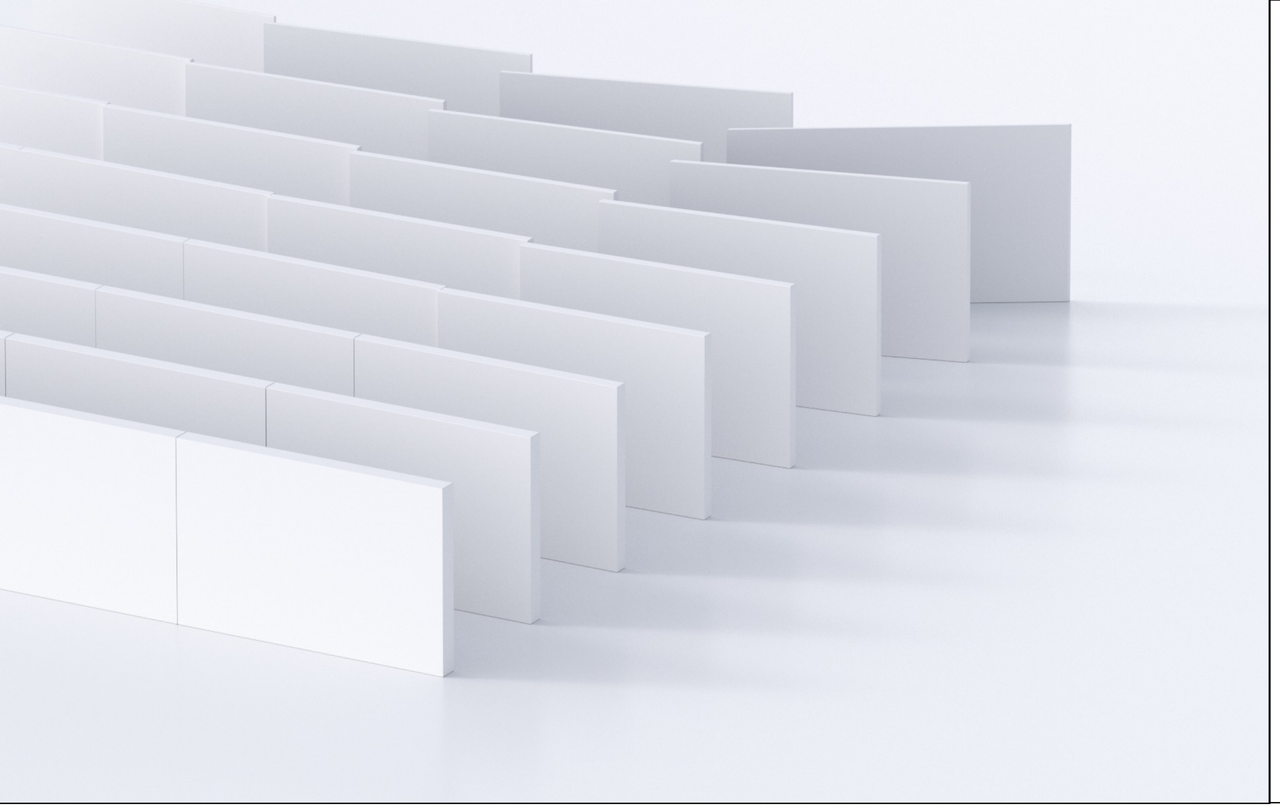

An Appraisal of Automated Tools for FAIRness Evaluation

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Contents

Context

There are several mechanisms to support the design of FAIR data

- Guidelines
- Questionnaires
- Semi-automated tools
- Automated tools

Mechanisms' goals

- Characterize digital objects related to the FAIR principles

