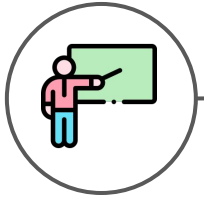
All's FAIR in Love and… Software

Bhavesh Patel, Ph.D.
Associate Research Professor

About This Presentation

40 min + Q&A



Learn why & how to make biomedical research software FAIR

About Research Software

About Research Software

Definition

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

Source: Gruenpeter, M. et al. Defining Research Software: a controversial discussion. Zenodo https://doi.org/10.5281/zenodo.5504016 (2021).

Excel used to analyze and visualize data

Python script developed to analyze and visualize data

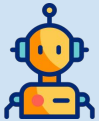
About Research Software

There are many different types

Various applications

Data analysis code

Computational model



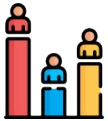
AI/ML model

Various applications

Python script

R code

Jupyter notebook



Poll Time!

Respond through the Zoom prompt

Before today, did you know what a research software was?

1. Yes
2. No
3. Sort of

About Research Software

It is an essential element of biomedical research...

More and more biomedical research projects include development of research software

Research software such as AI/ML are the main outcomes of many projects

https://www.researchsoft.org/resa-resources

About Research Software

… and sharing and making it reusable is thus critical

Enable reproducible, transparent research

Prevent duplicate effort

Increase the pace of discoveries to improve human health

About Research Software

Sharing policies

Closed on February 1st 2024

Poll Time!

Respond through the Zoom prompt

Do you think it is important to share and make research software reusable?

1. Yes
2. No

How to Make Research Software Reusable?

How to Make Research Software Reusable?

FAIR Principles - Overview

FAIR Principles (2016) were established to optimize the reusability of all digital research objects, including software

To be Findable:

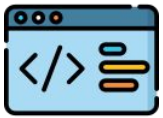
F1. (meta)data are assigned a globally unique and persistent identifier
F2. data are described with rich metadata (defined by R1 below)
F3. metadata clearly and explicitly include the identifier of the data it describes
F4. (meta)data are registered or indexed in a searchable resource

(and more)

How to Make Research Software Reusable?

FAIR Principles - Problem

Many in the research software community found that the FAIR Principles were not suitable for software



- ➔ Granularity
- ➔ Dependencies
- ➔ Multiple versions

How to Make Research Software Reusable?

FAIR4RS Principles - Background

FAIR for Research Software (FAIR4RS) Working Group

200+ stakeholders involved

2020 - 2022

FAIR Principles for Research Software or FAIR4RS Principles (2022)

How to Make Research Software Reusable?

FAIR4RS Principles - Overview

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)

How to Make Research Software Reusable?

FAIR4RS Principles - Problem

The FAIR4RS Principles, by design,
do not provide actionable instructions

How do I assign a unique identifier?

How do I provide rich metadata?

