An Overview of Platforms for Reproducible Research and New Ways of Publications

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Plan

1. Introduction

1.1 Quick overview of RR

- RR redefines the result of the research. Not just a paper, but also all the procedures needed to obtain the same published results.
- Which items? The article itself, the source code, and the data.
- Definition of a "reproducible scientific publication" given by Claerbout and followed also by Buckheit and Donoho [Buckheit & Donoho 95]: *"An article about computational science in a scientific publication is not the scholarship itself, it is merely advertising of the scholarship. The actual scholarship is the complete software development environment and the complete set of instructions which generated the figures."*

1.2 Benefits of RR

- Less prone to errors, since all the methods are clear, public, and therefore auditable.
- Good practices. Reliable science. The descriptions match what the published descriptions.
- The descriptions, methodology, source code, and data is available to the scientific community
- Comparison of methods easier (or even possible!).
- For authors, possibility of publishing research of high quality. Counterexample: the case of a copy-pasted image in a disputed biology article.
- Also for authors: increase of the visibility of the publications.

2. Main Platforms for Reproducible Research

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- **Galaxy** - https://galaxyproject.org
- **IPython** - https://ipython.org
- **Jupyter** - http://jupyter.org
- **Code Ocean** - https://codeocean.com
- **Research Compendia** - http://researchcompendia.science
- **RunMyCode** - http://www.runmycode.org
- **DAE** - http://dae.cse.lehigh.edu/DAE
- **IPOL** - https://www.ipol.im

2. Main Platforms for Reproducible Research: Galaxy

Description:

- Platform for genomic research.
- It makes available tools which can be used by non-expert users too.
- Galaxy defines a workflow as a reusable templates which contains different algorithms applied to the input data.
- In order to achieve reproducibility the system stores:
  - the input dataset,
  - the tools and algorithms which were applied to the data along the chain,
  - the parameters,
  - the output result.

https://galaxyproject.org

2. Main Platforms for Reproducible Research: IPython

Description:

- Generic tool that can be used for Reproducible Research.
- Mature tool: created in 2001.
- Allows creating reproducible articles by not only editing text in the notebook, but allowing code execution and creating figures *in situ*.
- Follows closely the definition of a "reproducible scientific publication" of Claerbout, Buckheit, and Donoho [Buckheit & Donoho 95].

`https://ipython.org`

2. Main Platforms for Reproducible Research: Jupyter

Description:

- Spin-off of IPython in 2014.
- Main goal: separate the Python language used in IPython from all the other functionalities needed to run the notebooks (for example, the notebook format, the web framework, or the message protocols).
- Languages: execution kernels in Jupyter.
- Nowadays it supports more than 40 languages that can be used as kernels.

http://jupyter.org

2. Main Platforms for Reproducible Research: Code Ocean

Description:

- Stated in 2014 as part *Runway Startup Postdoc Program* at the Jacobs Technion Cornell Institute.
- Sponsored by IEEE.
- Defined by themselves as a *computational reproducibility platform*.
- Not a journal itself. It only runs code, but not publishes articles.
- Assigns a DOI to each source code.
- Several languages accepted: Python, R, Julia, Matlab, Octave, C++, Fortran, Perl, Java
- They claim *to view and download for everyone for free*. The free plan is limited and the other are paid.
- Plans based on CPU time and storage usage. For example, the *researcher* plan allows 1h CPU and 5GB of storage per month.
- No statistics on usage. Seems low by website inspection.

https://codeocean.com/

2. Main Platforms for Reproducible Research: Research Compendia

Description:

- A dissemination platform, not a journal.
- Reproducibility in computational research.
- Share and archive the data, codes, documentation, parameters, and environmental settings.
- Free. Non-profit organization.
- No DOI for the moment. Future plan.
- Supported languages: R, MatLab, Python, and Cactus.
- No online demos, just shared files.

http://researchcompendia.science

2. Main Platforms for Reproducible Research: RunMyCode

Description:

