



DRESDEN LEIPZIG

CENTER FOR SCALABLE DATA ANALYTICS
AND ARTIFICIAL INTELLIGENCE

Research Data Management

Robert Haase

GEFÖRDERT VOM



Bundesministerium
für Bildung
und Forschung

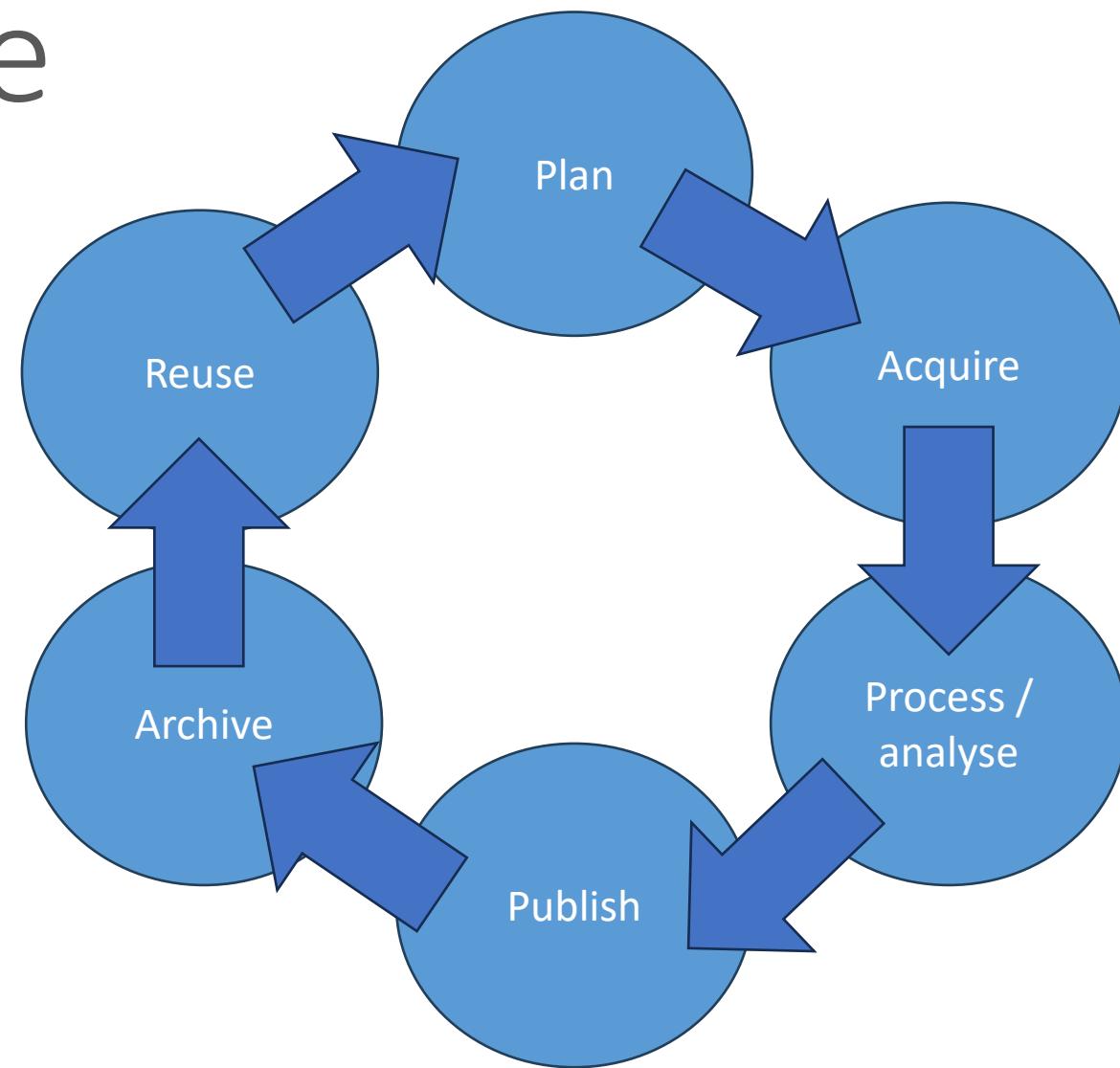
Research Data Management (RDM)

- All activities, processes, terms, persons which have relationships with data
 - Processing
 - Storage
 - Organisation
 - Publication
 - ...
- In routine: working with data



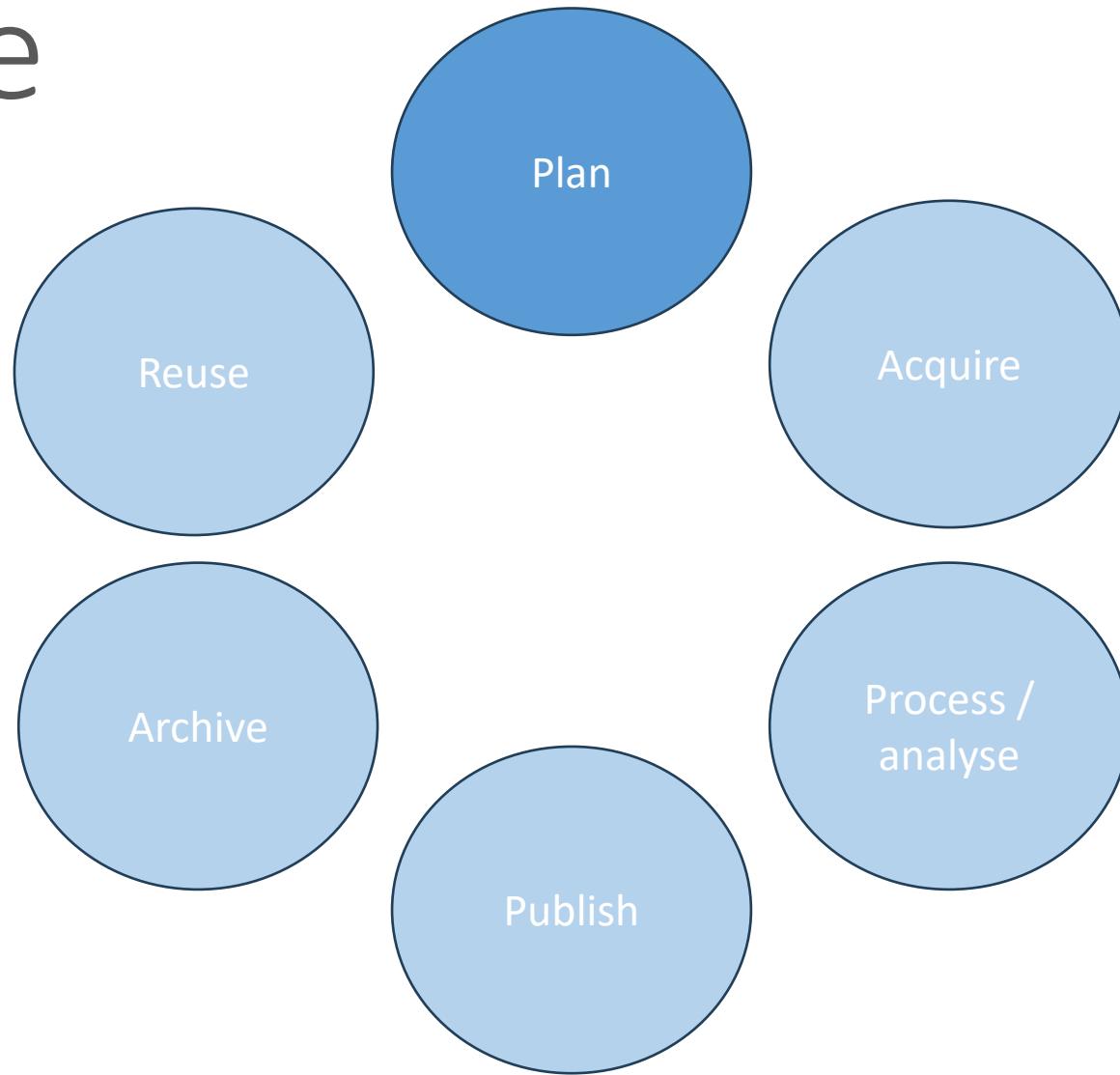
RDM Life Cycle

- Processes are ideally cyclic



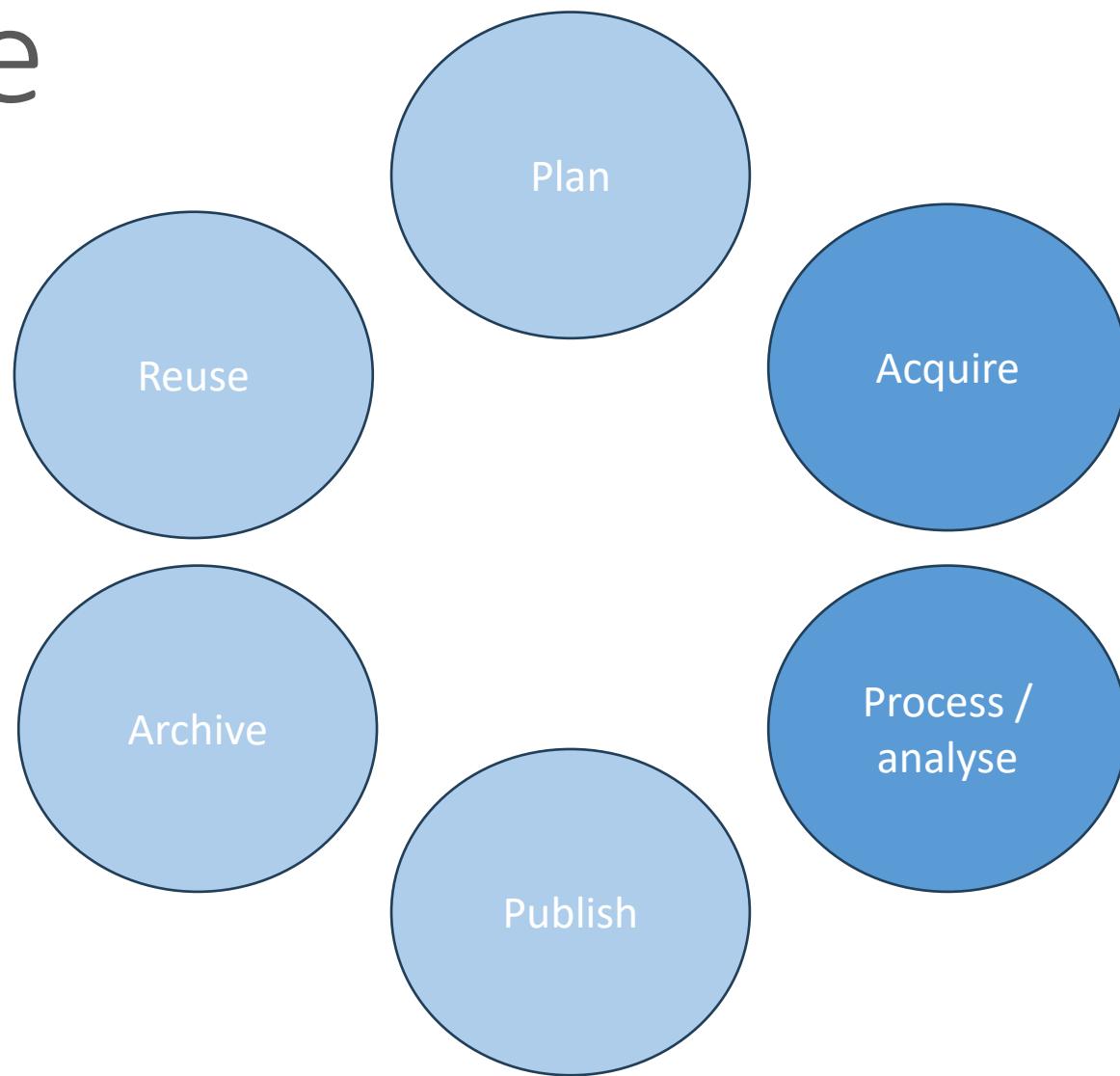
RDM Life Cycle

- Cost
- Benefit
- Quality
- Strategic decisions



RDM Life Cycle

- Types of data
- Terms and conditions
 - Usage rights
 - Copyright
- IT infrastructure
- Backup



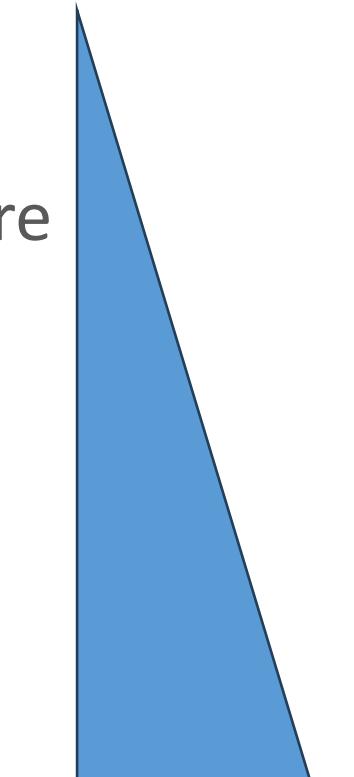
Types of data

- Structured data
 - Tables, databases
- Unstructured data
 - Texte, emails, videos, pictures
- Semi-structured data
 - Fragebögen
 - Scientific images



Types of data

- Openly accessible data
 - „open data“
 - „open source“ software
- Business data
- Research data
 - Hot / cold
- Personal data
- Secret data

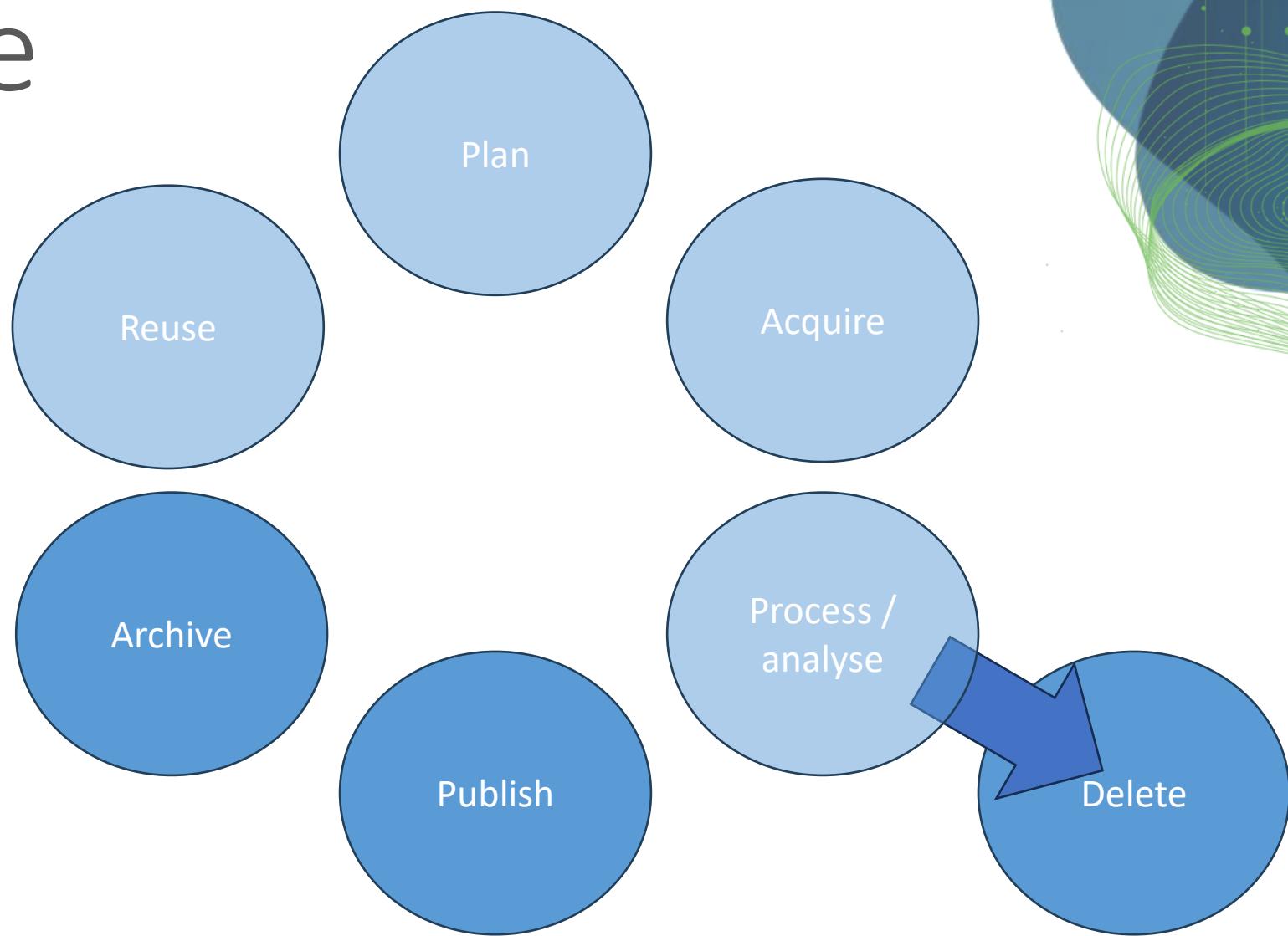


In need of protection
(schutzbedürftig)



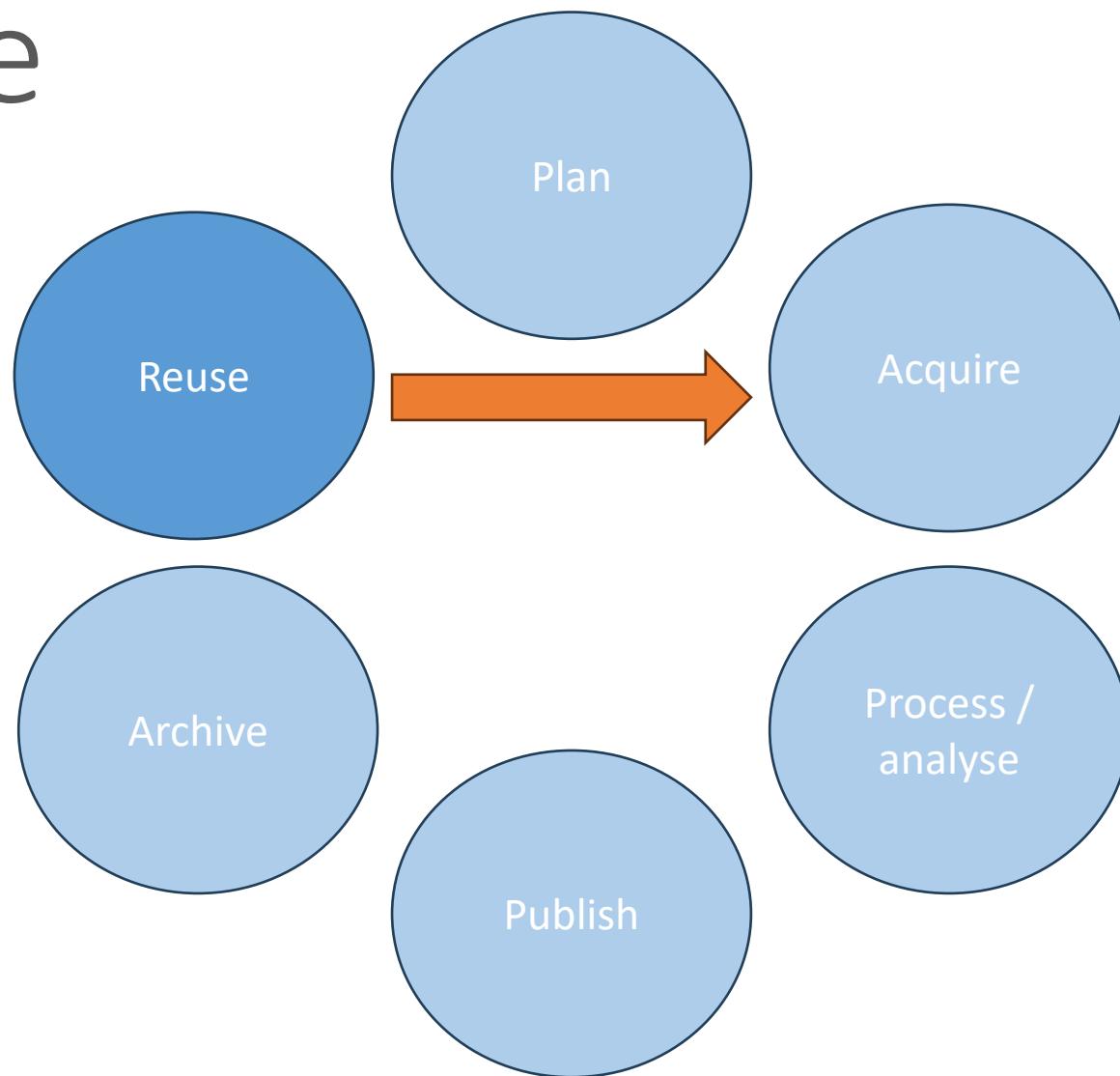
RDM Life Cycle

- Right to publish
- Regulatory aspects
 - Research data: archive 15 years
- Authorship
- Registration (-> Findable)