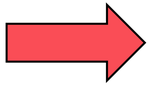
And/or

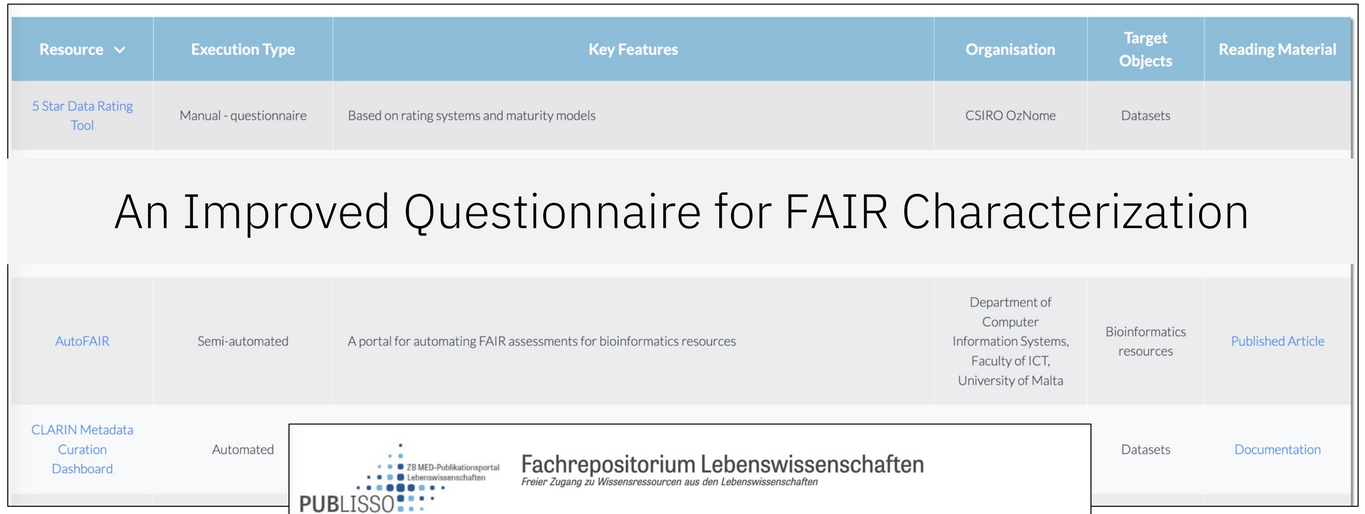
- Evaluate digital object's FAIRness level

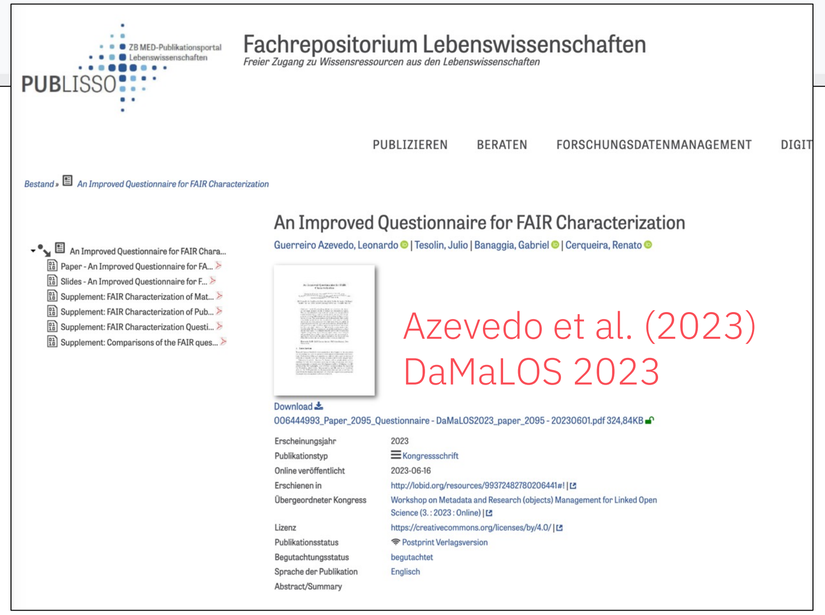
Context

Manual and semi-automated tools

FAIRassist.org







Azevedo et al. (2023)
DaMaLOS 2023

- Strengths
  - Essential for
    - Overall understanding and
    - Appreciation of the research life cycle