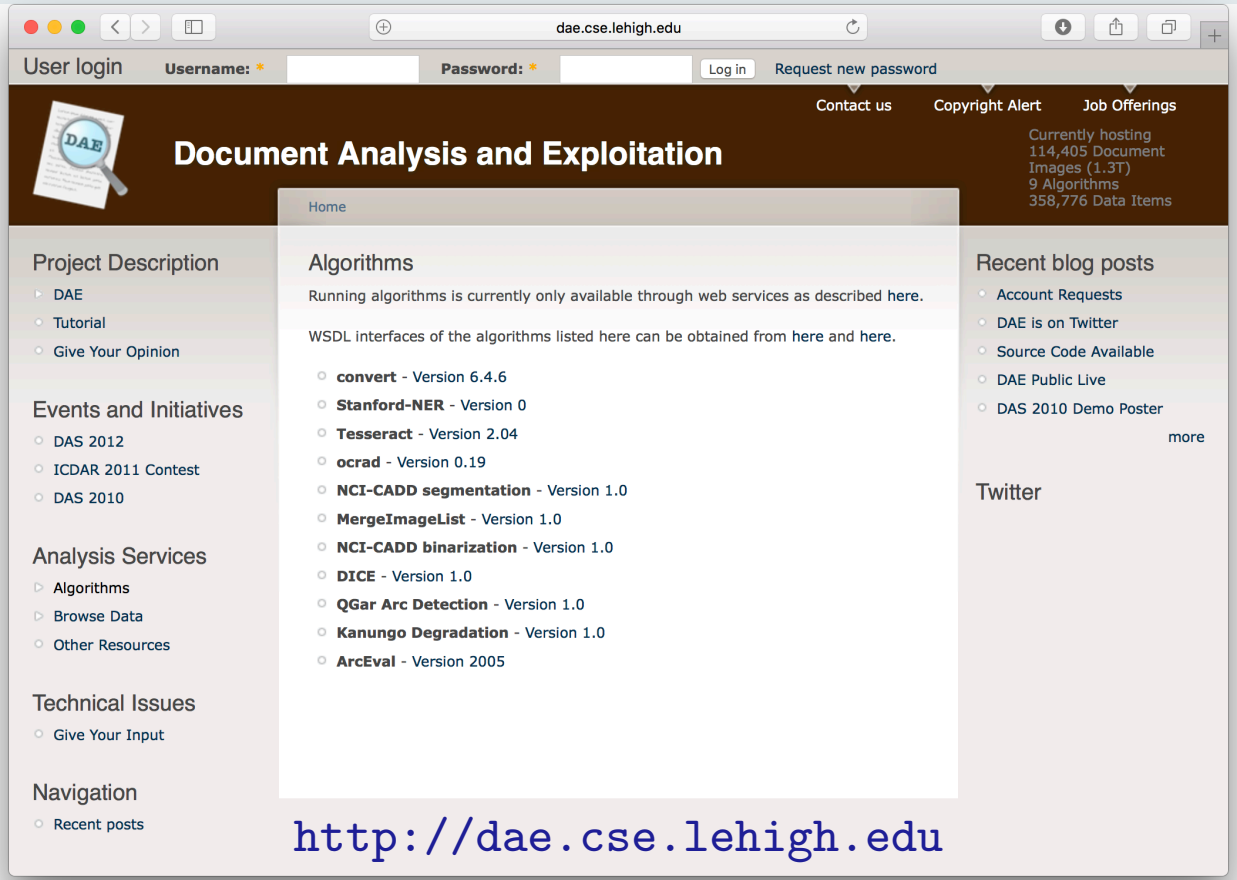
- Confusing: two different services with the same name! `runmycode.online`, `www.runmycode.org`.
- Both dissemination platforms, not a journals.
- runmycode.online: run online code from Githut, Gitlab, BitBucket, Go by Example, Github Gist, Gitlab Snippets, Bitbucket Snippets.
- runmycode.online languages: C/C++, Java, Nodejs, Python 2/3, Ruby, PHP, Go, Kotlin, Scala.
- runmycode.org: shares source code and data associated to a publication.
- runmycode.org: no code execution. All languages and data formats accepted.

