadata?

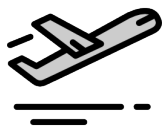


FAIR Research Software

FAIR-BioRS Guidelines

FAIR Biomedical Research Software (FAIR-BioRS) Guidelines

Minimal, actionable, step-by-step guidelines for
complying with each of the FAIR4RS principles



December 2021
Beginning of this effort



August 2023
Manuscript published

FAIR Research Software

FAIR-BioRS Guidelines Overview



Full guidelines: fair-biors.org



Step-by-step process



Clear & actionable instructions

The screenshot shows a web browser window with the address bar displaying 'fair-biors.org'. The page title is 'Guidelines'. The main heading is 'Guidelines', followed by 'FAIR-BioRS Guidelines v2.0.0'. The content is organized into sections and numbered steps:

- 1. Prepare prior to the development of the software**
 - 1.1. Select a version control system platform to work from (GitHub, Bitbucket, or GitLab are suggested) and create a repository there for your software.
 - 1.2. Select a license and include the license terms in a file called "LICENSE" using plain text or markdown syntax. Locate it in the root directory of the software. While the FAIR4RS principles do not require research software to be open-source, it is highly recommended to use a license approved by the Open Source Initiative (OSI). Amongst those licenses, it is encouraged to use the permissive MIT or Apache 2.0 licenses. Use choosealicense.com and/or the [SPDX License List](https://spdx.org/licenses/) for help. During development, ensure that the software's license is compatible with the software's dependencies.
- 2. Follow coding standards and best practices during development**
 - 2.1. Have code-level documentation (e.g., in code comments, description in the file headers) when deemed necessary for code reuse.
 - 2.2. Record dependencies as per standard practices for the coding language, e.g. in a requirements.txt file for Python code, in a package.json file for Node projects, or in a DESCRIPTION file for R packages.
 - 2.3. Follow language-specific standards and best practices (e.g. [PEP 8 Style Guide for Python Code](https://pep8.org/), [Google's R Style Guide for R code](https://google.github.io/styleguide/rguide/), etc.) and document them (c.f. 3.2).
 - 2.4. Ensure that inputs/outputs of the software follow any applicable community standards (e.g., General Feature Format (GFF) for genomic annotation files). Use fairsharing.org for finding relevant standards.

FAIR Research Software

Lesson Learned #2

Actionable guidelines for making research outcomes FAIR can reduce burden on researchers and are needed to make FAIR more fair to them



FAIR Research Software

Codefair



Codefair is a free and open source GitHub app that acts as
your personal assistant for making software FAIR

1

Install codefair (codefair.io) on the GitHub repository of your software

2

Develop your software as usual from GitHub

3

Track and address FAIR compliance issues through the Codefair GitHub issue

FAIR Research Software

Codefair Issue Dashboard

The screenshot shows a web browser window displaying the 'FAIR Compliance Dashboard #1' issue page. The interface includes a top navigation bar with tabs for Code, Issues (1), Pull requests, Actions, Projects, Wiki, Security, Insights, and Settings. The issue title is 'FAIR Compliance Dashboard #1' with 'Edit' and 'New issue' buttons. Below the title, it says 'codefair-app [bot] opened this issue 14 minutes ago · 0 comments'. The issue content is a comment from 'codefair-app [bot]' with a 'Contributor' button. The comment text reads: 'Check the FAIRness of your software'. It explains that this issue is the repository's dashboard for all things FAIR and provides a link to the documentation. It then lists two sections: 'LICENSE' with a checkmark and an 'Edit License' button, and 'Metadata' with a red X and an 'Add Metadata' button. The 'Metadata' section explains that CITATION.cff and codemetada.json files are expected at the root level and provides a link to the FAIR-BioRS Guidelines. On the right side, there are settings for Assignees (No one—assign yourself), Labels (None yet), Projects (None yet), Milestone (No milestone), Development (Create a branch for this issue or link a pull request.), Notifications (Unsubscribe button), and 0 participants.

FAIR Compliance Dashboard #1

codefair-app [bot] opened this issue 14 minutes ago · 0 comments

codefair-app [bot] commented 14 minutes ago • edited

Contributor

Check the FAIRness of your software

This issue is your repository's dashboard for all things FAIR. Keep it open as making and keeping software FAIR is a continuous process that evolves along with the software. You can read the [documentation](#) to learn more.

LICENSE ✓

A LICENSE file is found at the root level of the repository.

[Edit License](#)

Metadata ✗

To make your software FAIR, a CITATION.cff and codemetada.json are expected at the root level of your repository, as recommended in the [FAIR-BioRS Guidelines](#). These files are not found in the repository. If you would like Codefair to add these files, click the "Add metadata" button below to go to our interface for providing metadata and generating these files.