- Weaknesses
  - Time consuming
  - Requires experience and technical skills
  - Carries difficulties when inspections is needed
  - Does not scale for several digital objects

Context

Manual and semi-automated tools

- Strengths
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Automated tools

- Strengths
  - Performs evaluation without human intervention
  - Scale when evaluating several digital objects
  - More objective
  - Allow comparison of distinct digital objects

- Weaknesses
  - Requires precise definition of metrics and evaluation tests
    - May be difficult to fit if community standards are not defined
  - May result on using domain-agnostics concepts
    - May not fit community needs

Contribution

Goal

– Analyze automated tools for FAIRness assessment

Steps

– Search for existing tools in the literature
  - Discover the tools
  - Elicit requiments
– Examine tools regarding elicited requirements

Literature review

Abbreviated systematic literature review

Research questions

- RQ1: What are the existing automated tools for FAIRness evaluation?
- RQ2. Which requirements do these tools meet?
- Search string
  ("Tool" OR "Automated") AND
  ("Assessment" OR "Evaluation") AND
  ("FAIR- ness" OR "FAIRification") AND
  ("FAIR Principles" OR "FAIR Data")

Search on Scopus, IEEE and ACM digital libraries

- 32 works found
- Exclution and inclusion criteria endup with 4
  - Krans et al. (2022)
  - Peters-Von Gehlen et al. (2022)
  - Slamkov et al. (2022)
  - Sun et al. (2022)
- Gaps on exiting works
  - Abstract characterization and comparison of tools
  - Do not propose or use requirements

Literature review

RQ1: What are the existing automated tools for FAIRness evaluation?

– Tools referenced in the works
  - Krans et al. (2022)
  - Peters-Von Gehlen et al. (2022)
  - Slamkov et al. (2022)
  - Sun et al. (2022)

Search for existing tools in the literature

Tool	Automated?
F-UJI	Yes
FAIR Evaluator	Yes
FAIR Enough*	Yes
FAIR-Checker	Yes
ARDC's FAIR Data Self Assessment Tool	No
Checklist for Evaluation of Dataset Fitness for Use	No
CSIRO's 5˚Oz Data tool	No
DANS's SATIFYD	No
Data Stewardship Wizard	No
EUDAT's Checklist	No
FAIRdat	No
FAIRenough	No
FAIRshake	No
GARDIAN	No
RDA's Simple Grid	No
Semi-automated workflow for FAIR maturity indicators	No

* FAIR Enough was found when we looked for a reference of FAIRenough. FAIR Enough is an automated tool based on F-UJI and FAIR Evaluator.

Literature review

RQ2. Which requirements do these tools meet?

– Requirements
  - Guide the appraisal and development of tools
  - Crucial for making objective FAIRness evaluations and improving digital objects

– Requirements elicited from
  - The works (Krans et al., Peters-Von Gehlen et al., Slamkov et al., and Sun et al.)

  - Tools documentation (F-UJI, FAIR Evaluator, FAIR Enough, FAIR Checker)

Elicited requirements
(23 requirements)

Req	Requirement: The tool should …
R1	… be fully **automated.**
R2	… give a FAIRness **score**/grade.
R10	… be **customizable** according to the type of digital object and community.
R12	… provide a visual representation (e.g., a **badge**) of the FAIR assessment results.
R14	… rely on **FAIR-enabling services**.
R15	…offer **guidance** on how it is used (e.g., providing user manual, help, and publications).
R18	… disclose its **rating system** (e.g., evidences and rationale).
R19	…be informative, i.e., **teach** the user about FAIR.
R20	… give **recommendations** on how to improve the FAIRness of the evaluated resource.
R23	… support **versioning** of FAIRness assessment.