`http://www.runmycode.org`

2. Main Platforms for Reproducible Research: DAE

Description: [Lamiroy & Lopresti 16]

- Platform for **D**ocument **A**nalysis and **E**xploitation.
- Allows to run document analysis algorithms and apply comparisons.



http://dae.cse.lehigh.edu

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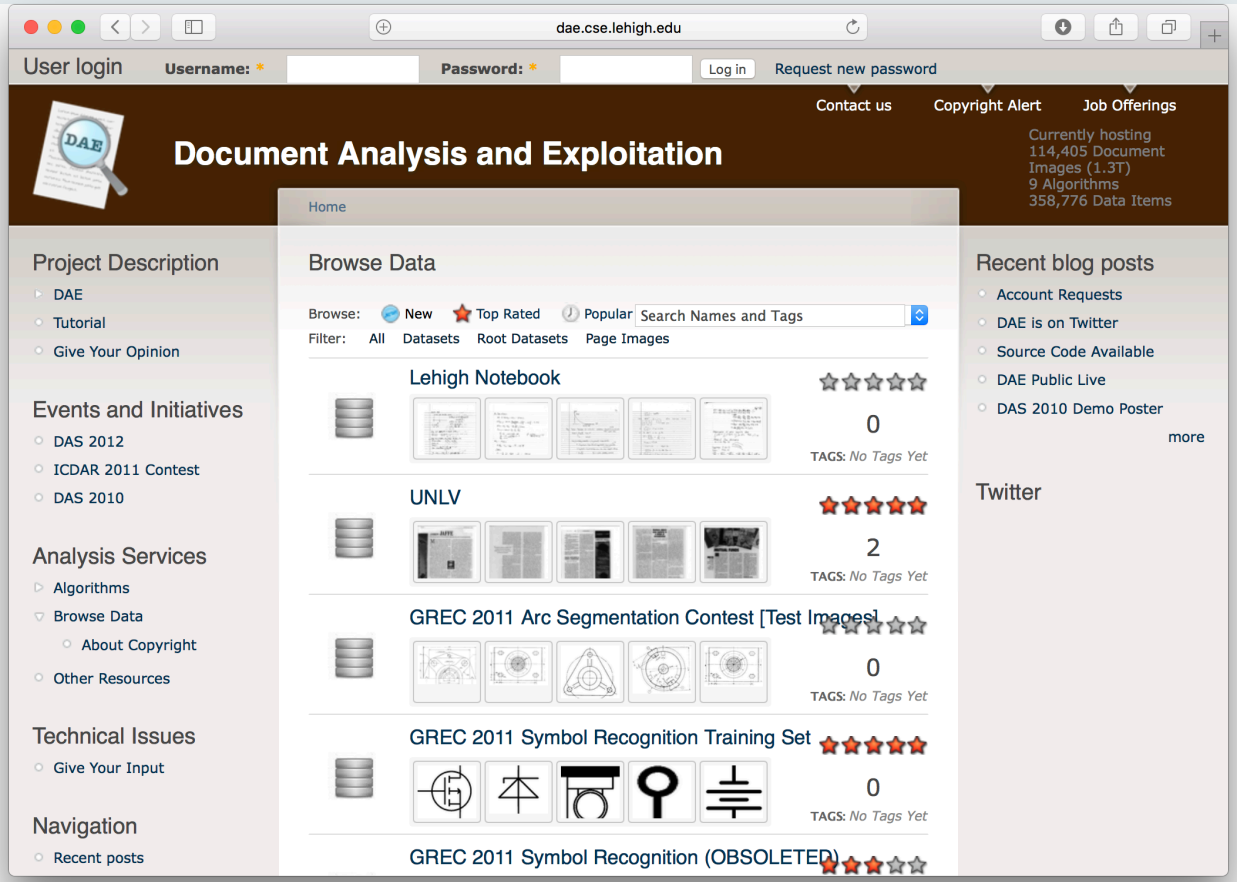

2. Main Platforms for Reproducible Research: IPOL Journal

Description: [Arevalo *et al.* 16]

- A complete peer-reviewed journal can be considered as a platforms.
- Image Processing domain.
- Focused on mathematical rigorness. Detailed descriptions.
- Fast to create new demos for editors: automatic system.
- Accepted languages: C/C++, Python, MATLAB, Octave.
- Free to use/submit.
- Next move: machine learning applications. Servers with GPU.

https://www.ipol.im

3. New Ways of Publications

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Recent original journals

- IPOL (as presented the morning)

  https://www.ipol.im

- ReScience

  http://rescience.github.io

- JOSS

  https://joss.theoj.org

3.1 IPOL Journal: Image Processing On Line

Origin: `http://www.ipol.im`

- Journal started in October 2009.
- Initiative of Nicolas Limare and Jean-Michel Morel (CMLA).
- First article published in 2010.
- Domain of Image Processing.