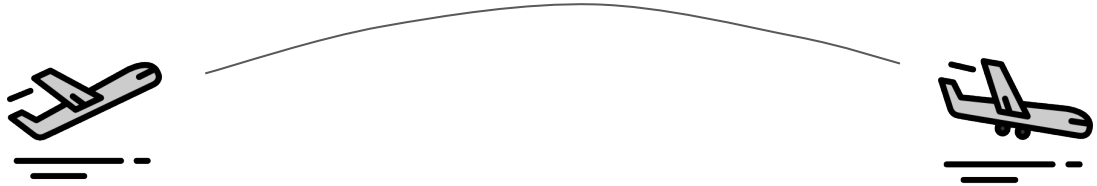
FAIR-BioRS Guidelines

FAIR-BioRS Guidelines

About

FAIR Biomedical Research Software (FAIR-BioRS) Guidelines

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



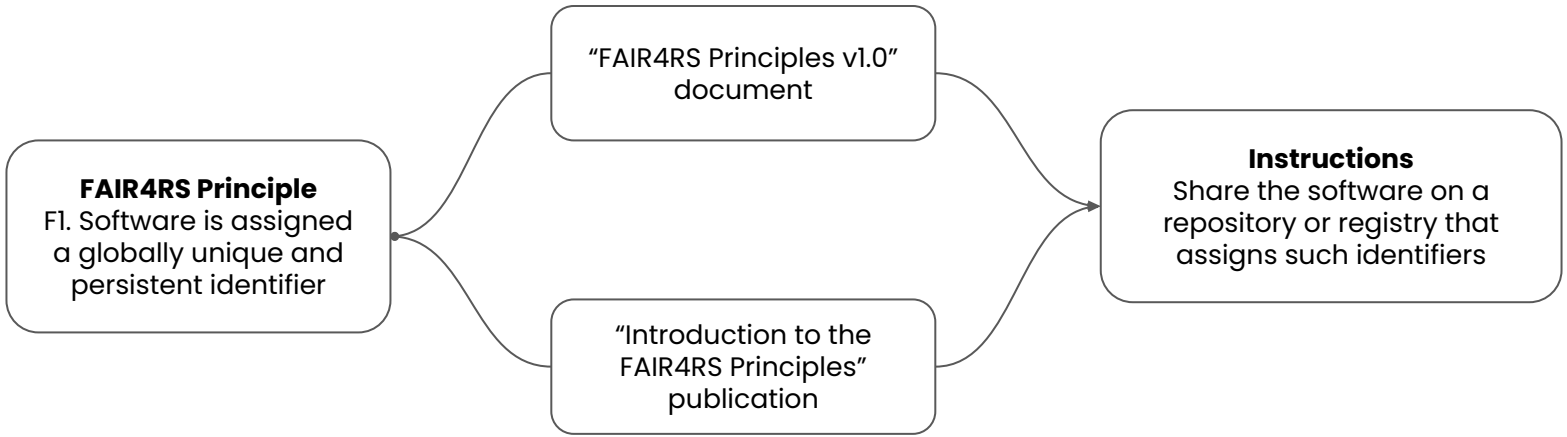
December 2021
Beginning of this effort

August 2023
Manuscript published

FAIR-BioRS Guidelines

Development process

Step 1: Derive high-level instructions for fulfilling each of the FAIR4RS principles



FAIR-BioRS Guidelines

Development process

Step 2: Combine instructions into categories based on common theme

- Category 1: Develop software following standards and best practices
- Category 2: Include metadata
- Category 3: Provide a license
- Category 4: Share software in a repository
- Category 5: Register in a registry

Step 3: Define outstanding questions for fulfilling the instructions from each category

Category 4: What repositories can be used?
In what format should research software be shared?

FAIR-BioRS Guidelines

Development process

Step 4: Find out answers for these questions

Literature review

Our assessment

External feedback

Hervé Ménager
(co-author)
Elixir Tools Platform Lead

Bioinformatic Open Source Conference (BOSC)

FAIR-BioRS Guidelines

Overview

Full guidelines: fair-biors.org

FAIR-BioRS Guidelines

They benefit everyone!

For researchers developing software

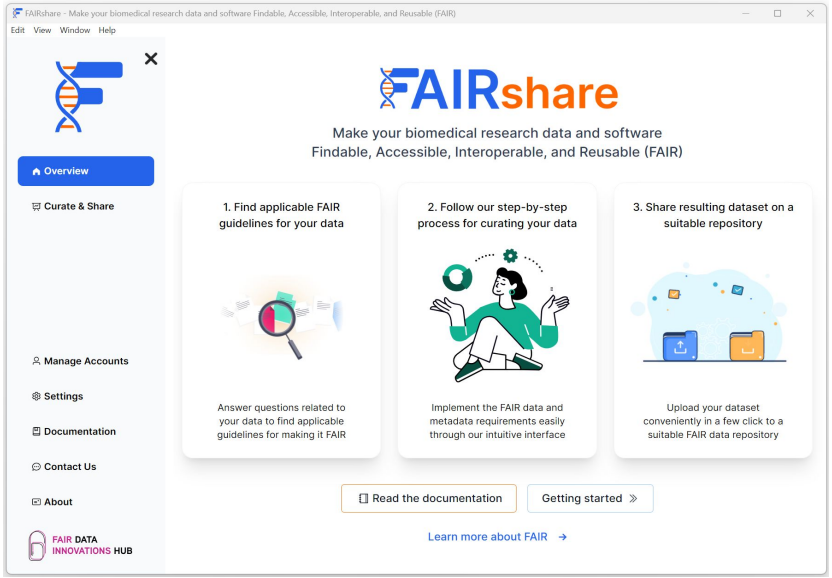
- Increase the impact of your software
- Get recognition for your development effort
- Increase opportunities for collaboration

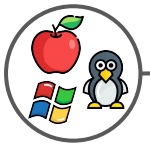
For funders

- Increase your return on investment
- Avoid funding duplicate development effort