Appraisal of the tools

Evaluation by reading tools' documentation
- Web pages
- GitHub pages
- Papers

Examine tools regarding elicited requirements

Req	Keyword	F-UJI	FAIR Evaluator	FAIR enough	FAIR Checker
R1	Automated	✅	✅	✅	✅
R2	Score	✅	✅	✅	✅
R10	Customizable	◑	◑	◑	◑
R12	Badge	✅	✗	✗	✅
R14	FAIR-enabling services	✅	✅	✅	◑
R15	Guidance	✅	✅	✗	✅
R18	Rating system	✅	✅	✅	✅
R19	Teach	◑	◑	◑	◑
R20	Recommendations	✗	✗	✗	✅
R23	Versioning	✗	✗	✗	✗

✅ Requirement is totally supported
✗ Requirement is not supported
◑ Requirement is partially supported

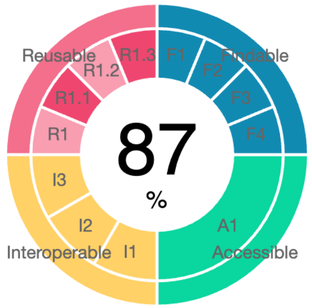
Badge

R12. The tool should provide a visual representation (e.g., a **badge**) of the FAIR assessment results.

✅

F-UJI

https://www.f-uji.net/index.php



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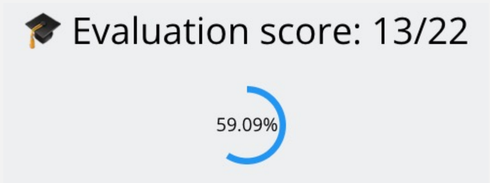
FAIR Enough

https://fair-enough.semanticscience.org/



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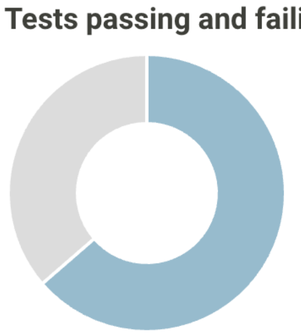
FAIR Evaluator

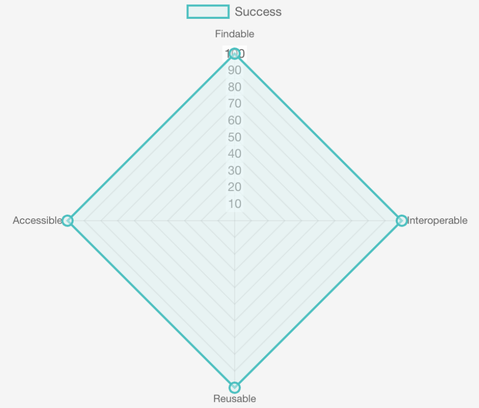
https://fairsharing.github.io/FAIR-Evaluator-FrontEnd/#!/evaluations



✅

FAIR Checker

https://fair-checker.france-bioinformatique.fr/check



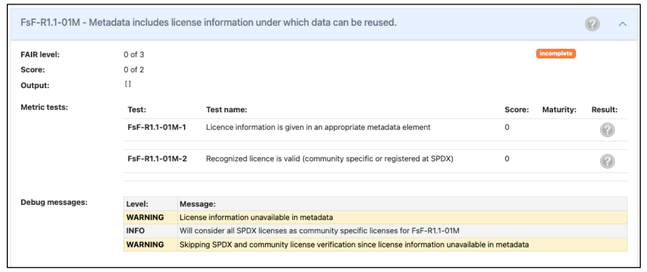
Without a badge, the user does have the whole assessment in a visual representation.

⁉ Main question: What is the best representation that present the results' overview for all evaluation levels (principles, metrics, tests)?