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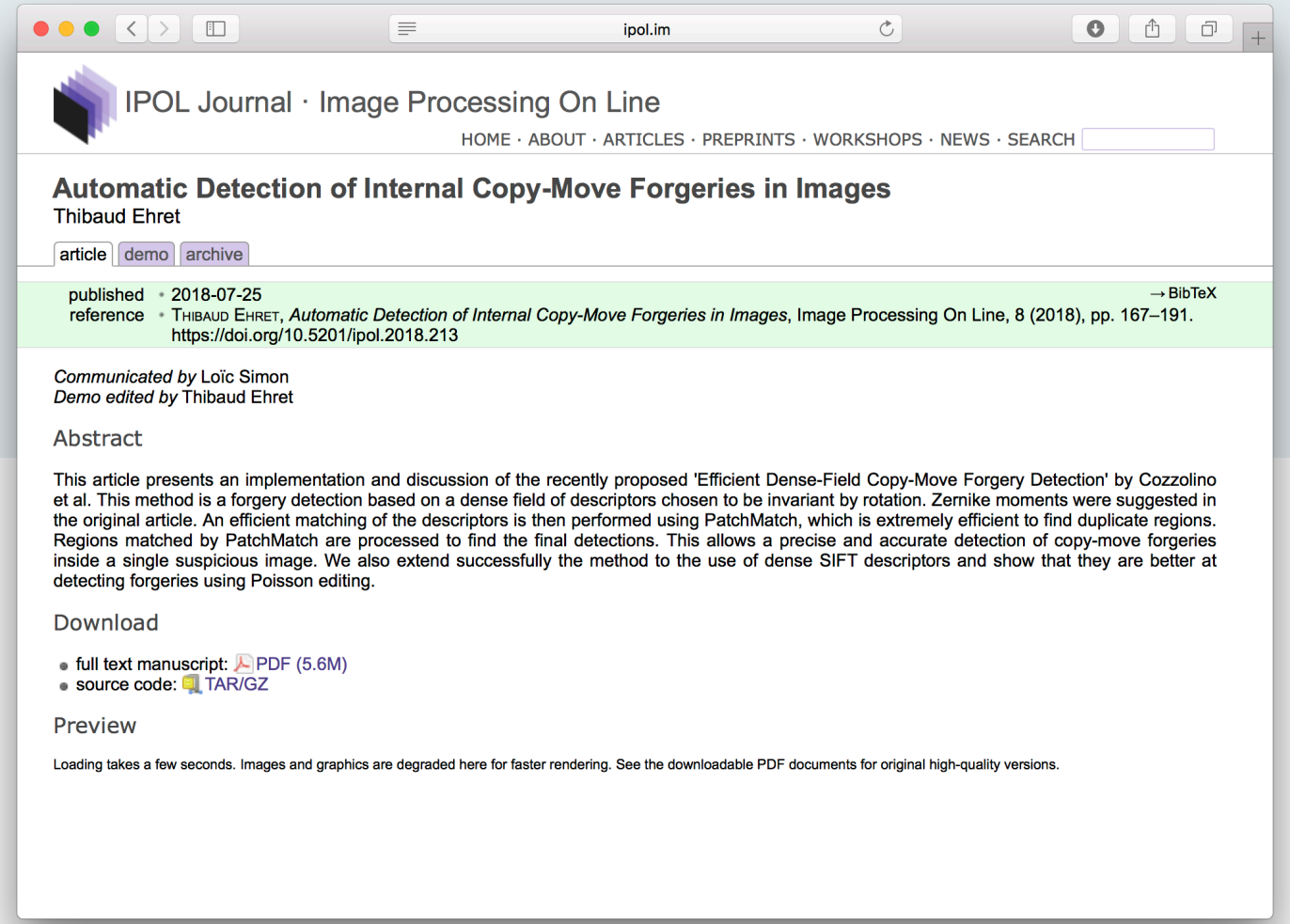
Motivations

- Reproducible Research.
- New way to publish research results.
- Allows everybody to test the algorithms (with their own images).
- Free online demonstration (user-platform independant) and source code.

3.1 IPOL Journal: short overview

Characteristics

- Journal publishing algorithm description, source code, online demonstration with experiment archives.