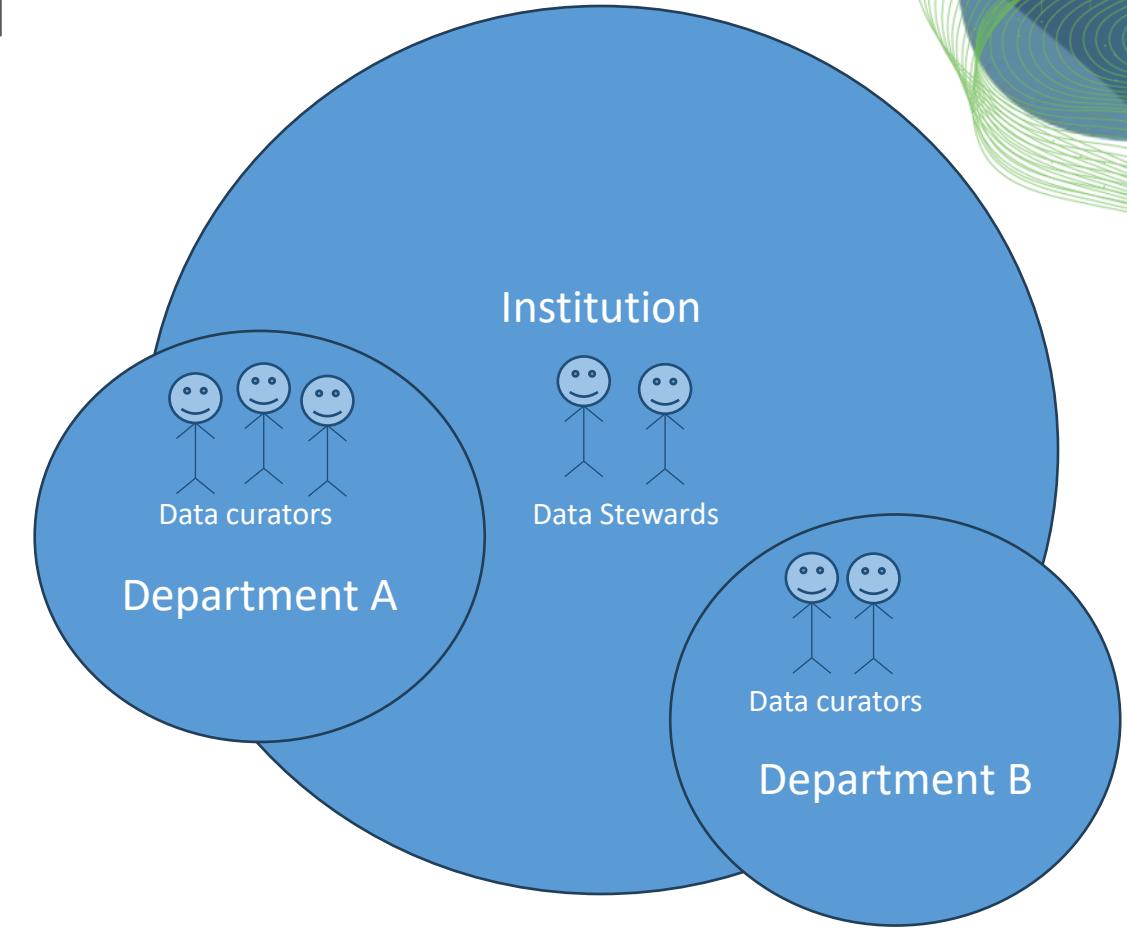
RDM Life Cycle

- Potential future benefit
- Sustainability
- Important: **Licensing**
 - Has impact on next cycle / acquisition



What is good RDM?

- Clearly defined responsibilities and processes (Governance)
 - Data Management Plan (DMP)
- Communication of goals, metrics, responsibilities, processes
- Dedicated personnel
 - “Data curators”
 - IT infrastructure maintainers
- Expert consultants
 - “Data stewards”

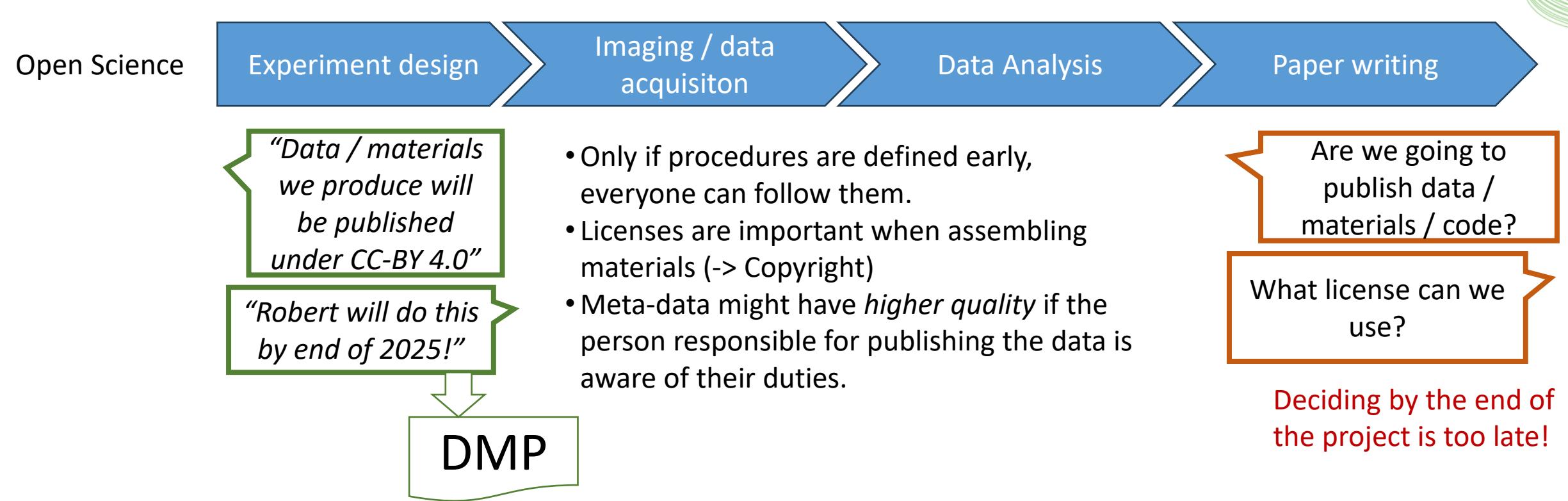


Data Management Plans (DMPs)

- Describes the **IS-state** of a data environment / project
 - Which data is acquired / processed?
(content, format, amount)
 - What meta-data is collected?
 - Which quality standards are targeted?
 - How is data saved, archived, backed-up, shared, published...?
 - Who is responsible for what?
 - Roles, job-profiles
 - What does this all cost?
(IT infrastructure + human resources)

Data Management Plans (DMPs)

- Define responsibilities and procedures early!



Data Management Plans

Checklist Regarding the Handling of Research Data

1. Data description

How does your project generate new data? Is existing data reused? Which data types (in terms of data formats like image data, text data or measurement data) arise in your project and in what way are they further processed? To what extent do these arise or what is the anticipated data volume?

2. Documentation and data quality

What approaches are being taken to describe the data in a comprehensible manner (such as the use of available metadata, documentation standards or ontologies)? What measures are being adopted to ensure high data quality? Are quality controls in place and if so, how do they operate? Which digital methods and tools (e.g. software) are required to use the data?

3. Storage and technical archiving the project

How is the data to be stored and archived throughout the project duration? What is in place to secure sensitive data throughout the project duration (access and usage rights)?

Data Management Plans

4. Legal obligations and conditions

What are the legal specifics associated with the handling of research data in your project? Do you anticipate any implications or restrictions regarding subsequent publication or accessibility? What is in place to consider aspects of use and copyright law as well as ownership issues? Are there any significant research codes or professional standards to be taken into account?

5. Data exchange and long-term data accessibility

Which data sets are especially suitable for use in other contexts? Which criteria are used to select research data to make it available for subsequent use by others? Are you planning to archive your data in a suitable infrastructure? If so, how and where? Are there any retention periods? When is the research data available for use by third parties?

6. Responsibilities and resources

Who is responsible for adequate handling of the research data (description of roles and responsibilities within the project)? Which resources (costs; time or other) are required to implement adequate handling of research data within the project? Who is responsible for curating the data once the project has ended?

Quiz

- Regularly copying files to a remote place is ...

Archiving



Backup



Publishing

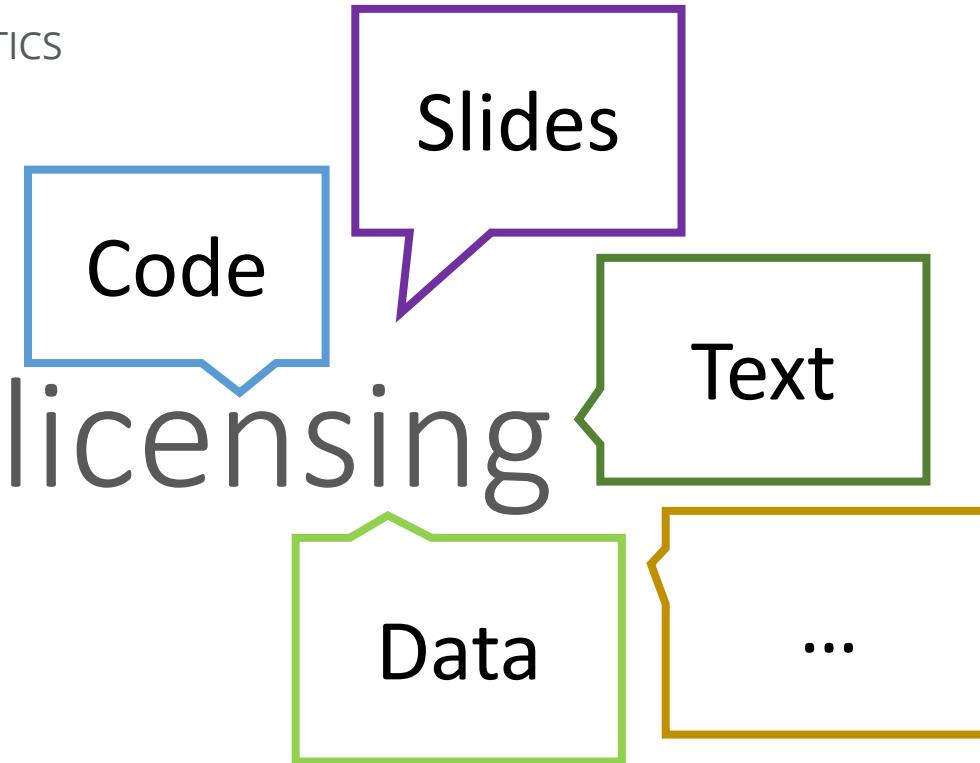


Reuse



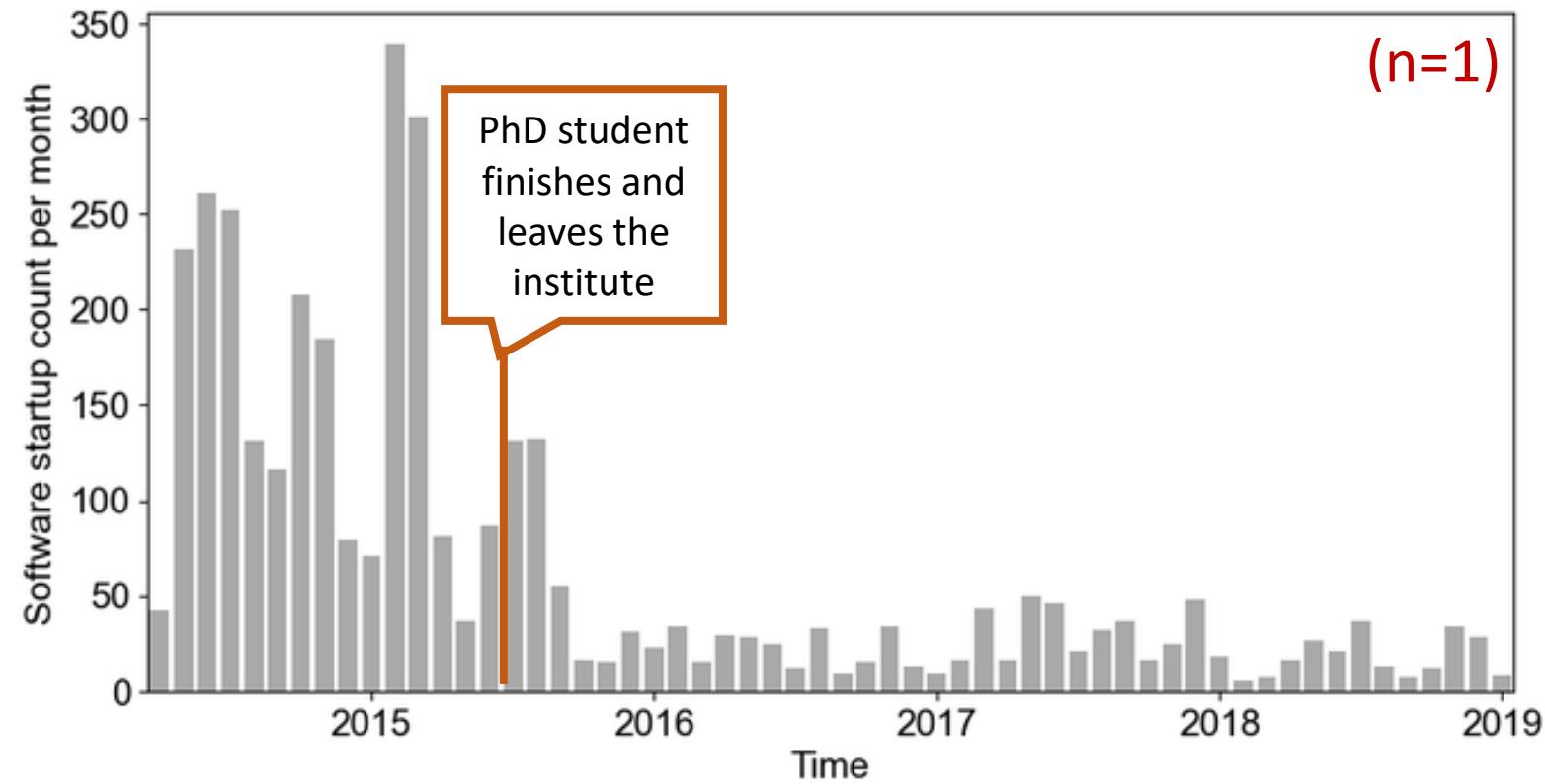
Sharing & licensing

Robert Haase



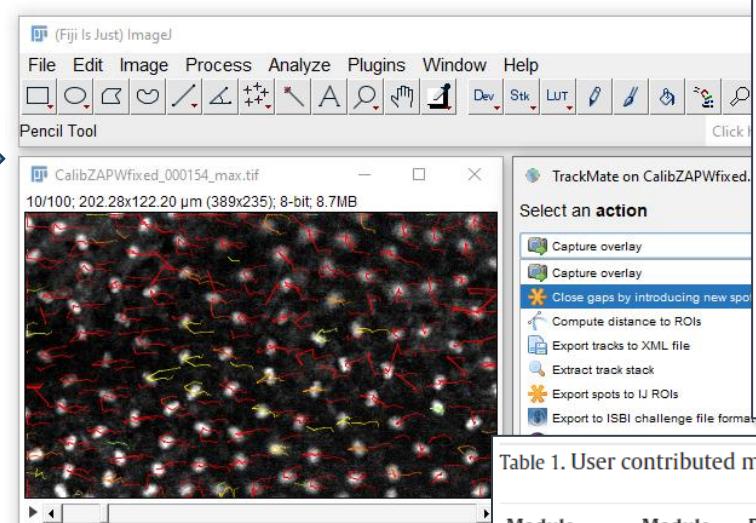
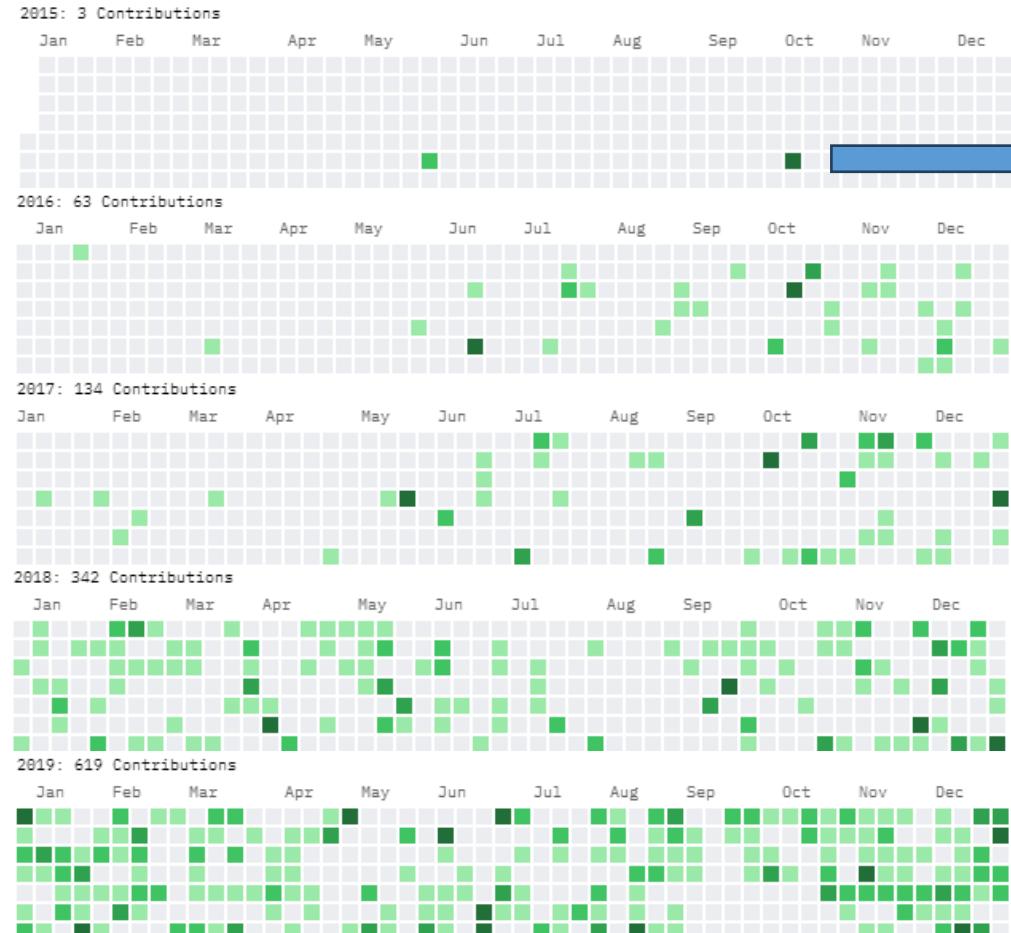
Sustainability of my contribution to science

- What happens to research software once the PhD student leaves the institute / field?