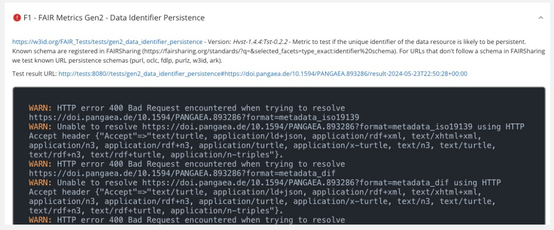
Recommendations

R20: The tool should give recommendations on how to improve the FAIRness of the evaluated resource

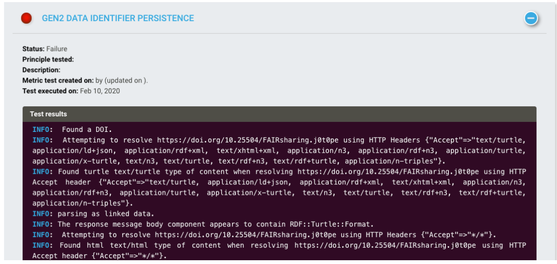
✗ F-UJI



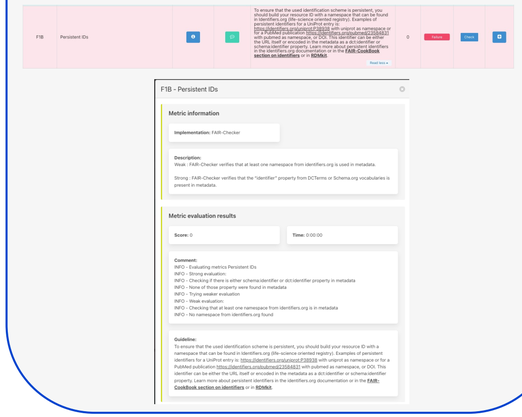
✗ FAIR Enough



✗ FAIR Evaluator



✅ FAIR Checker



Without giving recommendations (e.g., recipes or standard schemas), one misses the opportunity to increase the FAIRness of data

✗ F-UJI, FAIR Evaluator, FAIR Enough: present a log of the execution without explicit recommendations

✅ FAIR Checker: a set of recommendations for FAIRness improvements with links to training resources, such as FAIR-Cookbook

⁉ Main question: How to present FAIRness improvements recommendations to be followed by the non-technical users?

Customization

R10: The tool should be be customizable according to the type of digital object and community

F-UJI, FAIR Enough, and FAIR-Checker

- Does not support user friendly configuration
- Require software development skills

to develop and add new tests in the tool

FAIR Evaluator

- 👍 Allows users to group tests in a collection
- Requires software development skills

to develop and add new tests in the tool

Without the ability to customize the tool, evaluation is limited to agnostic parameters, i.e., does not handle community-specific needs.

⁉️ Main question: How to create FAIRness assessment tools that is easily adaptable by non software development users?

Appraisal results

Tools analysis

- Similar responses for 15 requirements
  - R1 to R8, R10, R13, R16, R18, R19, R22, and R23
- Different responses for 8 requirements
  - R9, R11, R12, R14, R15, R17, R20, R21

Fulfillment

- 74%: F-UJI
- 70%: FAIR Checker
- 63%: FAIR Evaluator and FAIR Enough

Tools main strenghts

- Employ good software development practices
- Use state-of-the art technologies in
  - Software Engineering
  - Semantic Web

Tools main weaknesses

- Reporting features should be improved
- Storage of results and versioning are not implemented

Conclusion

No tool meets all requirements and stands out as state-of-the-art

Choosing the best tool is challenging

There is room to solve the gaps by

- Evolving existing tools

or

- Developing a new tool

– The proposed requirements as a base for appraising automated tools for FAIRness assessment

To make a choice of tool or implementation

– Start by
  - Using requirements, like the ones we proposed
  - Identifying the most critial needs
  - Reading the details of our appraisal

– Then
  - Understand the difficulties to customize an existing tool
  - Test the tools in practice

– Make a decision
  - To use or improve a tool or develop your own

Conclusion

Limitation

- Search scope limited to academic works
  - Scopus, IEEE, and ACM
- Rationale
  - They include papers from relevant journals and conferences in Computer Science

Future work

- Broaden the literature review
  - Include other digital libraries
  - Include gray literature (e.g., FAIRassist.org)
- Detail the requirements
- Develop benchmarks considering our proposal of requirements
- Appraise the automated tools in practice

Thank you

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