[Add Metadata](#)

Assignees

No one—[assign yourself](#)

Labels

None yet

Projects

None yet

Milestone

No milestone

Development

[Create a branch](#) for this issue or link a pull request.

Notifications

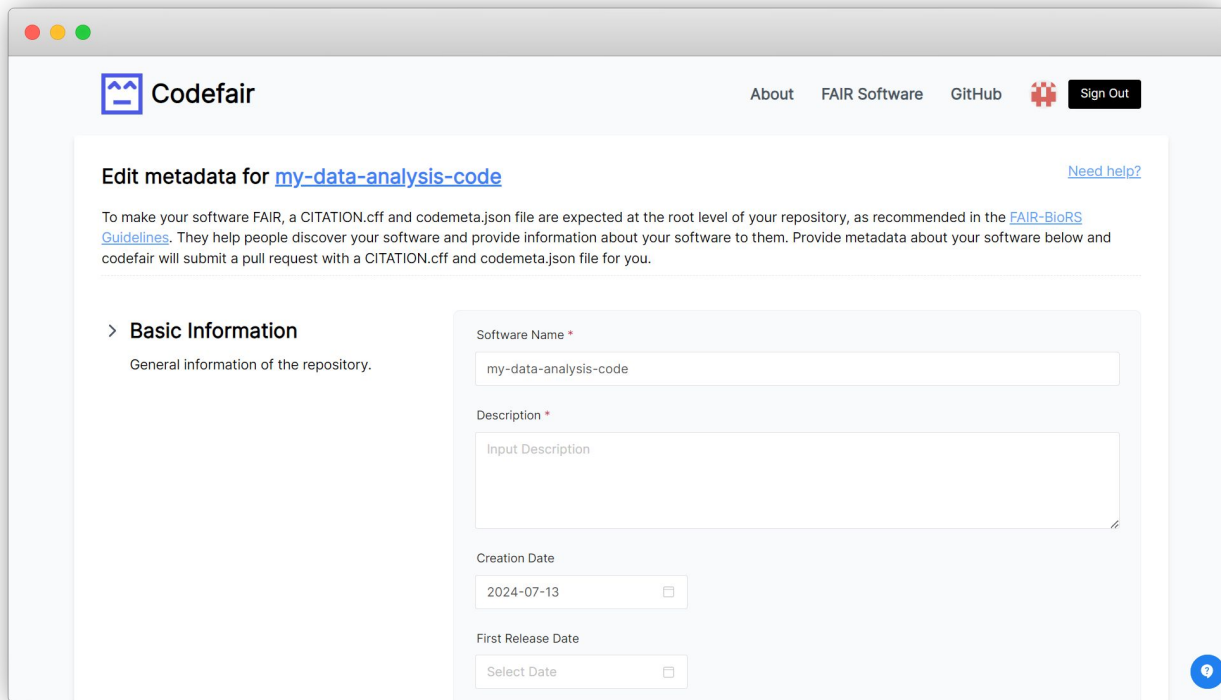
[Unsubscribe](#)

You're receiving notifications because you're watching this repository.

0 participants

FAIR Research Software

Codefair UI



The screenshot shows a web browser window with the Codefair logo and navigation links (About, FAIR Software, GitHub, Sign Out). The main content area is titled "Edit metadata for my-data-analysis-code" with a "Need help?" link. Below this is a paragraph explaining the purpose of the metadata files. A section titled "Basic Information" is expanded, showing a form with fields for Software Name, Description, Creation Date, and First Release Date.

Codefair About FAIR Software GitHub Sign Out

Edit metadata for [my-data-analysis-code](#) [Need help?](#)

To make your software FAIR, a CITATION.cff and codemeta.json file are expected at the root level of your repository, as recommended in the [FAIR-BioRS Guidelines](#). They help people discover your software and provide information about your software to them. Provide metadata about your software below and codefair will submit a pull request with a CITATION.cff and codemeta.json file for you.

> **Basic Information**
General information of the repository.

Software Name *
my-data-analysis-code

Description *
Input Description

Creation Date
2024-07-13

First Release Date
Select Date

FAIR Research Software

Codefair UI

The screenshot shows a web form for FAIR Research Software. At the top, there's a URL field with the value "https://example.com/download/1.0.0". Below it is a "Current Version Release Notes" section with a text area containing "Initial stable release.". The main section is titled "> Additional Information" and contains a description "Additional information about the software.". To the right of this section is a "Development Status" dropdown menu with "Select Category" as the current selection. Below this are two more fields: "Is Source Code Of" with the value "Bigger Application" and "Is Part Of" with the value "Bigger Suite". At the bottom left, there is a "Save draft" button. At the bottom right, there is a "Save and push to repository" button, which is highlighted with a red rectangular border. A blue circular help icon is located in the bottom right corner of the form.

https://example.com/download/1.0.0

Current Version Release Notes

Initial stable release.