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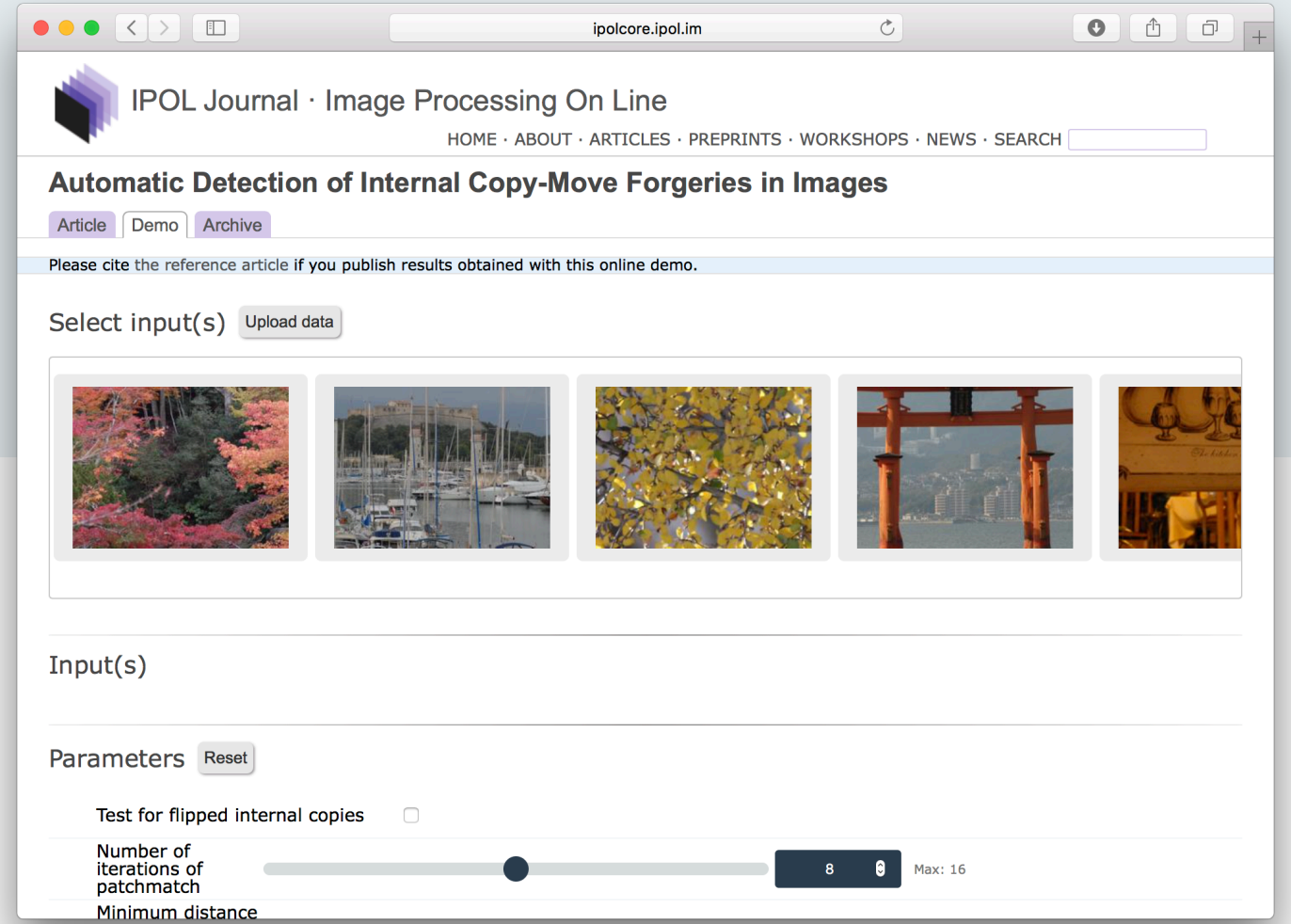