Version control [for code]: git

Github contributions



Methods
Volume 115, 15 February 2017, Pages 80-90

TrackMate: An open and extensible platform for single-particle tracking

Jean-Yves Tinevez^a , Nick Perry^a , Johannes Schindelin^b , Genevieve M. Hoopes^c, Gregory D. Reynolds^c, Emmanuel Laplantine^d, Sebastian Y. Bednarek^c, Spencer L. Shute^a, Kevin W. Eliceiri^b

Show more ▾

+ Add to Mendeley Share Cite

<https://doi.org/10.1016/j.jymeth.2016.09.016>

Get rights and content

Table 1. User contributed modules of TrackMate v3.4.0.

Module name	Module type	Purpose	Author	Location
Linear tracker	Particle-linking	Linking transported particles by extrapolating their velocity	Ronny Sczech	https://github.com/chicorrony/RonnyTrackMate
Batch mode	Plugin	Runs TrackMate in batch reading		
Close gaps	Generic action	Close gaps in tracks by creating spots in missing frame by linear interpolation of their coordinates	Robert Haase	Integrated into TrackMate v3.4.0

Note: The colour-code is not consistent between the years

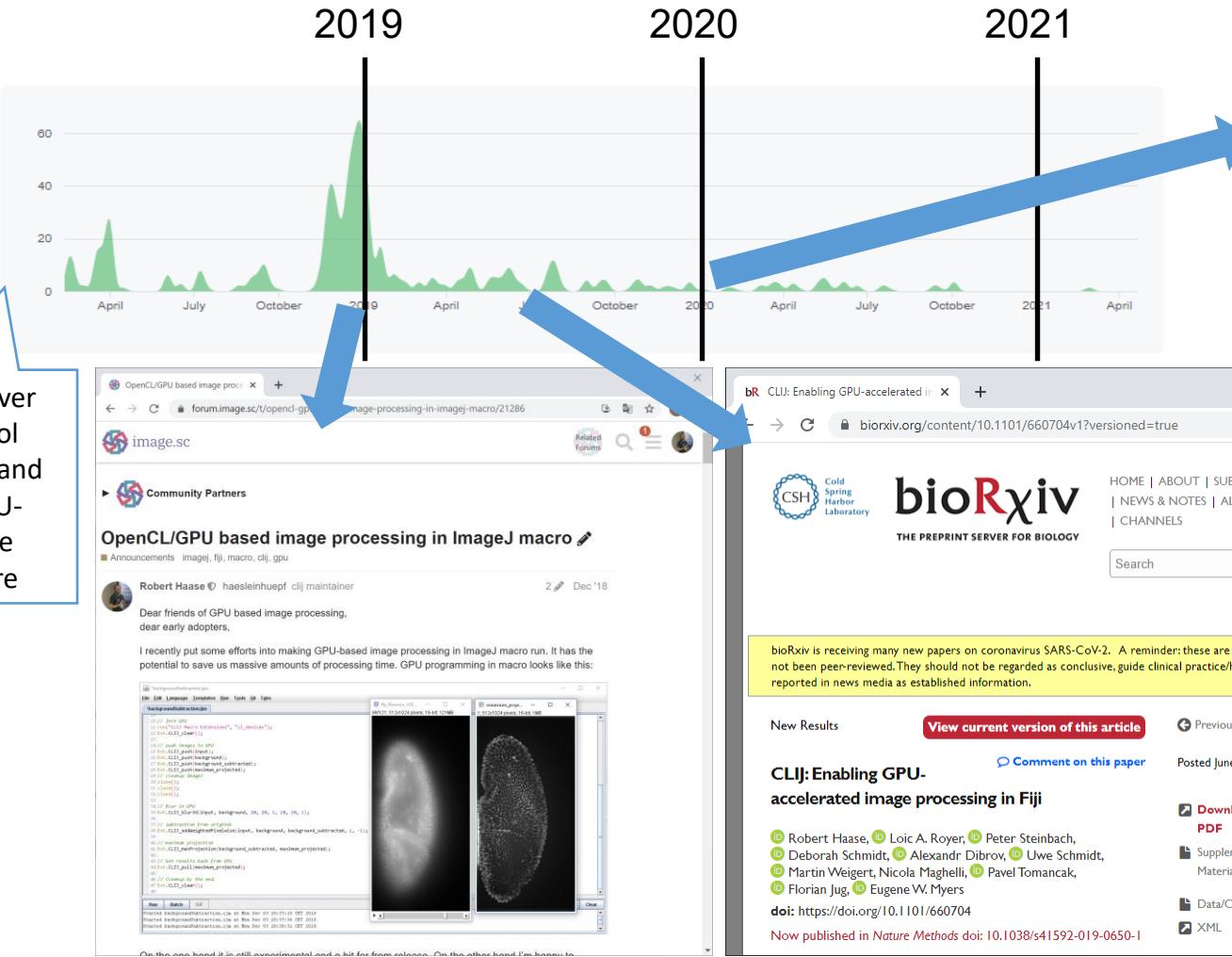
Developing software in the open



Nov. 2017: I took over microscopy control software from Loic and “found” some GPU-accelerated image processing in there

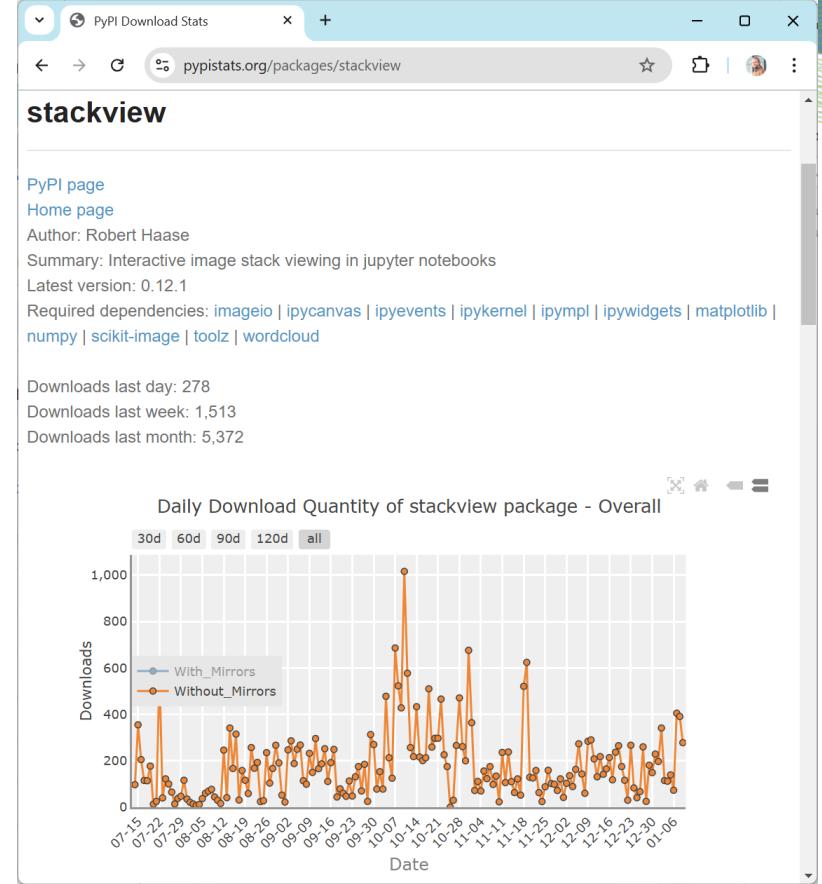
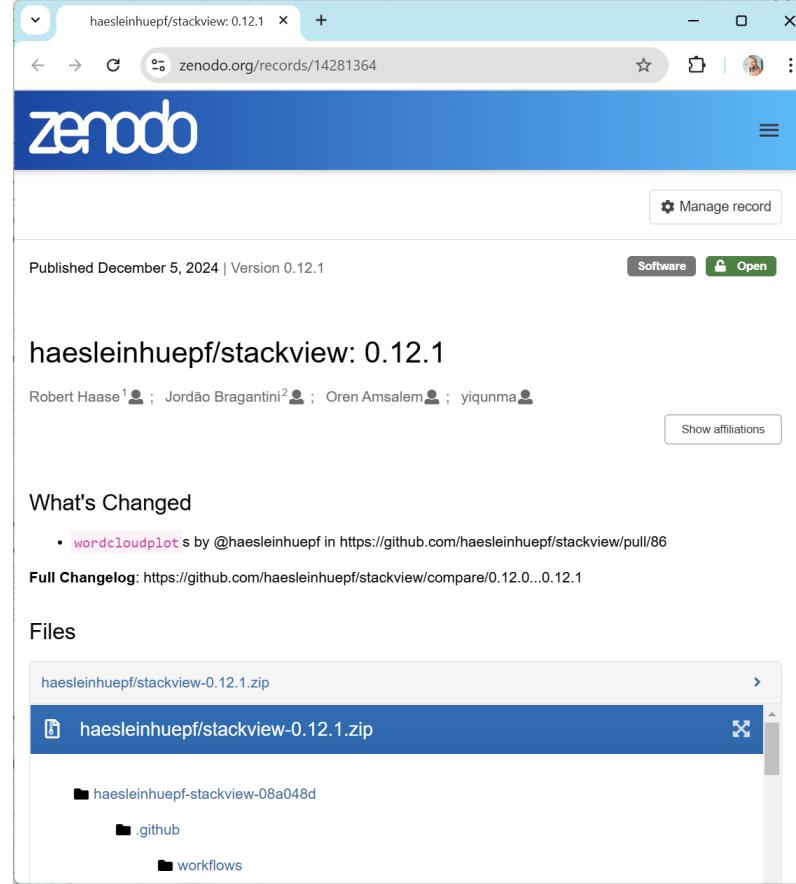
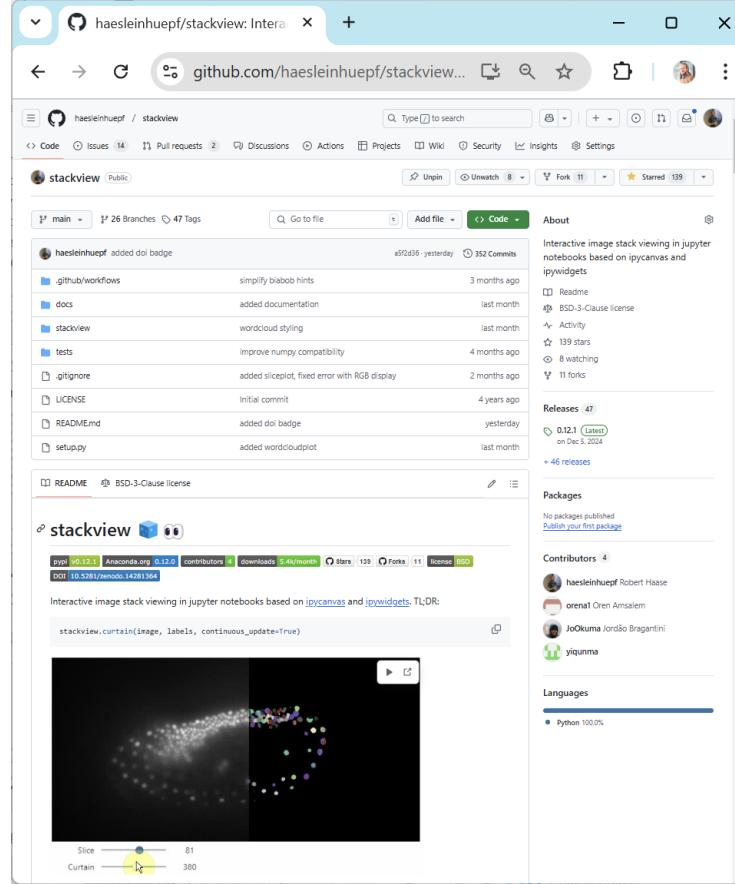


Loic A. Royer
(CZ Biohub)
@loicaroyer



Version control [for code]: git

- Me, today:



Recap: Software quality indicators

Software quality indicators

- Visit the project's github or gitlab page and review indicators.

A screenshot of a GitHub repository page for 'napari/napari'. The 'Code' tab is selected, showing a list of files and their commit history. Below the code area, there is a 'Contributors' section showing 196 contributors. At the bottom of the page, there is a summary of the repository's metrics: 64 stars, 131 topics, 95.2 MB repo size, 2.1.0 pypi package, 11k downloads/month, 3 python license, 25 contributors, and a website link.

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BIDS Lecture 1/12
April 11th 2025

<https://github.com/napari/napari>



A screenshot of a GitHub repository page for 'napari/napari' showing the 'About' tab. It displays various badges for documentation status, testing, coverage, and other metrics. A callout box on the right states: 'Note, github badges cannot be deserved. Developers put them there'. To the right of the callout is a small image of a man in a military uniform with many medals.

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April 11th 2025

Image source: Adapted from <https://www.pexels.com/photo/shallow-focus-photo-of-two-persons-wearing-military-uniform-2859046/>

64 TECHNISCHE UNIVERSITÄT DRESDEN

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BIDS Lecture 1/12
April 11th 2025

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Scientific culture

Public access to research results -> Reusability



Guideline 13: Providing public access to research results

► As a rule, researchers make all results available as part of scientific/academic discourse. In specific cases, however, there may be reasons not to make results publicly available (in the narrower sense of publication, but also in a broader sense through other communication channels); this decision must not depend on third parties. Researchers decide autonomously – with due regard for the conventions of the relevant subject area – whether, how and where to disseminate their results. If it has been decided to make results available in the public domain, researchers describe them clearly and in full. Where possible and reasonable, this includes making the research data, materials and information on which the results are based, as well as the methods and software used, available and fully explaining the work processes. Software programmed by researchers themselves is made publicly available along with the source code. Researchers provide full and correct information about their own preliminary work and that of others.

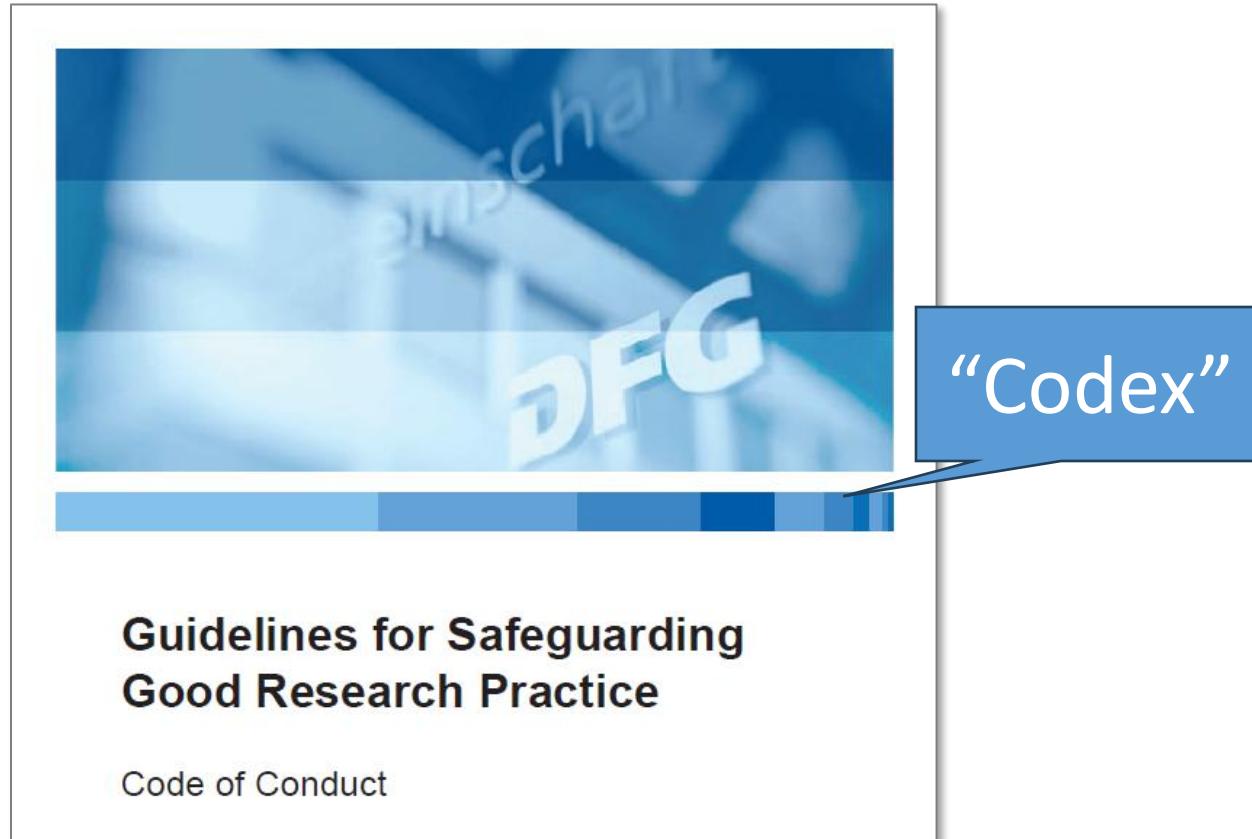
Explanations:

In the interest of transparency and to enable research to be referred to and reused by others, whenever possible researchers make the research data and principal materials on which a publication is based available in recognised archives and repositories in accordance with the FAIR principles (Findable, Accessible, Interoperable, Reusable). Restrictions may apply to public availability in the case of patent applications. If self-developed

Scientific culture

Public access to research results -> Reusability

Guideline 14: Authorship



An author is an individual who has made a genuine, identifiable contribution to the content of a research publication of text, data or software. All authors agree on the final version of the work to be published. Unless explicitly stated otherwise, they share responsibility for the publication. Authors seek to ensure that, as far as possible, their contributions are identified by publishers or infrastructure providers such that they can be correctly cited by users.