FAIR-BioRS Guidelines

FAIRshare





Cross-platform

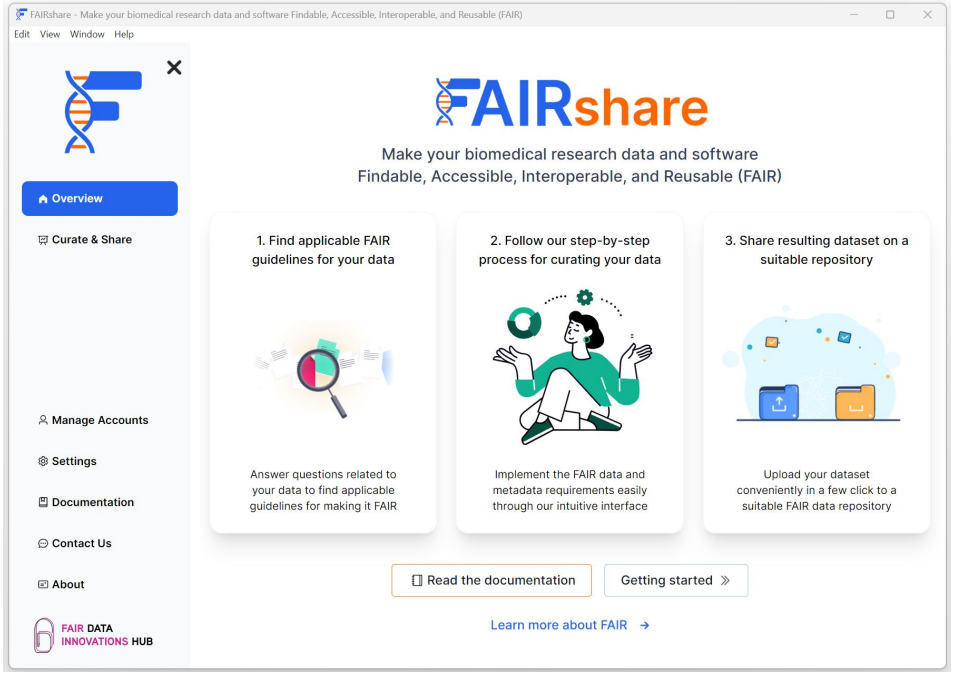
Open source

Free

https://docs.fairshareapp.io

FAIR-BioRS Guidelines

FAIRshare



https://docs.fairshareapp.io

FAIR-BioRS Guidelines

What now?

- ✓ Publish manuscript in Scientific Data (August 2023)
  https://doi.org/10.1038/s41597-023-02463-x
- 

  Promote the guidelines
- 

  Setup a working group to review the guidelines periodically
- 

  Develop a GitHub app that automates implementation of the FAIR-BioRS guidelines

How Can You Support This Effort?

How Can You Support This Effort?

Researchers

Follow the FAIR-BioRS guidelines as you are developing your software (fair-biors.org)

Use FAIRshare for support (docs.fairshareapp.io)

Reach out to us with questions or suggestions (bpatel@calmi2.org)

How Can You Support This Effort?

Librarians

Establish/update your software management guidelines to include the FAIR-BioRS guidelines (fair-biors.org)

University X Guidelines for Managing Research Software

1. **Security**
   - _____
   - _____
   - _____
2. **FAIR**
   → FAIR-BioRS Guidelines

How Can You Support This Effort?

Funders

Require/recommend to make software FAIR
and refer to the FAIR-BioRS guidelines (fair-biors.org)

Support the maintenance of the guidelines
and development of automation tools

Poll Time!

Respond through the Zoom prompt

Will you consider using the FAIR-BioRS guidelines and/or including them in your software management plan?

1. Yes
2. No
3. Maybe

Closing Comments

Closing Comments

Summary

Background	Biomedical research software is an essential element of research and making it FAIR is critical
Problem	The FAIR4RS principles only provide high-level instructions for making software FAIR
Solution	We developed minimal and actionable guidelines to make software FAIR called the FAIR-BioRS guidelines
Support us!	Promote making software FAIR, use the FAIR-BioRS guidelines, and contribute to them!

Together, Let's Make Sure
All's FAIR in Love… and Software

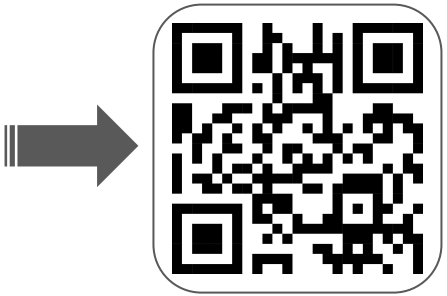
Thank You!

bpatel@calmi2.org

fairdataihub.org

fairdataihub

Find these slides and all resources here



tinyurl.com/softwarelove

Resources

- Making Biomedical Research Software FAIR: Actionable Step-by-step Guidelines with a User-support Tool. https://doi.org/10.1038/s41597-023-02463-x
- Website for the FAIR-BioRS guidelines and associated resources. fair-biors.org
- GitHub organization of the FAIR-BioRS guidelines. https://github.com/FAIR-BioRS
- FAIRshare software. https://docs.fairshareapp.io
- Defining Research Software: a controversial discussion. https://doi.org/10.5281/zenodo.5504016
- Introducing the FAIR Principles for research software. https://doi.org/10.1038/s41597-022-01710-x
- FAIR Principles for Research Software version 1.0. https://doi.org/10.15497/RDA00068
- NIH Best Practices for Sharing Research Software. https://datascience.nih.gov/tools-and-analytics/best-practices-for-sharing-research-software-faq
- The FAIR Guiding Principles for scientific data management and stewardship https://doi.org/10.1038/sdata.2016.18