> Additional Information

Additional information about the software.

Development Status

Select Category

Is Source Code Of

Bigger Application

Is Part Of

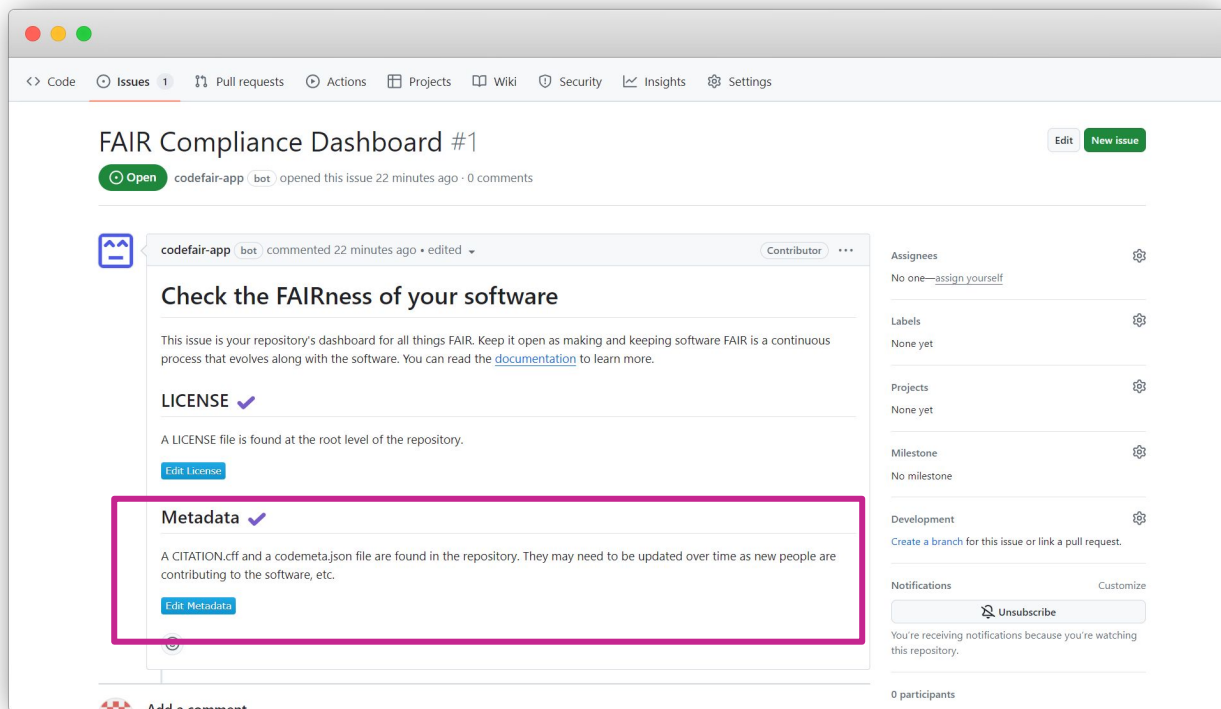
Bigger Suite

Save draft

Save and push to repository

FAIR Research Software

Codefair Issue Dashboard



The screenshot shows a GitHub issue titled "FAIR Compliance Dashboard #1" created by the "codefair-app" bot. The issue is currently open and has no comments. The main content of the issue is a checklist for ensuring software is FAIR, with two items highlighted by a red box:

- LICENSE** ✓
A LICENSE file is found at the root level of the repository.
[Edit License](#)
- Metadata** ✓
A CITATION.cff and a codemeta.json file are found in the repository. They may need to be updated over time as new people are contributing to the software, etc.
[Edit Metadata](#)

On the right side of the issue, there are sections for Assignees (No one—assign yourself), Labels (None yet), Projects (None yet), Milestone (No milestone), Development (Create a branch for this issue or link a pull request.), Notifications (Unsubscribe), and 0 participants.



Closing Comments

Closing Comments



Requiring researchers to make their research outcomes FAIR can rapidly become **unfair** to them



FAIR can be made more **fair** to the researchers through actionable guidelines and tools for implementing them

Thank You!



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fairdataihub.org

*Find these slides and
all resources here*



bit.ly/FAIRfair