Explanations:

The contribution must add to the research content of the publication. What constitutes a genuine and identifiable contribution must be evaluated on a case-by-case basis and depends on the subject area in question. An identifiable, genuine contribution is deemed to exist particularly in instances in which a researcher – in a research-relevant way – takes part in

- the development and conceptual design of the research project, or
- the gathering, collection, acquisition or provision of data, software or sources, or
- the manuscript analysis/evaluation or interpretation of data, sources and conclusions drawn from them, or
- the drafting of the manuscript.

Scientific culture



About Us ▾ Funding ▾ Basics and Topics ▾ Funded Projects ▾ News ▾

DFG > News > News and Current Topics > Information for Researchers > Package of Measures to Support a Shift in the Culture of Research Assessment

Information for Researchers, No. 61 | September 1, 2022

Package of Measures to Support a Shift in the Culture of Research Assessment

DFG changes proposal forms and introduces mandatory CV template / The aim is to support a shift in the culture of research assessment / Improvement of equal opportunity practices

DFG changes proposal forms and introduces mandatory CV template / The aim is to support a shift in the culture of research assessment / Improvement of equal opportunity practices

Successful science and research require suitable framework conditions. The Deutsche Forschungsgemeinschaft (DFG, German Research Foundation) ensures these conditions by regularly conducting analyses, providing the relevant information and adapting its procedures accordingly. The DFG set out the challenges and fields of action in a position paper on academic publishing published in May of this year: it sees both the academic community as a whole and itself as a funding organisation as being responsible for initiating a cultural shift towards research assessment that is geared more towards equal opportunity and attaches even greater importance to the substance of research. In the interests of bringing about such a shift, it is up to research funding organisations to broaden the spectrum of accepted publication formats, to attach greater value to content-based evidence of achievement and to strengthen the recipient side of publishing. The DFG has launched a comprehensive and far-reaching package of measures in order to fulfil this mandate.

Binding CV template across all funding programmes

For this reason, the assessment of a researcher's accomplishments must be holistic and based on substantive qualitative criteria. In order to strengthen qualitative evaluation criteria over quantitative indicators, the DFG will be introducing a curriculum vitae template that will be mandatory across all programmes from 1 March 2023 (the template will be adapted shortly for proposals under the Collaborative Research Centre and Research Training Group programmes; information will be provided separately in this regard). The template adopted by the DFG Senate allows applicants to provide both narrative and tabular information, thereby facilitating a holistic view of the applicant's academic career in the review and evaluation process.

In addition to the mandatory information required in order to assess eligibility, applicants may also provide details of special circumstances or additional services to scholarship such as committee activities or the establishment of research infrastructures. As such, the template provides the basis for a qualitatively sound assessment of academic performance that takes greater account of the respective stage of the individual's life and career. Accordingly, reviewers are now instructed to consider applicants' academic performance in the context of their individual curriculum vitae and career stage.

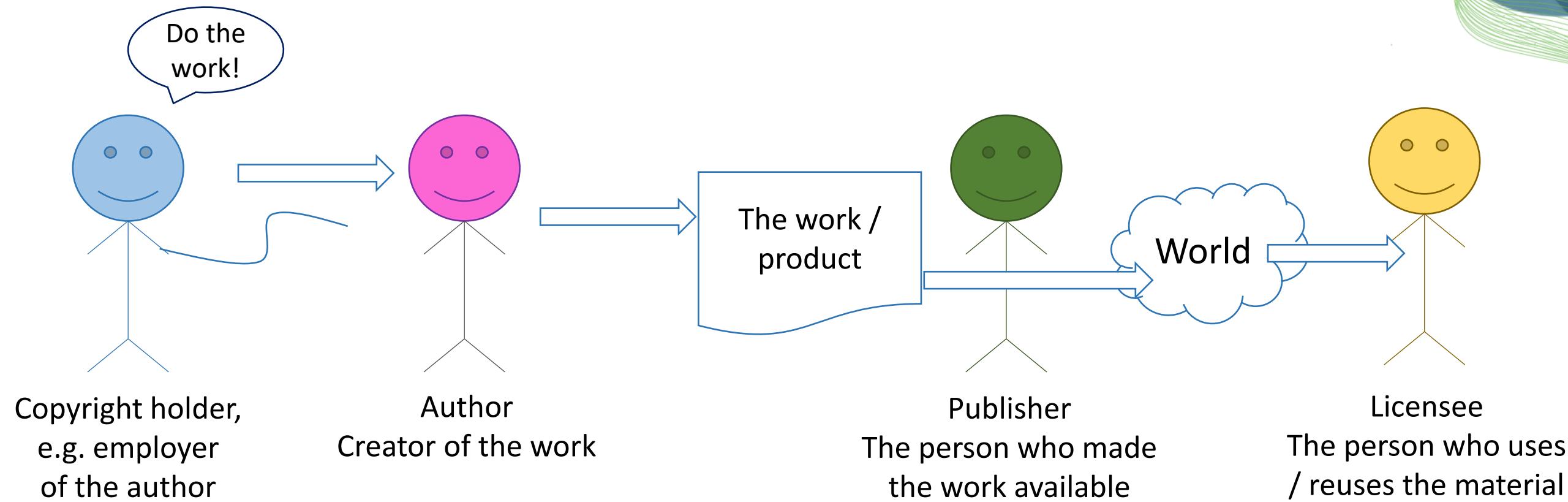
Publication details in proposals and CVs

Performance assessment based on content-related qualitative criteria also explicitly includes ensuring that the entire spectrum of academic publication types are equally displayed and acknowledged in funding proposals and CVs. In addition to a maximum of ten publications in the more common publication formats, the CV can therefore now list up to ten further sets of research outcomes and findings that have been publicised in a variety of other ways, including articles on preprint servers, data sets or software packages, for example. In DFG proposals, the project-specific list of publications will be included in the general bibliography. The intention here is to shift the focus of the review and the evaluation of a proposal away from the list of publications and towards the substance of the applicant's accomplishments. In order to document their own published preliminary work, applicants can typographically highlight (e.g. in bold) a maximum of ten of their own publications in the bibliography that are important for the project. No information on quantitative metrics such as impact factors and h-indices is required in the CV or the proposal, and such information is not to be considered in the review. The relevant details are included in DFG forms and review instructions.

These modifications and innovations reflect the fact that the DFG is continuing to promote the cultural shift in research assessment that was advocated in May with the publication of the position paper on academic publishing. The DFG hopes that this refocus – away from quantitative indicators and towards the substance of scholarship – will lead to improved equality of opportunity and a higher-quality basis for review overall.

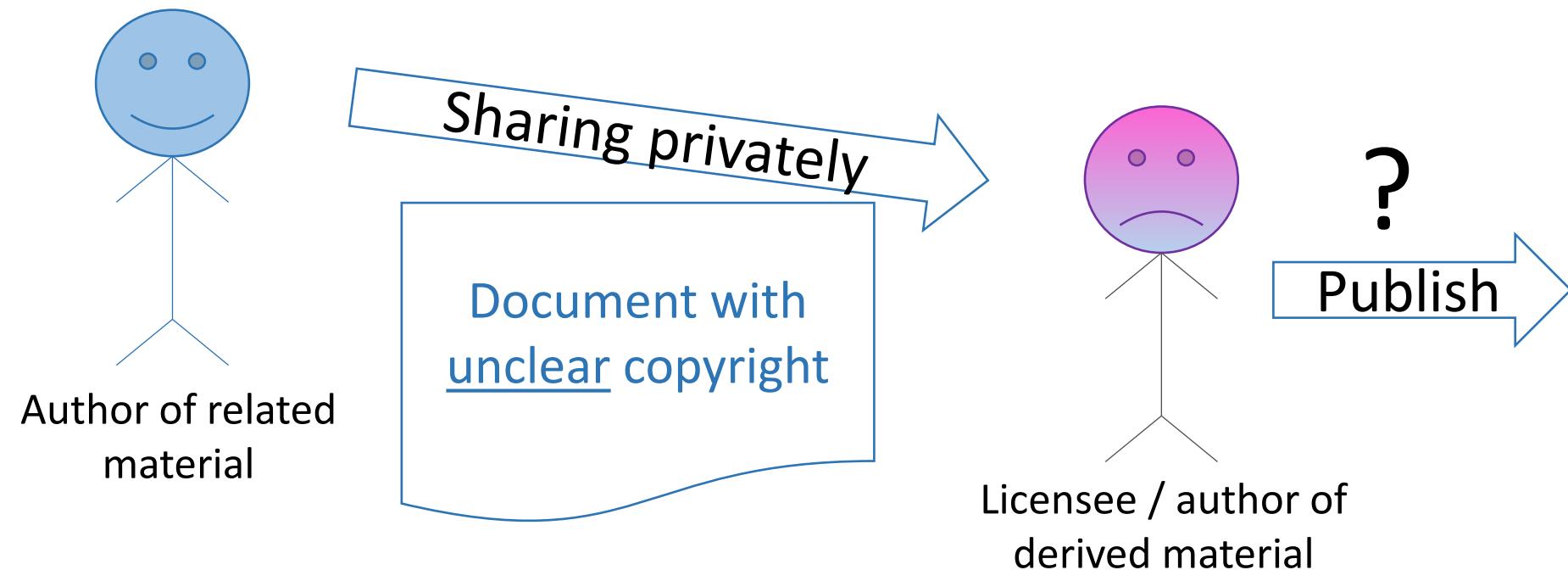
Am I allowed to publish my stuff?

- ... it depends... on who is responsible



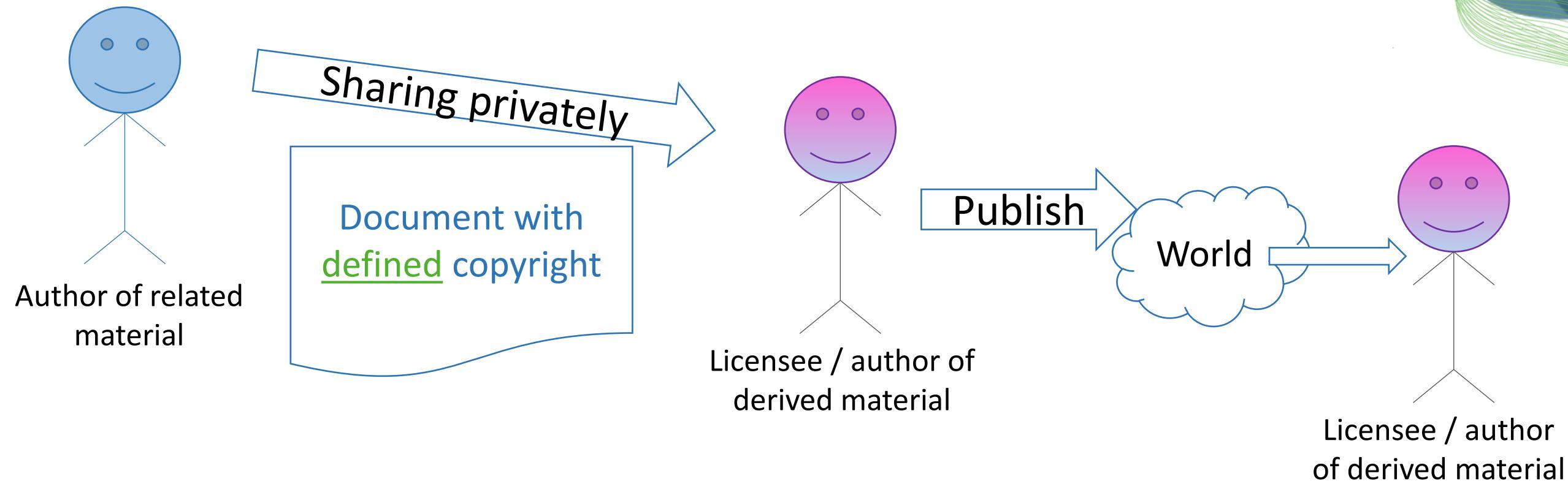
Am I allowed to publish my stuff?

- ... it depends... on what materials served as basis



Am I allowed to publish my stuff?

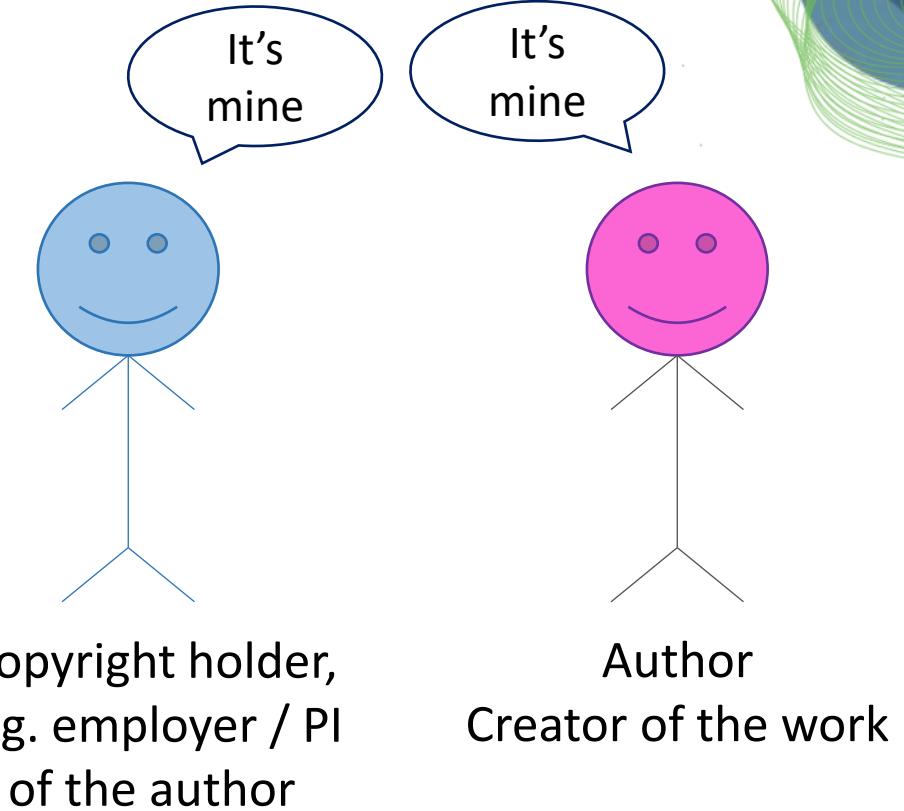
- ... it depends... on what materials served as basis



Public versus institutional repositories

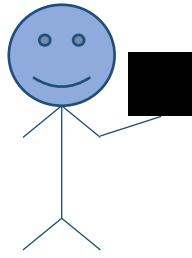
Conflict of interest between employers and scientists

- Universities seek to keep things secret and potentially exploit them commercially (licenses, startups, ...)
- Scientists need to publish to advance their career.
- Hints:
 - Decide early during the project what will be published and by who (-> DMP)
 - Check your job description! (Is “Programming” or “model training” part of it?)



Openness of software / projects

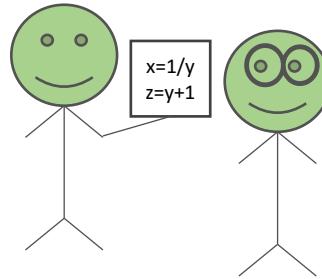
Closed source



- Open to collaborations
- “Black box”
- Compiled code (e.g. C/C++)
- Good for protecting intellectual properties (\$\$\$)

Hardware device drivers

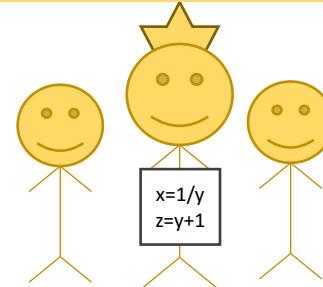
Open source



- Code available to read
- Not necessarily executable code
- No maintenance / support efforts

Custom image analysis scripts

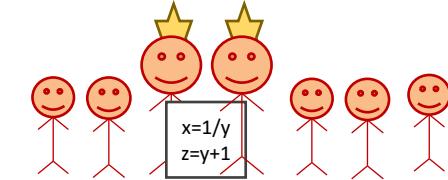
Benevolent dictatorship



- Open to contributions
- Single maintainer, often overwhelmed
- Efficient decision making
- Bus factor ≈1

TrackMate, SNT, MorpholibJ, CLIJ

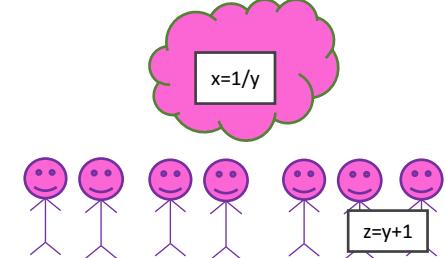
Community driven



- Open to contributions
- Partially democratic
- Board of maintainers (core developers)
- Long-winded decision making

scikit-image, scipy, OpenCL

Openly extensible



- Openly extensible; without maintainers involved
- Partially community driven

ImageJ, Python, numpy

Quiz

- What is the role of Github in the context of publishing open-source code?

Copyright holder



Author



Publisher



Licensee



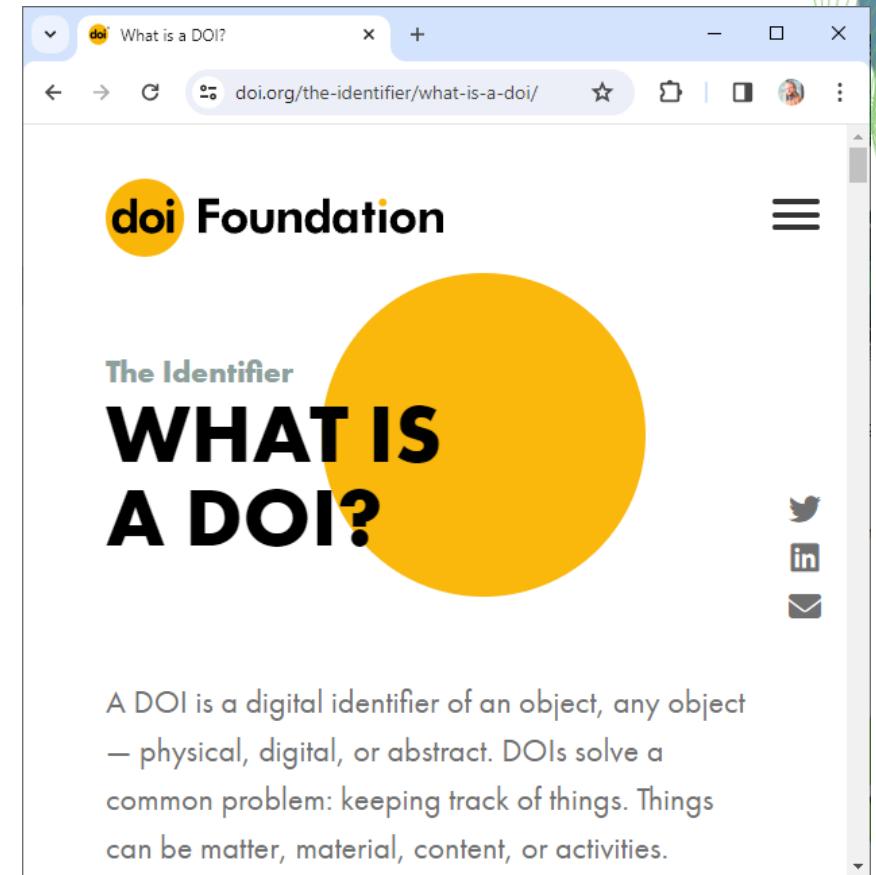
Standard for sharing: The FAIR-principles

- Findable
- Accessible
- Interoperable
- Reusable



The FAIR-principles

- Findable
- F1. (Meta)data are assigned a globally unique and persistent identifier
 - Universal Resource Identifier (URI)
 - Digital Object Identifier (DOI)
- F2. Data are described with rich metadata (defined by R1 below)
- F3. Metadata clearly and explicitly include the identifier of the data they describe
- F4. (Meta)data are registered or indexed in a searchable resource

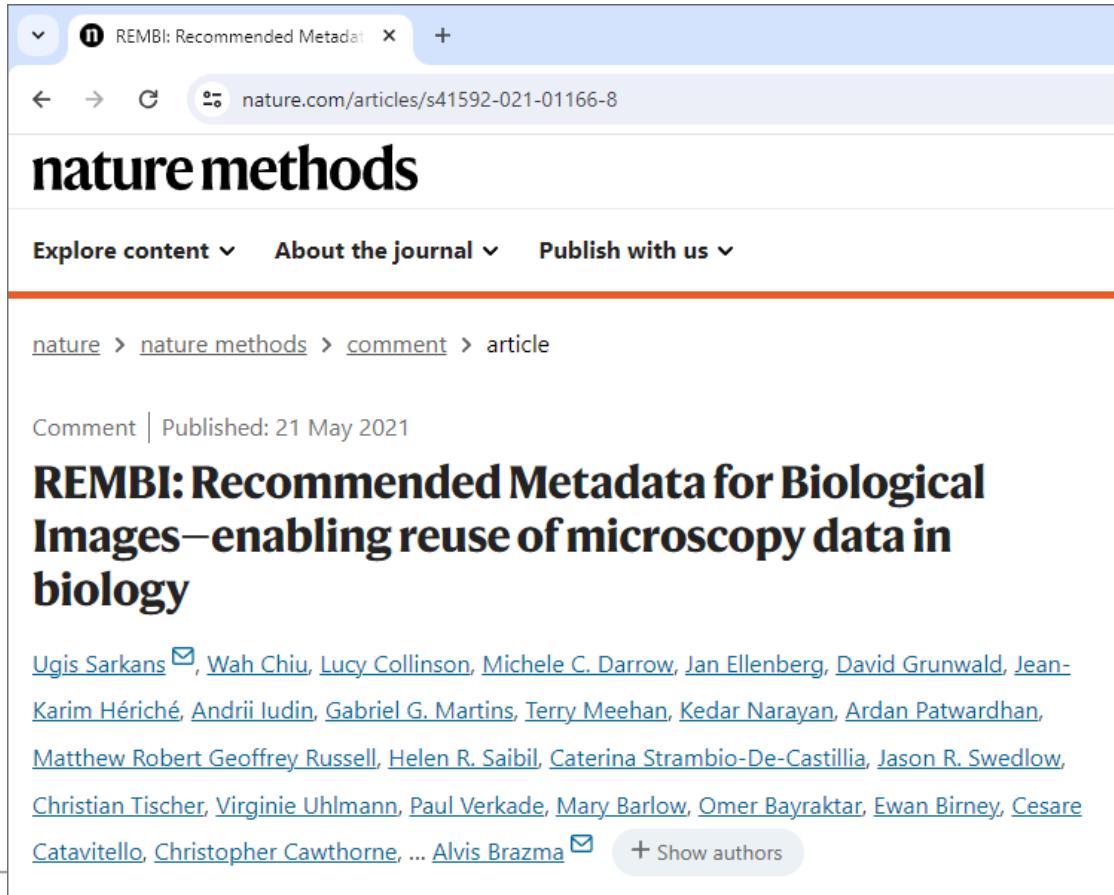


Meta data

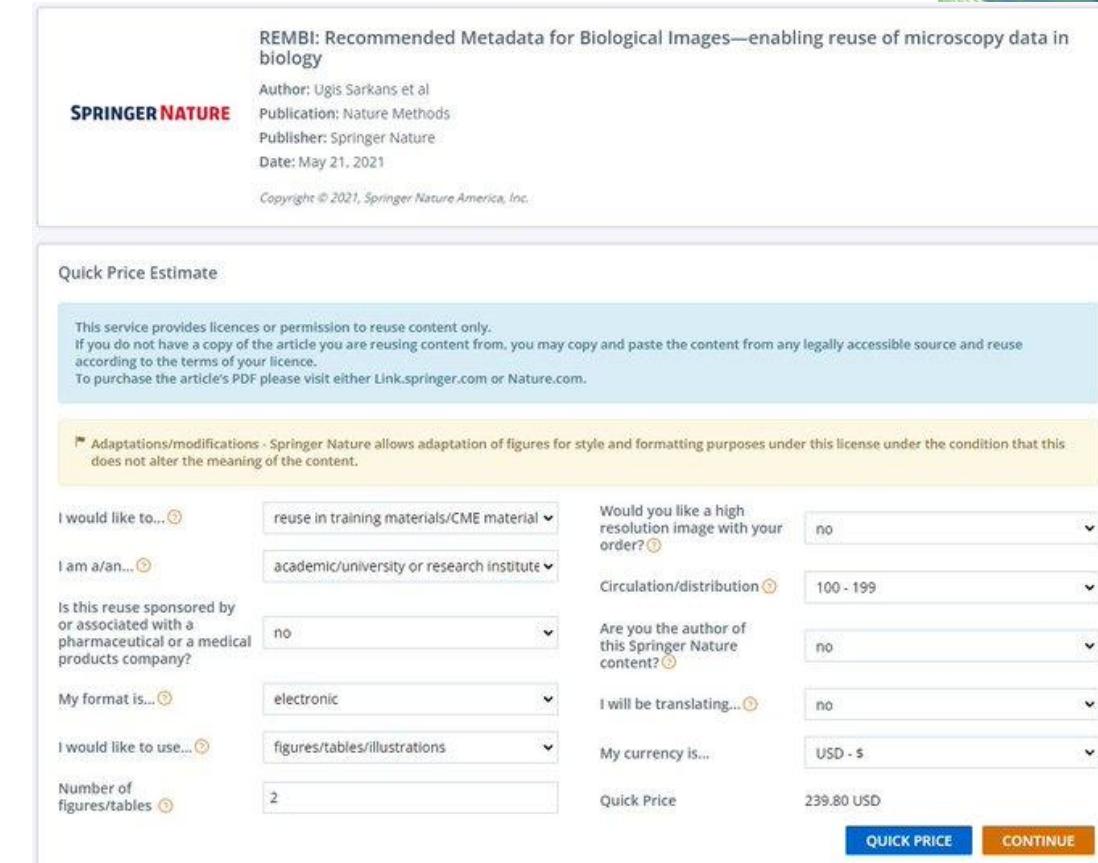
- Generic
 - Author
 - Usage license
 - Creation date
- Field-specific (microscopy)
 - Exposure time
 - Wavelength (colour)
 - Microscope type/vendor
- Field-specific (software)
 - Dependencies
 - Requirements
 - Purpose of the code
 - User documentation

REMBI: Recommended Metadata for Biological Images—enabling reuse of microscopy data in biology

- Read more:



A screenshot of a web browser showing the REMBI article on nature.com. The title "REMBI: Recommended Metadata for Biological Images—enabling reuse of microscopy data in biology" is displayed prominently. Below the title, a list of authors is provided, including Ugis Sarkans, Wah Chiu, Lucy Collinson, Michele C. Darrow, Jan Ellenberg, David Grunwald, Jean-Karim Hériché, Andrii Iudin, Gabriel G. Martins, Terry Meehan, Kedar Narayan, Ardan Patwardhan, Matthew Robert Geoffrey Russell, Helen R. Saibil, Caterina Strambio-De-Castillia, Jason R. Swedlow, Christian Tischer, Virginie Uhlmann, Paul Verkade, Mary Barlow, Omer Bayraktar, Ewan Birney, Cesare Catavitello, Christopher Cawthorne, and Alvis Brazma. A "Show authors" button is visible at the bottom right of the author list.



A screenshot of the REMBI article page on Springer Nature's website. The title "REMBI: Recommended Metadata for Biological Images—enabling reuse of microscopy data in biology" is shown. Below the title, it says "Author: Ugis Sarkans et al", "Publication: Nature Methods", "Publisher: Springer Nature", and "Date: May 21, 2021". A "Copyright © 2021, Springer Nature America, Inc." notice is also present. A "Quick Price Estimate" section follows, containing a note about reuse rights and a form for selecting reuse options like "reuse in training materials/CME material", "academic/university or research institute", and "My format is... electronic". Other fields include "Number of figures/tables" (set to 2), "Quick Price" (239.80 USD), and "CONTINUE" and "QUICK PRICE" buttons.

Digital Object Identifiers (DOI)

- DOIs / URIs always point at the same data
- DOIs are centrally registers, URIs not
- Unified Resource Locators (URLs) may point at different things

The screenshot shows a web browser window for the 'Straßennetz, Stadt Leipzig' dataset on the opendata.leipzig.de website. The page includes a navigation bar with links for 'Datensätze', 'Organisationen', 'Kategorien', 'Anwendungen', 'Über uns', 'Nutzung', and 'Hackathons'. Below this is a breadcrumb trail: '/ Organisationen / Verkehrs- und Tiefbauamt / Straßennetz, Stadt Leipzig'. The main content area features a title 'Straßennetz, Stadt Leipzig' with a subtitle 'Organization'. It lists download formats: 'Das Straßennetz im CSV-Format', 'Das Straßennetz im GeoJSON-Format', 'Das Straßennetz im GeoPackage-Format', and 'WFS-GetCapabilities'. There are also buttons labeled 'Entdecke' with dropdown menus. Below these are sections for 'Zusätzliche Informationen' (Additional Information) and a table of administrative details:

Feld	Wert
Ansprechpartner	Verkehrs- und Tiefbauamt, Stadt Leipzig
E-Mail	vta@leipzig.de
Verwaltungsebene	kommunale Ebene
Gemeindename	Leipzig, Stadt
Ausgestellt	2021-08-20
Aktualisiert	2024-01-17

A blue callout box on the right side of the table contains the text: 'This no DOI, no URI, it's a URL'.

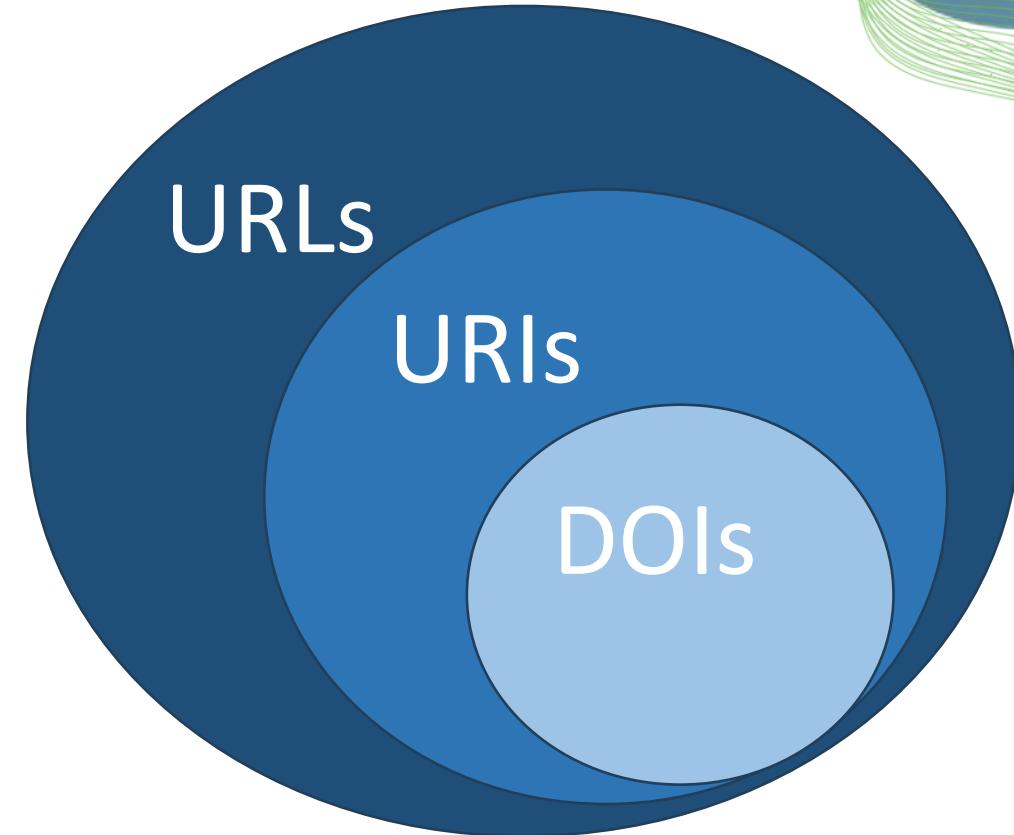
Universal Resource Locators (URL)

Universal Resource Identifiers (URI)

Digital Object Identifiers (DOI)

Goals: Cite resources, find them in the future

- URLs may point at different things over time
- DOIs and URIs always point at the same data (or different versions of it)
- DOIs are centrally registered, URIs not



Unified Resource Locators

- These are all URLs

<https://fairsharing.org/>

<https://doi.org/10.5281/zenodo.28325>

<https://dx.doi.org/10.14470/TR560404>

<https://geofon.gfz.de/doi/network/GE>

Unified Resource Identifiers

- These are also URIs

<https://fairsharing.org/>

<https://doi.org/10.5281/zenodo.28325>

<https://dx.doi.org/10.14470/TR560404>

<https://geofon.gfz.de/doi/network/GE>

Digital Object Identifiers

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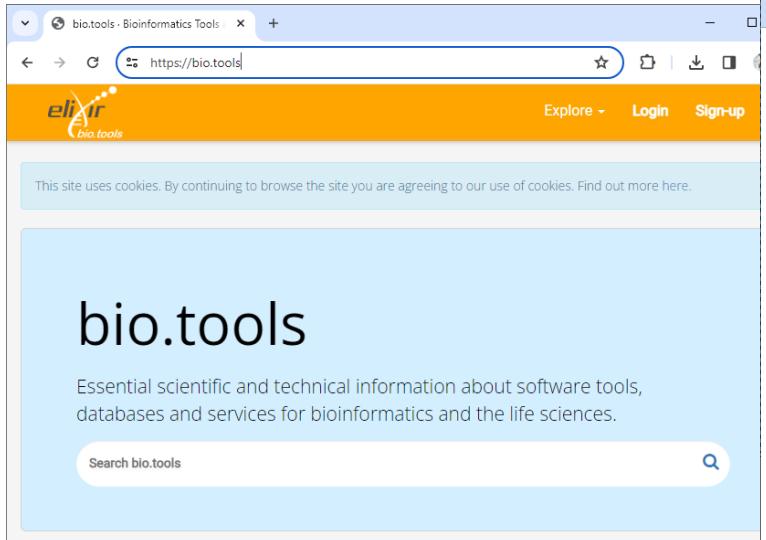
<https://doi.org/10.5281/zenodo.28325>

<https://dx.doi.org/10.14470/TR560404>

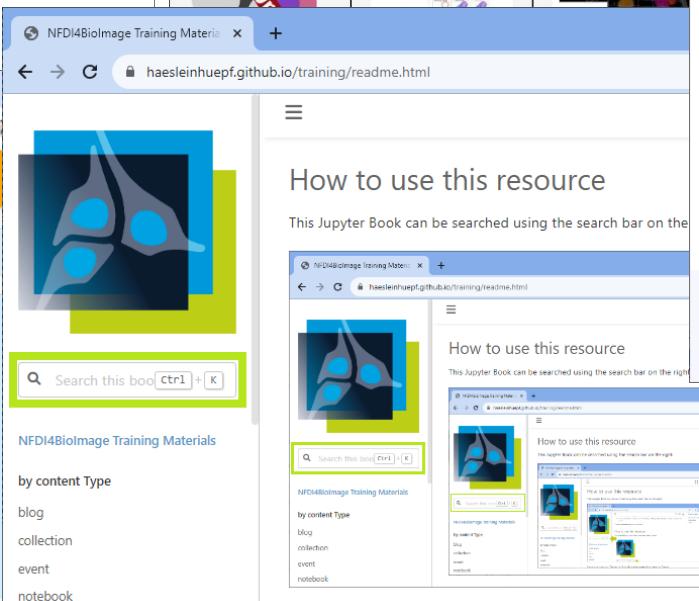
<https://geofon.gfz.de/doi/network/GE>

Indexing

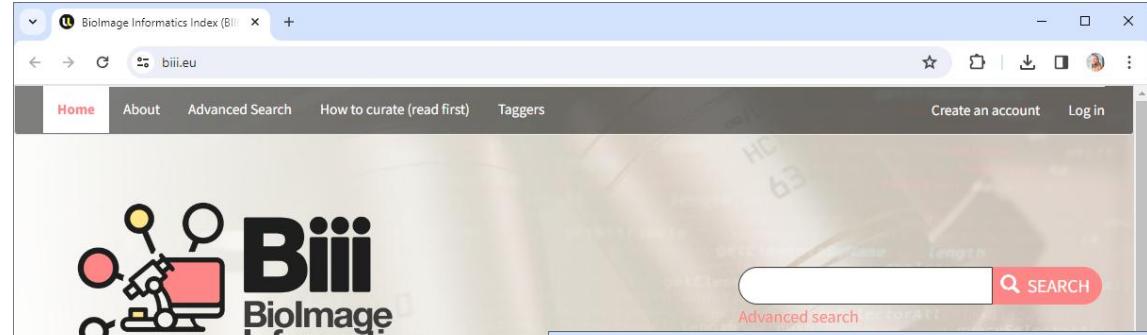
- Make sure your materials are listed in public search indices
- Do not trust google to make your stuff findable



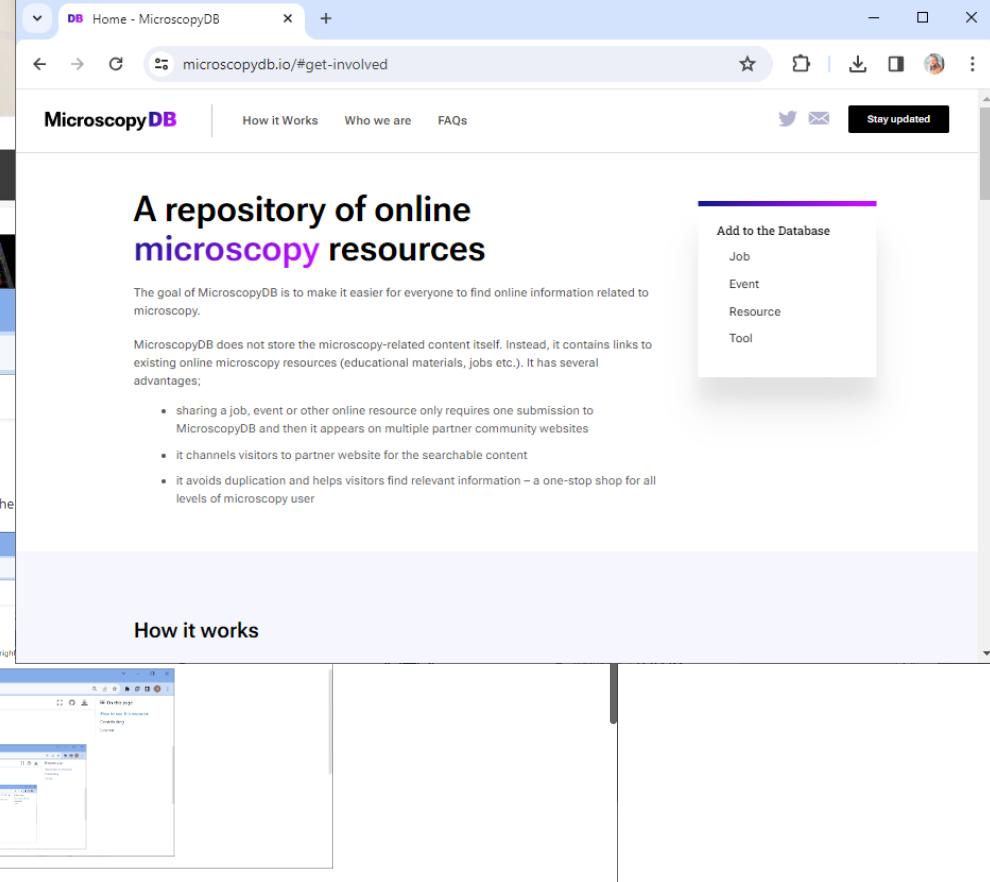
The bio.tools homepage features the Elixir bio.tools logo at the top. Below it is a search bar and a large "bio.tools" title. A sub-header states: "Essential scientific and technical information about software tools, databases and services for bioinformatics and the life sciences." A sidebar on the right contains a search bar and a "by content Type" section with options: blog, collection, event, and notebook.



A screenshot of a Jupyter Book titled "NFDI4BioImage Training Materials". It shows a thumbnail of a brain image, a search bar with the placeholder "Search this book [ctrl + K]", and a sidebar with a "How to use this resource" section and a "by content Type" dropdown menu.



The Biolimage Informatics Index (BiiI) homepage features a logo with a microscope and three spheres, followed by the text "BiiI Biolimage Informatics Index". It includes a search bar and navigation links for Home, About, Advanced Search, How to curate (read first), Taggers, Create an account, and Log in.



The MicroscopyDB homepage features a search bar and navigation links for DB Home, MicroscopyDB, How it Works, Who we are, and FAQs. It highlights "A repository of online microscopy resources" and "How it works". A sidebar on the right provides links for "Add to the Database" (Job, Event, Resource, Tool).

Findability

Domain-specific

- Search repository registries for your field!

Guidelines

- Publish where your community publishes
- Publish where everyone publishes (beyond your community)
- Publish in your local institute's infrastructure

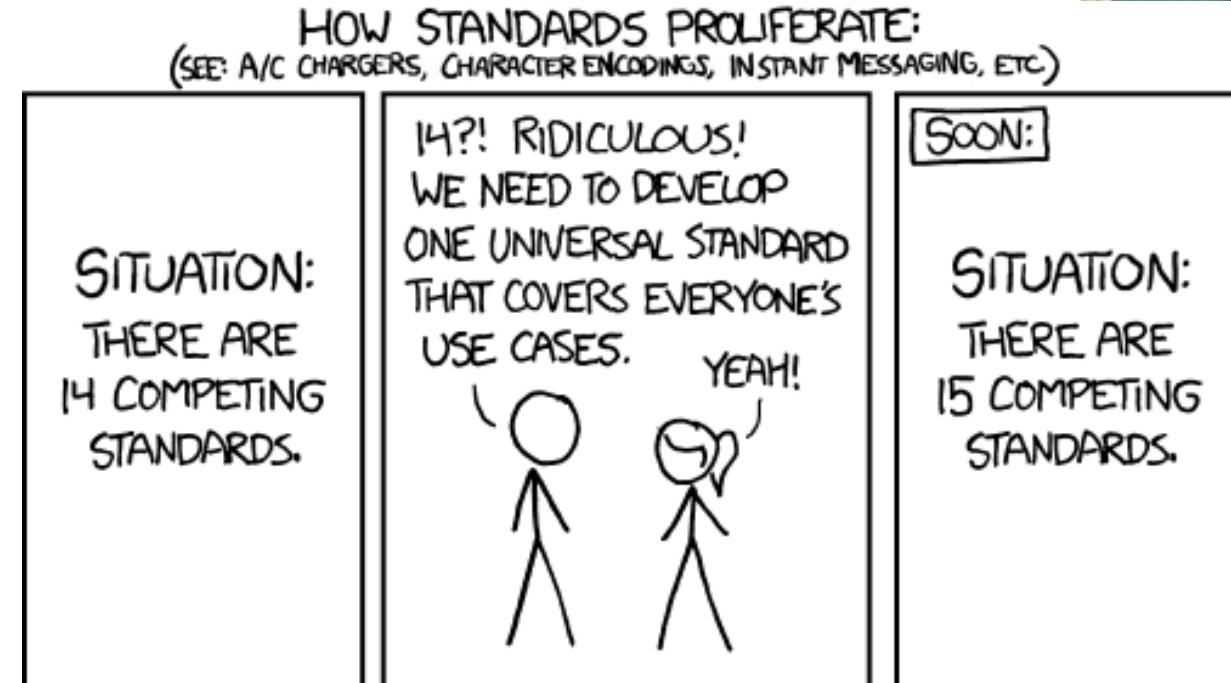


The top screenshot shows the re3data.org search results for 'seismology'. It includes fields for Subject(s) (Natural Sciences, Geosciences, Geophysics and Geodesy), Repository type(s) (disciplinary), and Provider type(s) (dataProvider). The bottom screenshot shows the FAIRsharing.org search results for 'seismology', which is described as a registry of knowledgebases and repositories of data and other digital assets. It displays a search interface with filters for terms like 'seismology', 'MAINTAINED', 'RECOMMENDED', etc., and a list of 14 results, with the first one being 'IRIS Data'.

The FAIR-principles

Accessible

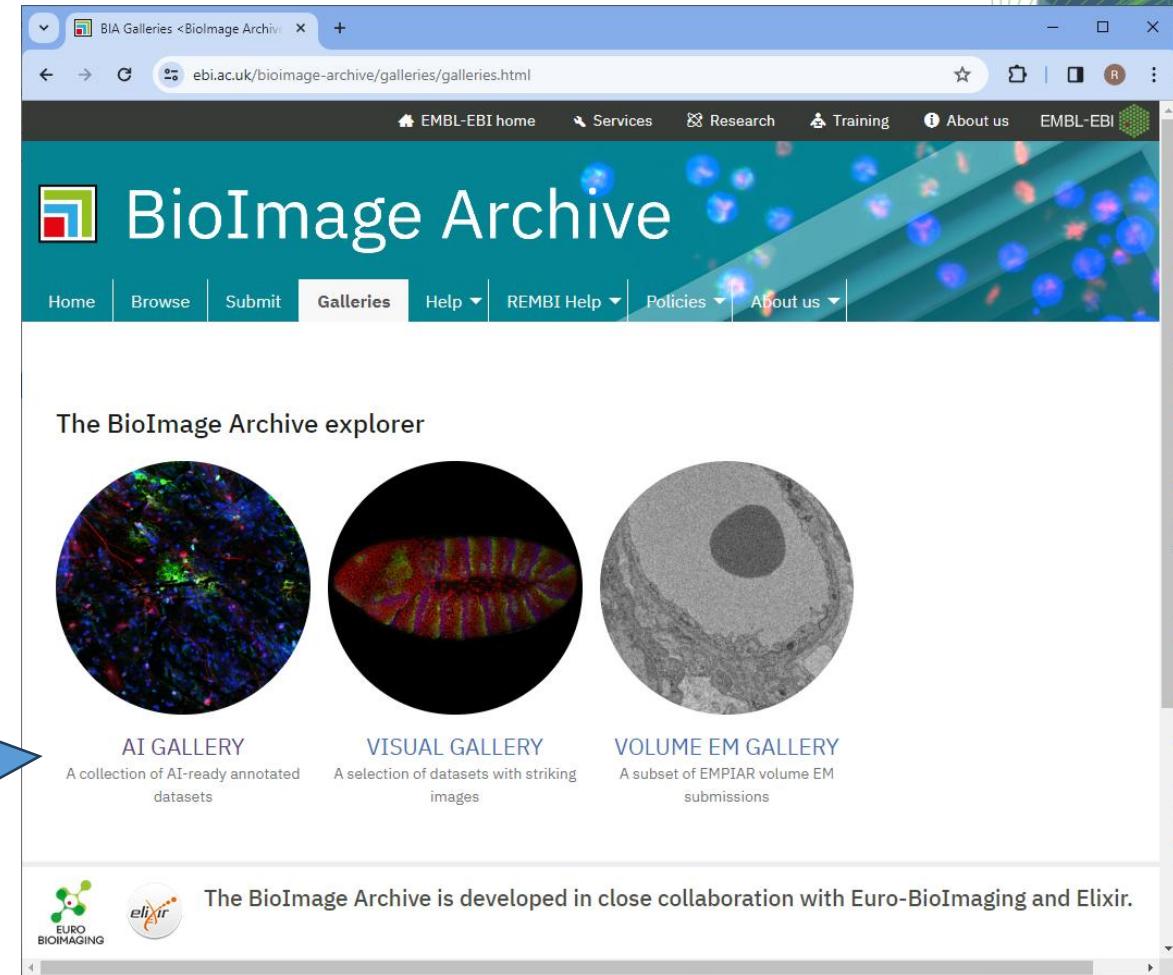
- A1. (Meta)data are retrievable by their identifier using a standardised communications protocol
 - A1.1 The protocol is open, free, and universally implementable
 - A1.2 The protocol allows for an authentication and authorisation procedure, where necessary
- A2. Metadata are accessible, even when the data are no longer available



Accessibility

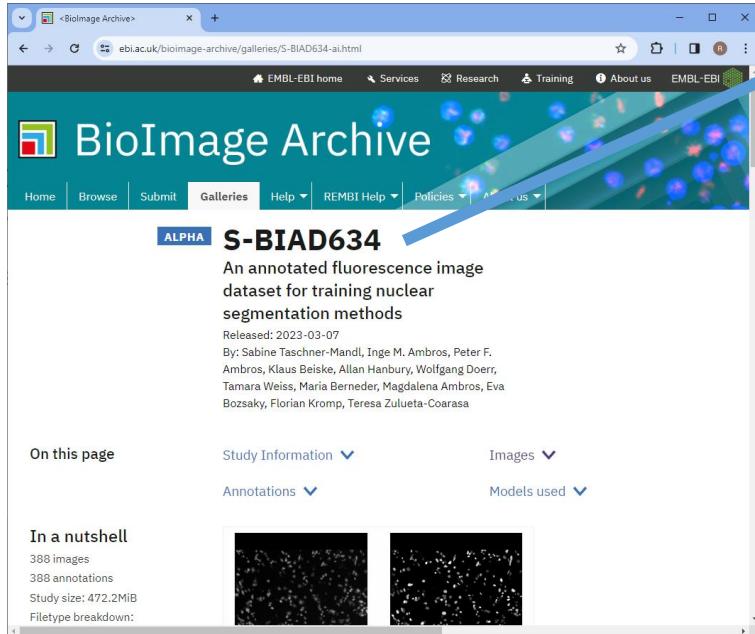
- The ability to download data, for humans and computers

Essential for AI
developers =-)



Accessibility

- The ability to download data, for humans and computers



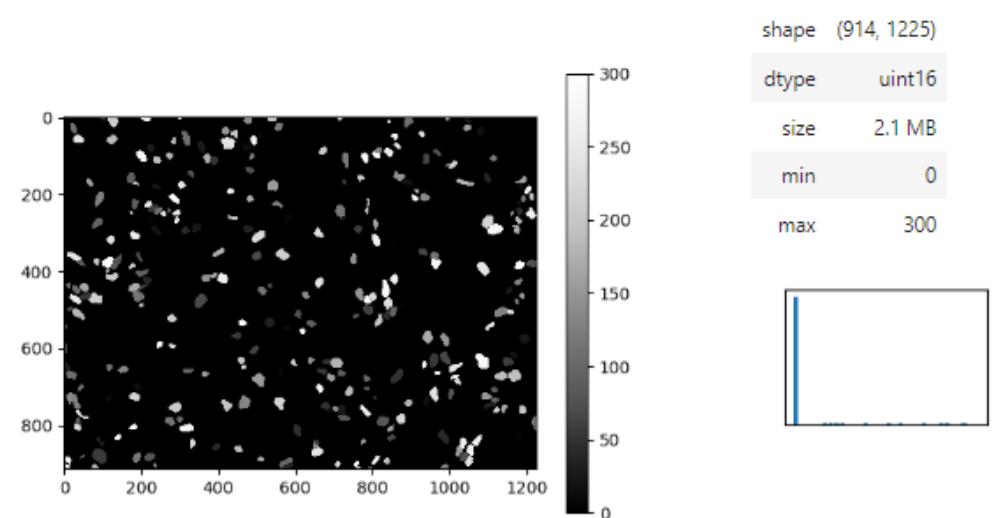
```
[1]: from bia_explorer import io, biostudies
from skimage.io import imread
import stackview

accession = 'S-BIAD634'
study = io.download_bia_study(accession)
image = study.images[0]
```

Displaying images using stackview

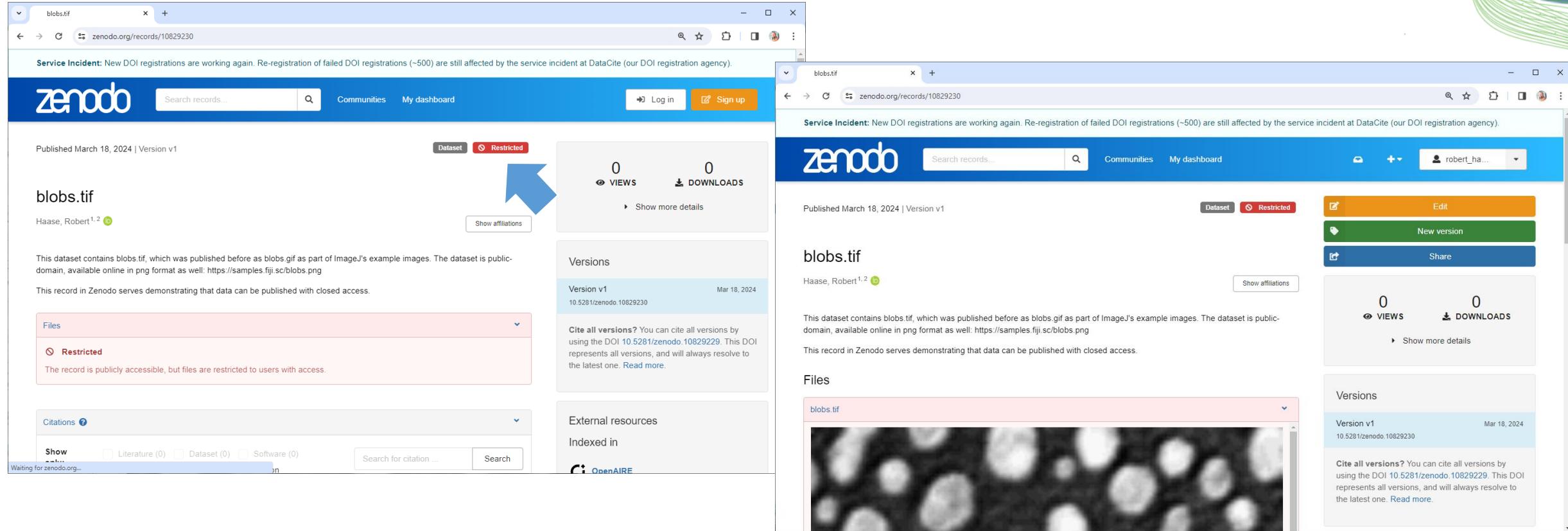
```
[2]: uri = image.uri.replace("\\\\", "/")
image_data = imread(uri)
stackview.insight(image_data)
```

```
[2]:
```



Restricted Access

- The A in FAIR does not necessarily stand for Open Access



The FAIR-principles

- Interoperable
 - I1. (Meta)data use a formal, accessible, shared, and broadly applicable language for knowledge representation.
 - I2. (Meta)data use vocabularies that follow FAIR principles
 - I3. (Meta)data include qualified references to other (meta)data



Where to share?

- Open science related content
 - bioRxiv (manuscripts, no reviews)
 - Figshare
 - F1000
 - Bioimage Archive (data)
 - Github (code)
 - Zenodo
 - Focalplane
 - Institutional servers
(if there is no alternative)



Incentives: Citability

The screenshot shows a Zenodo dataset page for a dataset associated with an article. The page includes sections for dataset statistics, versions, and citation/export options.

Dataset associated with article: Self-sufficient seismic boxes for monitoring glacier seismology in Greenland

Published: September 22, 2022 | **Version Uploaded at:** 2023-01-09

Dataset **Open**

240 VIEWS **131** DOWNLOADS

Versions

Version	Uploaded at	Size	Actions
Version Uploaded at 2023-01-09	Sep 22, 2022	9.9 kB	Preview Download
Version v1	Sep 22, 2022	3 kB	Preview Download
		0.0 GB	Preview Download
		7 kB	Preview Download
		7 kB	Preview Download

Cite all versions? You can cite all versions by using the DOI 10.5281/zenodo.7105051. This DOI represents all versions, and will always resolve to the latest one. [Read more](#).

Weather_station_data_Greenland_2021.zip
md5:90d1bae30bde05352d97e09ee6897af1

Rights: Creative Commons Attribution 4.0 International

Citation: Ana Nap, Fabian Walter, & Martin P. Lüthi. (2022). Dataset associated with article: Self-sufficient seismic boxes for monitoring glacier seismology in Greenland (Uploaded at 2023-01-09) [Data set]. Zenodo. <https://doi.org/10.5281/zenodo.7516192>

Style: APA **Export:** JSON **Export**

Technical metadata:
Created January 9, 2023
Modified April 3, 2023

Zenodo

- Publicly funded infrastructure @ CERN / Switzerland

The image displays two side-by-side screenshots of the Zenodo website. The left screenshot shows the homepage with a blue header and a 'Featured communities' section. It highlights the European Climate and Modelling Forum, which is associated with the European Climate and Modelling Forum logo (a stylized green and yellow circle). Below this, there is a 'Browse' button and a note about ECEMF being a Horizon 2020-funded project. The right screenshot shows the main navigation menu with links for About, Blog, Help, Developers, Contribute, and various documentation and support links. It also features a 'Funded by' section with logos for CERN, OpenAIRE, and the European Union.

Sharing files on Zenodo

- ... is easier than you think

The image shows three screenshots of the FocalPlane website, which serves as a guide for sharing research data with Zenodo.

- Screenshot 1:** The homepage of FocalPlane (focalplane.biologists.com) with a banner for "Sharing research data with Zenodo". It includes a "How to" section for Zenodo sharing.
- Screenshot 2:** A "How to" page titled "Sharing research data with Zenodo". It provides a TL;DR summary and a scenario about sharing datasets. It also features a screenshot of a Zenodo dataset page.
- Screenshot 3:** A "Zenodo" page on FocalPlane. It describes Zenodo as a platform for sharing data openly and provides a link to its own Zenodo dataset page.
- Screenshot 4:** The Zenodo "Upload form" page (<https://zenodo.org/deposit?&page=1&size=20&status=published&sort=-version>). It shows a list of uploaded files and a green arrow pointing to the "Upload" button.

Quiz

- Where might open source code be most *visible*?

Git server of the
university



Zenodo.org



Github.com



Group / institute /
personal website



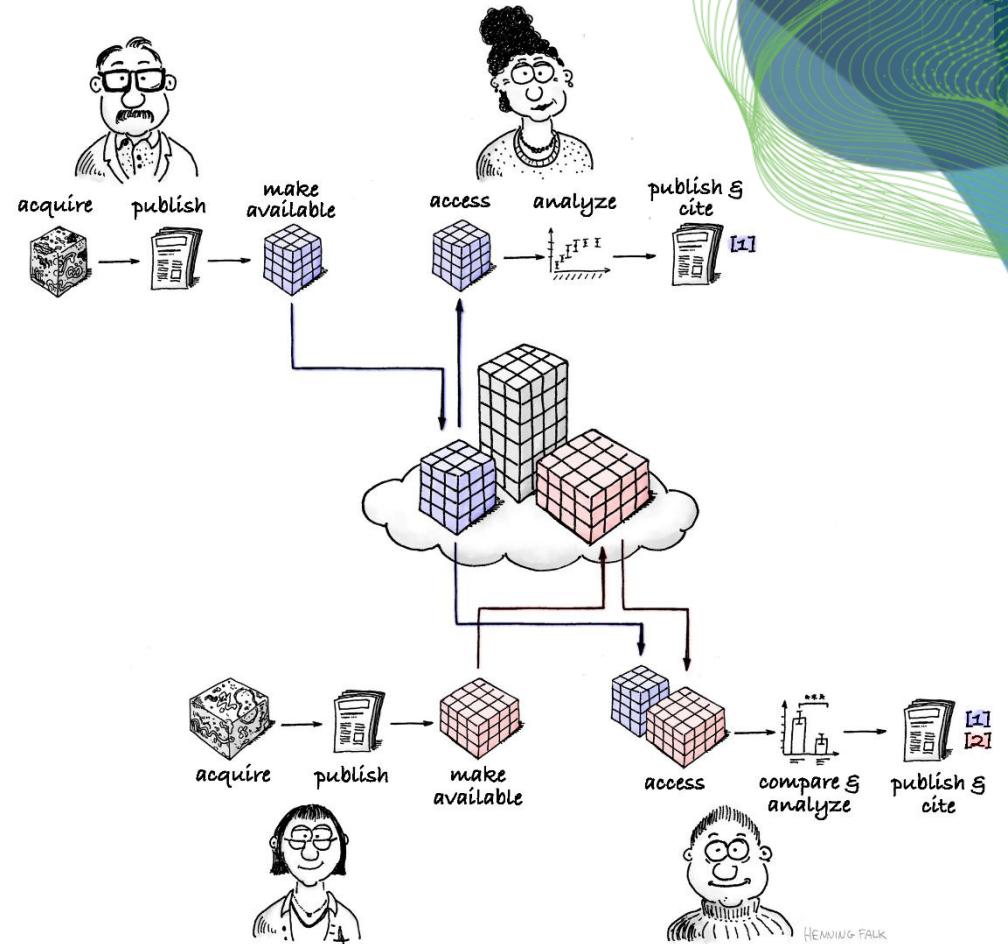
Licensing
Robert Haase



What are the
consequences of
this sentence?

The FAIR-principles

- Reusable
 - R1. (Meta)data are richly described with a plurality of accurate and relevant attributes
 - R1.1. (Meta)data are released with a clear and accessible data usage license
 - R1.2. (Meta)data are associated with detailed provenance
 - R1.3. (Meta)data meet domain-relevant community standards

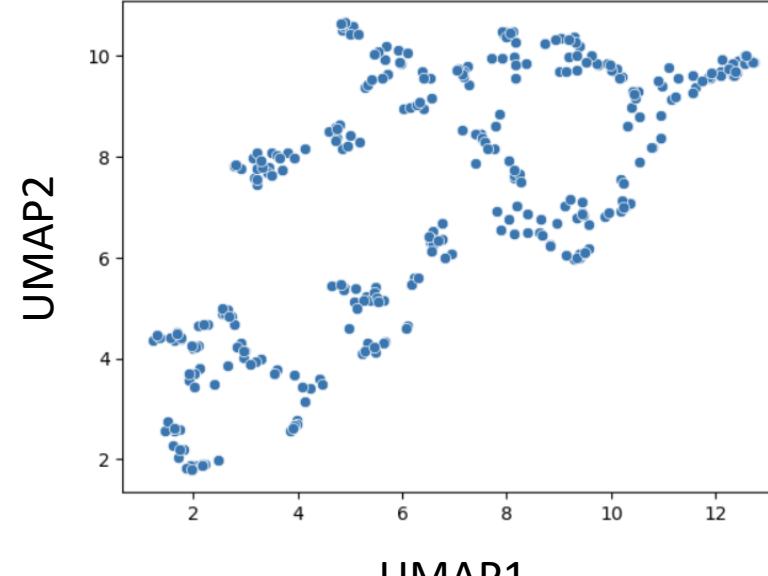


Quiz

How can you reuse
this plot?
What is allowed?

New Tab

Clustering objects can be challenging when working with many parameters, in particular when interacting with data manually. To reduce the number of parameters, dimensionality reduction techniques such as the Uniform Manifold Approximation Projection (UMAP) have been developed. In this notebook we use the technique to differentiate nuclei in an image which are mitotic from those which are not mitotic.



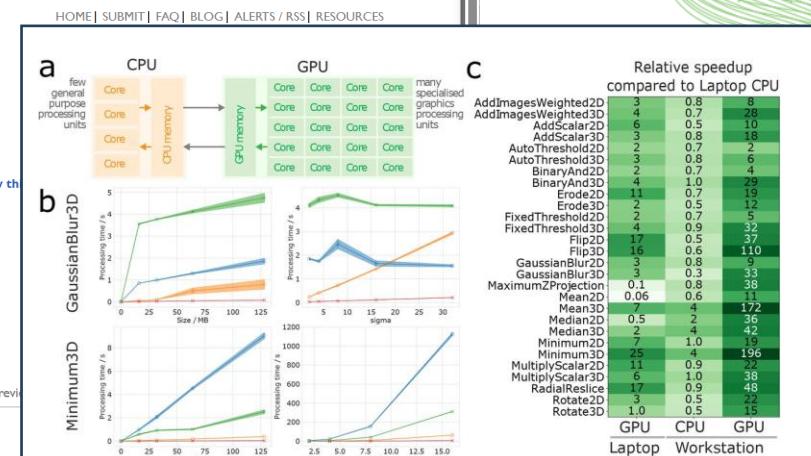
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Hint: Search for pre-prints

In case a journal doesn't allow reusing figures from a paper, search for the corresponding preprint!

The screenshot shows the Nature Methods website. The URL is nature.com/articles/s41592-019-0650-1. The page title is 'CLIJ: GPU-accelerated image processing for everyone'. It features a diagram comparing CPU and GPU architectures. The CPU has few general-purpose processing units, while the GPU has many specialized graphics processing units. Below the diagram, there are two graphs: 'GaussianBlur3D' and 'Minimum3D', showing processing time vs. size and radius. The 'Abstract' section includes a detailed description of the GPU plugin's performance and benefits. The 'Access options' section indicates that access via Universitätsbibliothek Leipzig AG eMedien is not available. The footer offers a 30-day trial of Nature+ for 24,99 €.

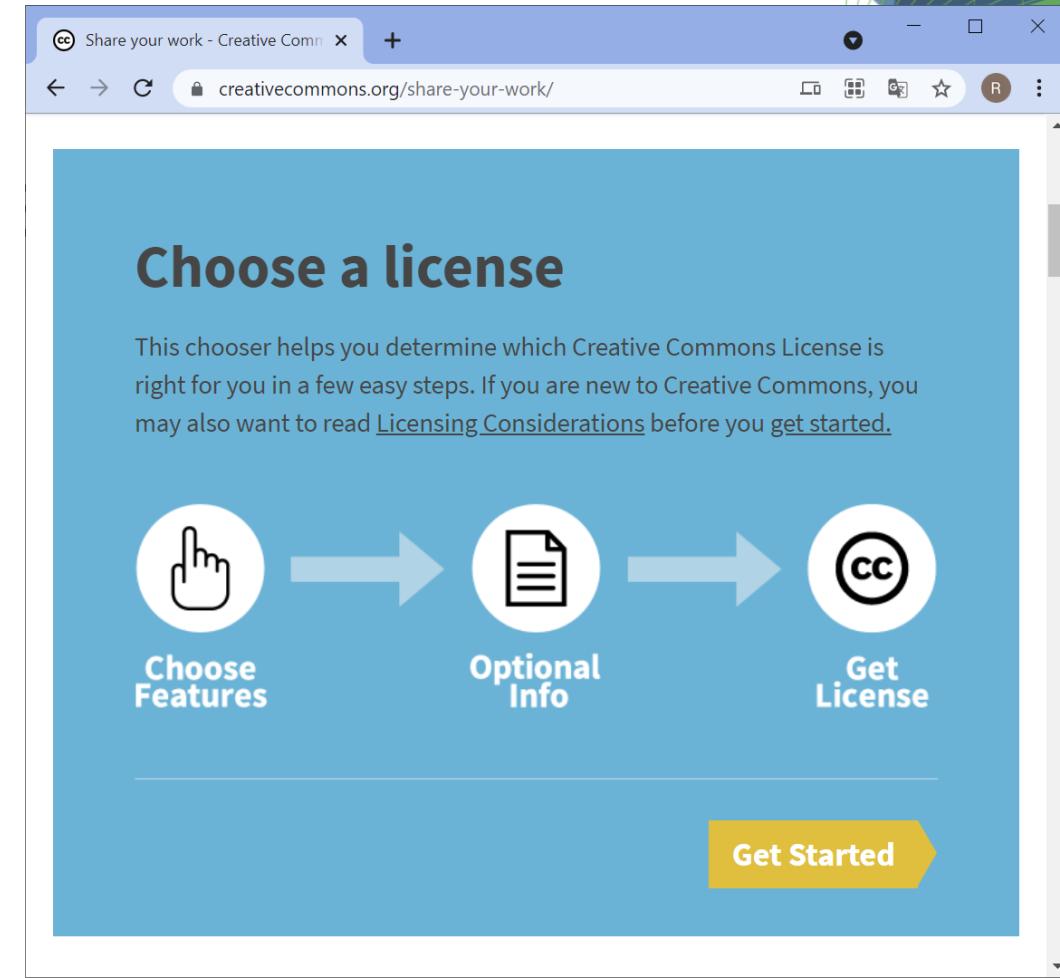
The screenshot shows the bioRxiv preprint server. The URL is biorxiv.org/content/10.1101/660704v2. The page title is 'CLIJ: GPU-accelerated image processing for everyone'. It includes the same CPU/GPU architecture diagram and processing time graphs. The 'Abstract' section is identical to the one on the Nature Methods site. The footer includes a copyright notice and a list of social media and service icons.



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Employers don't like this one because you give away the rights to *exploit* your work.

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Example



You must put such a sentence and keep the link to CC-BY

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I hope nobody feels hurt
by the following slides.

I just would like to
make a point.

Licensing: Permissive versus restrictive

Example

The screenshot shows a bioRxiv preprint page for the article "Bridging the Gap: Integrating Cutting-edge Techniques into Biological Imaging with deepImageJ". The page includes the CSHL logo, search and advanced search fields, and links to HOME, SUBMIT, FAQ, BLOG, ALERTS / RSS, and ABOUT. The article was posted on January 15, 2024. It has a DOI of <https://doi.org/10.1101/2024.01.12.575015>. The copyright notice states: "The copyright holder for this preprint is the author/funder, who has granted bioRxiv a license to display the preprint in perpetuity. It is made available under a CC-BY-ND 4.0 International license." A red box highlights the "CC-BY-ND 4.0 International license" text.

I would love to
show you a Figure
from this paper!

But I'm not
allowed!

Licensing: Permissive versus restrictive

Example

The screenshot shows a bioRxiv preprint page. The title is "Omnipose: a high-precision morphology-independent solution for bacterial cell segmentation". The authors are Kevin J. Cutler, Carsen Stringer, Paul A. Wiggins, Joseph D. Mougous. The DOI is <https://doi.org/10.1101/2021.11.03.467199>. The preprint was posted on July 27, 2022. The copyright notice at the bottom states: "The copyright holder for this preprint is the author/funder, who has granted bioRxiv a license to display the preprint in perpetuity. It is made available under a CC-BY-NC-ND International license."

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from this paper!

But I'm not
allowed!

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Example

The screenshot shows a bioRxiv preprint page for "ModularImageAnalysis (MIA): Assembly of modularised image and object analysis workflows in ImageJ". The page includes author information (Stephen J. Cross, Jordan D. J. R. Fisher, Mark A. Jepson), a DOI, and a note about publication in the Journal of Microscopy. It features social sharing icons and navigation links for abstract, full text, and metrics. A red box highlights the copyright notice: "The copyright holder for this preprint is the author/funder, who has granted bioRxiv a license to display the preprint in perpetuity. All rights reserved. No reuse allowed without permission." Below the main content is a sidebar with links for COVID-19 SARS-CoV-2 preprints, subject areas (Bioinformatics), and all articles.

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show you a Figure
from this paper!

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allowed!

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Example

SPRINGER LINK

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Swarm Intelligence for Medical Volume Segmentation: The Contribution of Self-reproduction

Robert Haase, Hans-Joachim Böhme, Daniel Zips & Nasreddin Abolmaali

Conference paper

1628 Accesses | 2 Citations | 3 Altmetric

Part of the [Lecture Notes in Computer Science](#) book series (LNCS, volume 7006)

Abstract

For special applications in diagnostics for oncology the analysis of imaging data from Positron Emission Tomography (PET) is obfuscated by low contrast and high noise. To deal with this issue we propose a segmentation algorithm based on Ant Colony Optimization (ACO) and evolutionary selection of ants for self reproduction. The self reproduction approach is no standard for ACO, but appears to be crucial for volume segmentation. This investigation was focused on two different ways for reproduction control and their contribution to quantity and

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My format is... electronic	My currency is... EUR - €
I would like to use... figures/tables/illustrations	Quick Price 100.91 EUR
Number of figures/tables 1	QUICK PRICE CONTINUE

The issue is not so
much paying 100 Eur,
but the related
administrative effort.

Licensing: Permissive versus restrictive

Restrictive licensing is
a community-wide issue.

*I presume due to lack of
awareness & training*

Licensing: Permissive versus restrictive

	Download and share for free	Reuse parts, e.g. Figures	Reuse parts, e.g. in paid training
CC-BY	✓	✓	✓
CC-BY-SA	✓ Only under CC-BY-SA	✓ Only under CC-BY-SA	✓ Only under CC-BY-SA
CC-BY-NC	✓	✗ (if free of charge)	✗
CC-BY-ND	✓	✗	✗
CC-BY-NC-ND	✓	✗	✗

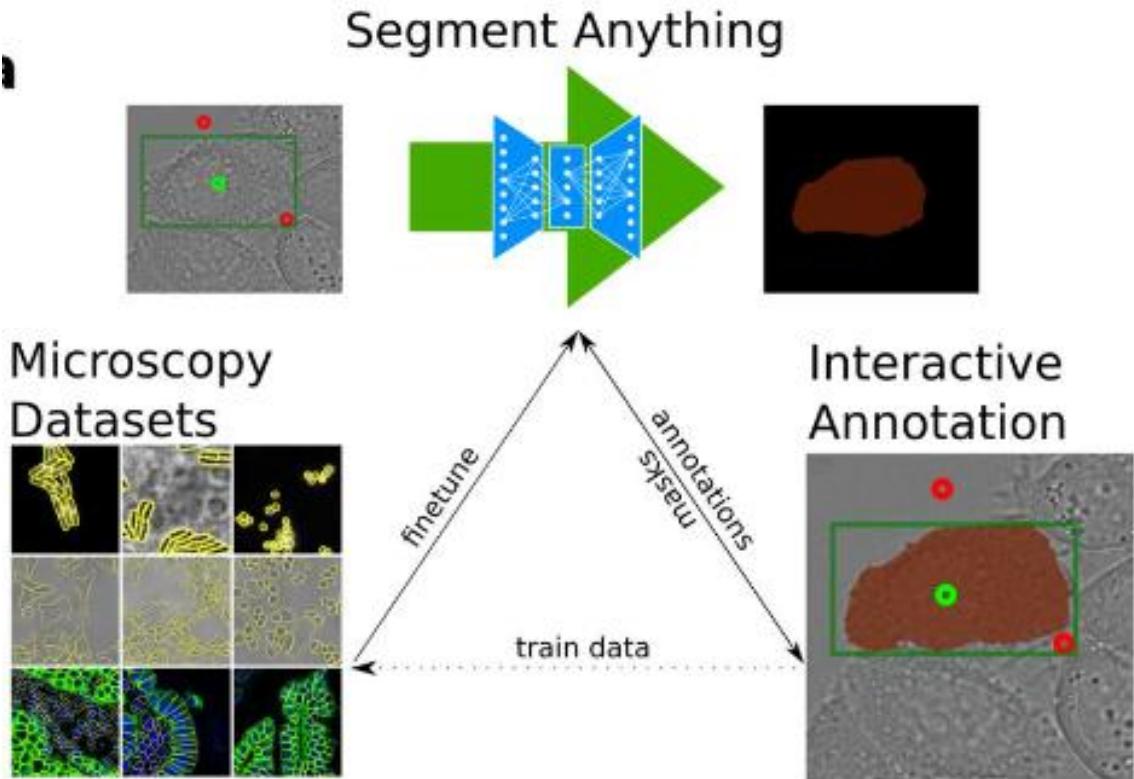
A dashed orange circle highlights the 'Bad for the progress of science' status of CC-BY-NC and CC-BY-ND when reuse is restricted.

Bad for the progress of science

Licensing: Permissive versus restrictive

Example

Look at this great figure! It's cropped from / licensed [CC-BY 4.0](#) by A. Archit et al.



A screenshot of a web browser displaying the bioRxiv preprint server. The URL in the address bar is [biorxiv.org/content/10.1101/2023.08.21.554208v1.article-info](https://www.biorxiv.org/content/10.1101/2023.08.21.554208v1.article-info). The page header includes the bioRxiv logo and navigation links for HOME, SUBMIT, FAQ, BLOG, ALERTS / RSS, ABOUT, and CHANNELS. A search bar is also present. The main content area displays the preprint titled "Segment Anything for Microscopy" by Anwai Archit et al., posted on August 22, 2023. The article summary, authors, DOI, and metrics (0 comments, 0 likes, 3 reads, 0 downloads, 0 preview PDFs, 85 tweets) are shown. The "Info/History" tab is selected. The copyright notice at the bottom states: "The copyright holder for this preprint is the author/funder, who has granted bioRxiv a license to display the preprint in perpetuity. It is made available under a CC-BY 4.0 International license."

Licensing: Permissive versus restrictive

Example

Look at this great figure! It's taken from M. Hartley et al.

The glucosylceramide synthase inhibitor PDMP causes lyso-somal lipid accumulation and mTOR inactivation

Name	Size	Section	staining	cells	labeling	treatment	Channel 1	Channel 2	timepoint
experimentA_11_WT_Miglustat.cz	1.6 MB	Study Component	click chemistry and IF	WT	pacSph	50 µM NB-DNJ (Miglustat)	pacSph	Lamp1	continuous labeling
experimentA_12_SGPL1_PDMP.cz	1.6 MB	Study Component	click chemistry and IF	SGPL1-/-	pacSph	20 µM PDMP	pacSph	Lamp1	continuous labeling
experimentA_13_SGPL1_PDMP.cz	1.6 MB	Study Component	click chemistry and IF	SGPL1-/-	pacSph	20 µM PDMP	pacSph	Lamp1	continuous labeling

The BiоМage Archive - building a home for life-sciences microscopy data

Matthew Hartley, Gerard J. Kleywegt, Ardan Patwardhan, Ugis Sarkans, Jason R. Swedlow, Alvis Brazma

doi: <https://doi.org/10.1101/2021.12.17.473169>

Now published in *Journal of Molecular Biology* doi: 10.1016/j.jmb.2022.167505

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Quiz

- May I use one of the Figures from this preprint?
- May I download and redistribute this preprint to students of a course for free?

The image shows a screenshot of a bioRxiv preprint page. At the top left is the CSHL logo and the bioRxiv logo with the tagline "THE PREPRINT SERVER FOR BIOLOGY". A yellow banner at the top states: "bioRxiv posts many COVID19-related papers. A reminder: they have not been formally peer-reviewed and should not guide health-related behavior or be reported in the press as conclusive." Below this, the title "Content-Aware Image Restoration: Pushing the Limits of Fluorescence Microscopy" is displayed, along with the names of the authors and their ORCID IDs. The DOI is listed as <https://doi.org/10.1101/236463>. It also mentions that it was published in *Nature Methods* with DOI [10.1038/s41592-018-0216-7](https://doi.org/10.1038/s41592-018-0216-7). Below the title are social media sharing icons (1 comment, 0 tweets, 2 likes, 0 shares, 2 saves, 0 reads, 618 views) and navigation links for Abstract, Full Text, Info/History (which is selected), and Metrics. A "Preview PDF" link is also present. The "ARTICLE INFORMATION" section includes the DOI and a "History" entry for July 3, 2018. The "ARTICLE VERSIONS" section lists five versions, with Version 5 being the most recent. The footer contains a "Copyright" notice about the license.

Yes



No



Yes

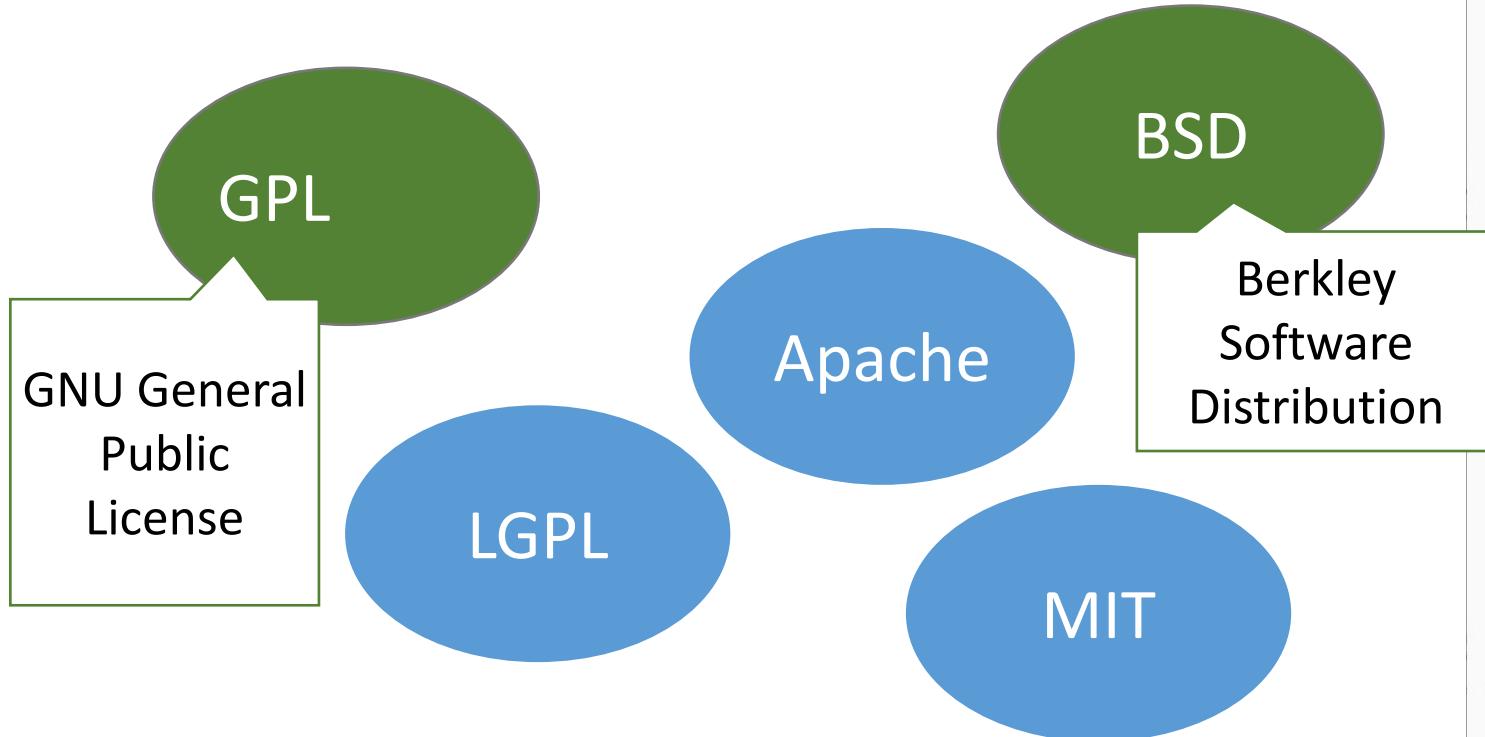


No



Licensing Software

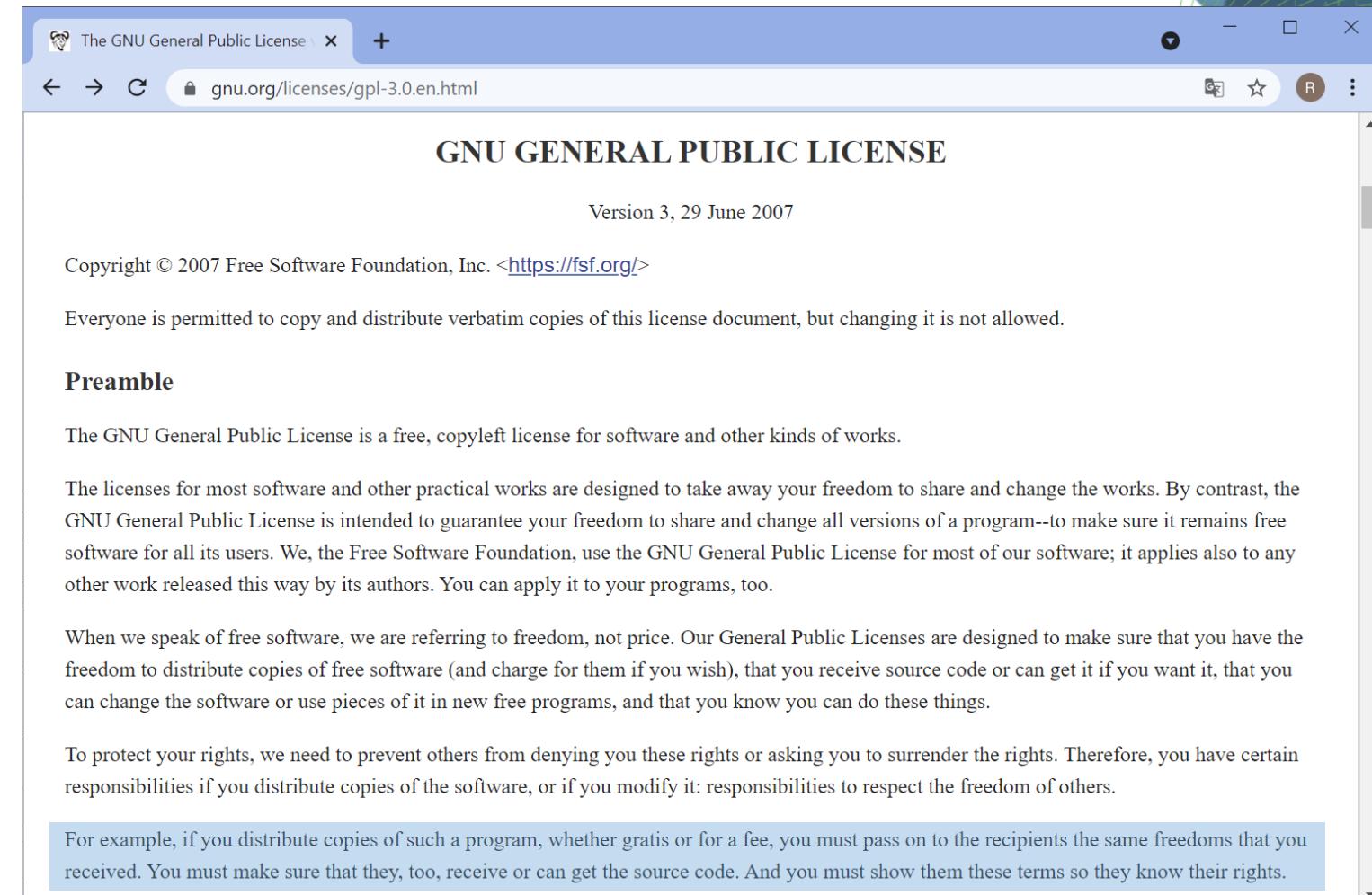
In the software world, other licenses are more popular, historically grown.



Licensing Software: GPL

GPL-derivatives must also
be GPL-licensed

“Restrictive”
licensing



The screenshot shows a web browser window with the title "The GNU General Public License" and the URL "gnu.org/licenses/gpl-3.0.en.html". The page content is the GNU GENERAL PUBLIC LICENSE, Version 3, dated 29 June 2007. It includes the FSF logo, copyright information, a statement about copying and distributing verbatim copies, the Preamble, and sections about free software rights and responsibilities. A callout box highlights the requirement for derivative works to be licensed under the GPL.

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Quiz

Can I build a commercial product on the basis of GPL-licensed code?

Yes



No



Do I have to release the code openly for this commercial product?

Yes



No



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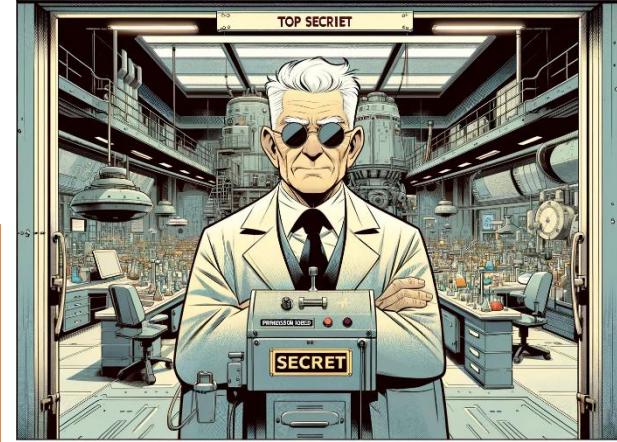
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I conclude,
these are
less open in
a sense



Quiz

It's ok to reuse this code if ...

haesleinhuepf / **imagej-run-async** Public

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haesleinhuepf initial version 2f8c334 on 23 Jun 2019 1 commit

src/main/java/net/haeslein... initial version 3 years ago

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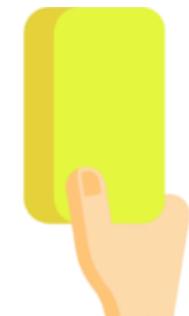
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Exercises

Robert Haase

GEFÖRDERT VOM



Bundesministerium
für Bildung
und Forschung



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Exercise (nextcloud)

- Register at Speicherwolke @ Uni Leipzig,
- Upload segmented images to a folder in the Speicherwolke.

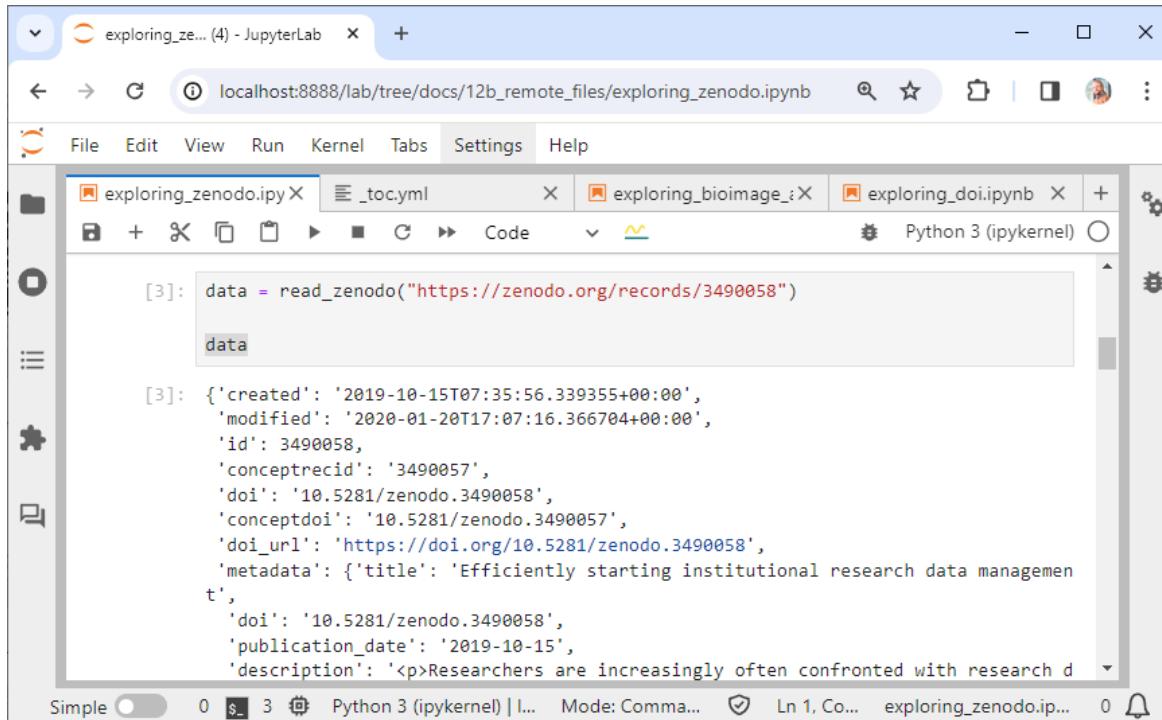
The screenshot shows a web browser window with the URL urz.uni-leipzig.de/unseren-services/servicedetail/service/eigener-cloud-speicher-speicherwolke. The page is titled "EIGENER CLOUD-SPEICHER (SPEICHERWOLKE)". It contains a brief description of the service, stating that users can store files and documents centrally and synchronize them with various devices. The page also includes links to "UNSERE SERVICES" and "ZU „SERVICEKATALOG“".

The screenshot shows a web browser window with the URL speicherwolke.uni-leipzig.de/index.php/apps/files/?dir=/data&fileid=103. The interface is a NextCloud file manager. The left sidebar shows navigation options like "Recent", "Favorites", "Shares", "Group folders", "Shared to Circles", "Deleted files", and "Files settings". The main area displays a list of files and folders in the "data" folder. The files listed are "groundtruth", "images", "blobs.tif", and "blobs_labels.tif". The "images" folder was uploaded a minute ago, while the other files were uploaded a year ago. The total usage is 277 KB out of 5 GB.

Name	Size	Modified
groundtruth	0 KB	a minute ago
images	0 KB	a minute ago
blobs.tif	23 KB	a year ago
blobs_labels.tif	254 KB	22 minutes ago

Exercise (Zenodo and DOI)

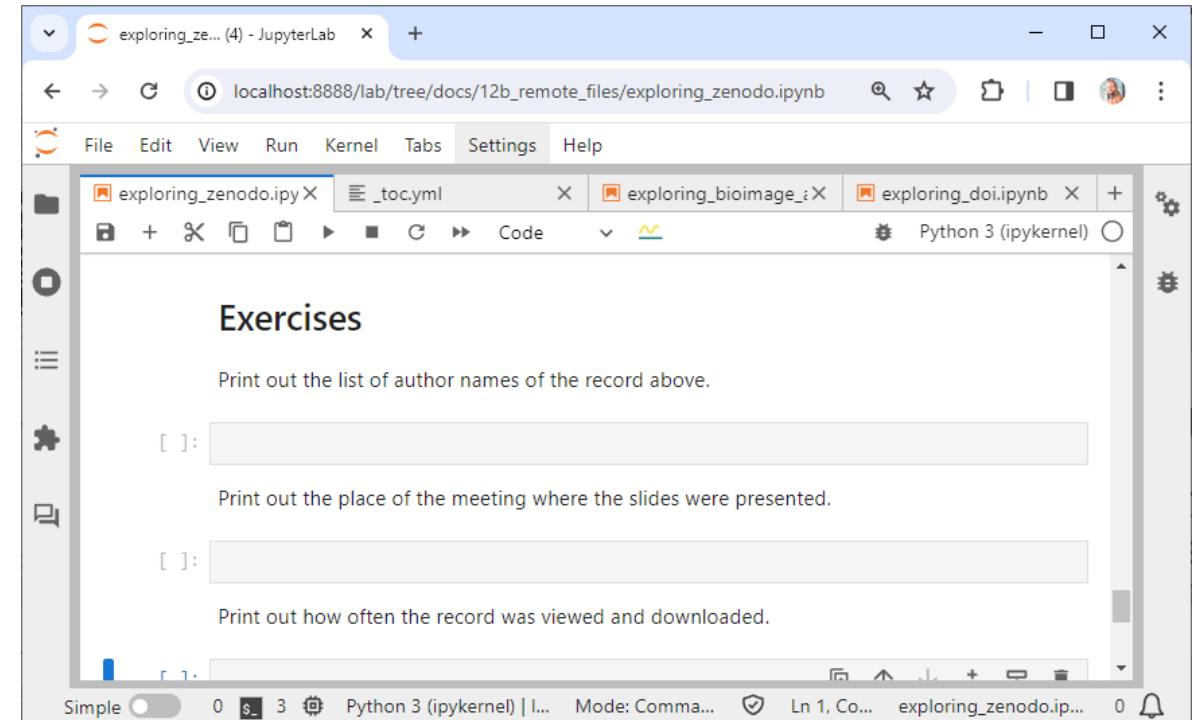
- Explore the DOI and Zenodo APIs to find out the author of online records



The screenshot shows a JupyterLab interface with two tabs open: "exploring_zenodo.ipynb" and "exploring_doi.ipynb". The code cell contains the following Python code:

```
[3]: data = read_zendoo("https://zenodo.org/records/3490058")
data
```

The output cell displays the JSON data of the Zenodo record, which includes fields like 'created', 'modified', 'id', 'doi', and 'description'.



The screenshot shows a JupyterLab interface with two tabs open: "exploring_zenodo.ipynb" and "exploring_doi.ipynb". The main area contains the following text:

Exercises

Print out the list of author names of the record above.

```
[ ]:
```

Print out the place of the meeting where the slides were presented.

```
[ ]:
```

Print out how often the record was viewed and downloaded.

```
[ ]:
```