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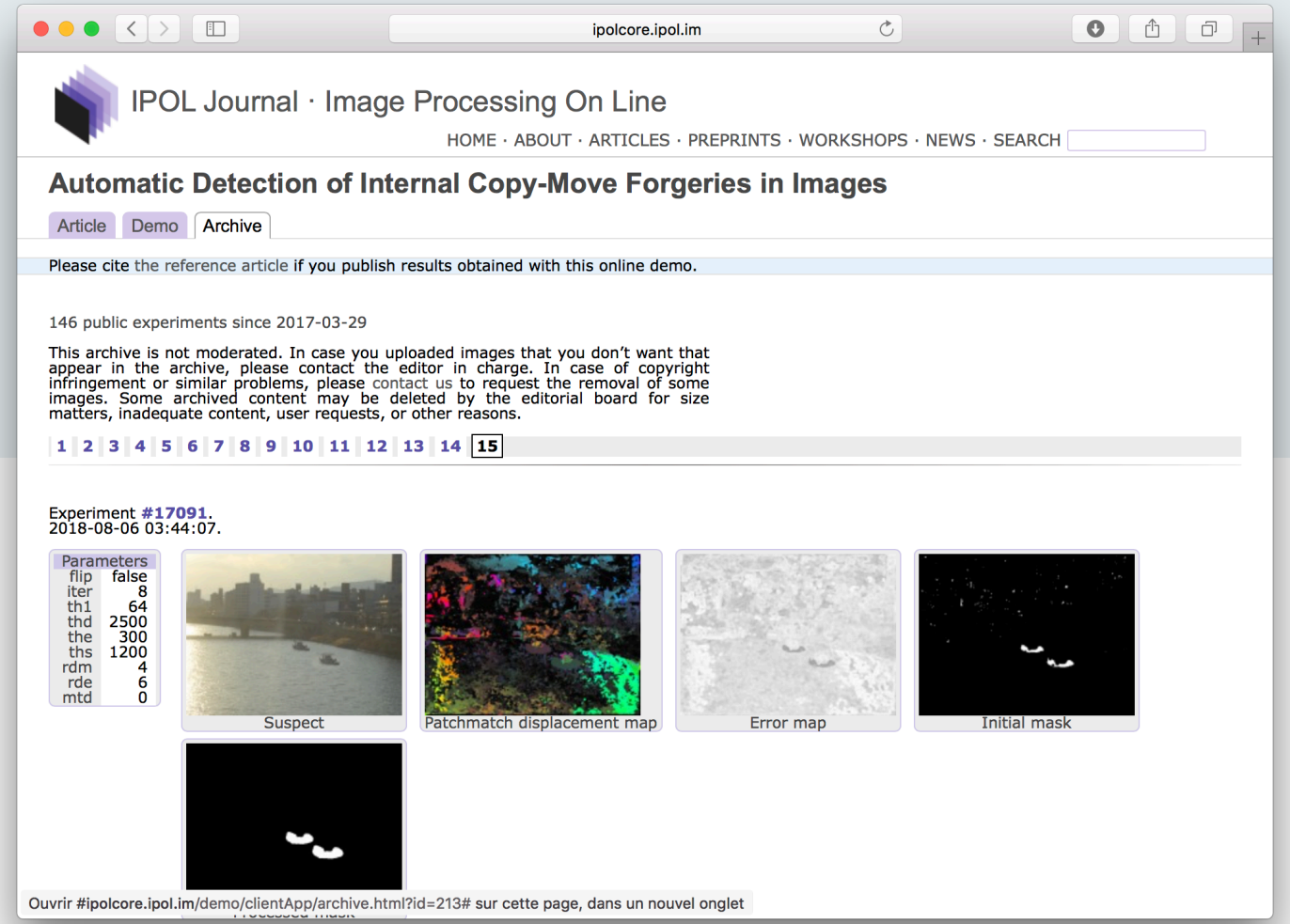

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- Open Science journal and Reproducible Research.
- Like classic journal: ISSN, DOI, indexed by:
  SCOPUS, DBLP, Scirus, Google Scholar, DOAJ, SHERPA/RoMEO, Héloïse, WorldCat, CrossRef, Ulrich, Index Copernicus, PBN, JGate, VisionBib, CVonline, JournalSeek and NewJour.

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Recent evolution

- New system to automatically create our own online demontrations (see next session).
- Extended topics to sound and video processing with 3D processing.

3.2 ReScience Journal

Philosophy (`http://rescience.github.io`)

- Context of Reproducible research [Buckheit & Donoho 95].
- Explicit replication: propose a new implementation of an existing work.
- Motivated from replication problems in computational science [Hinsen 15], [Topalidou *et al.* 15], [Hinsen 14].

3.2 ReScience Journal

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- Explicit replication: propose a new implementation of an existing work.
- Motivated from replication problems in computational science [Hinsen 15], [Topalidou *et al.* 15], [Hinsen 14].

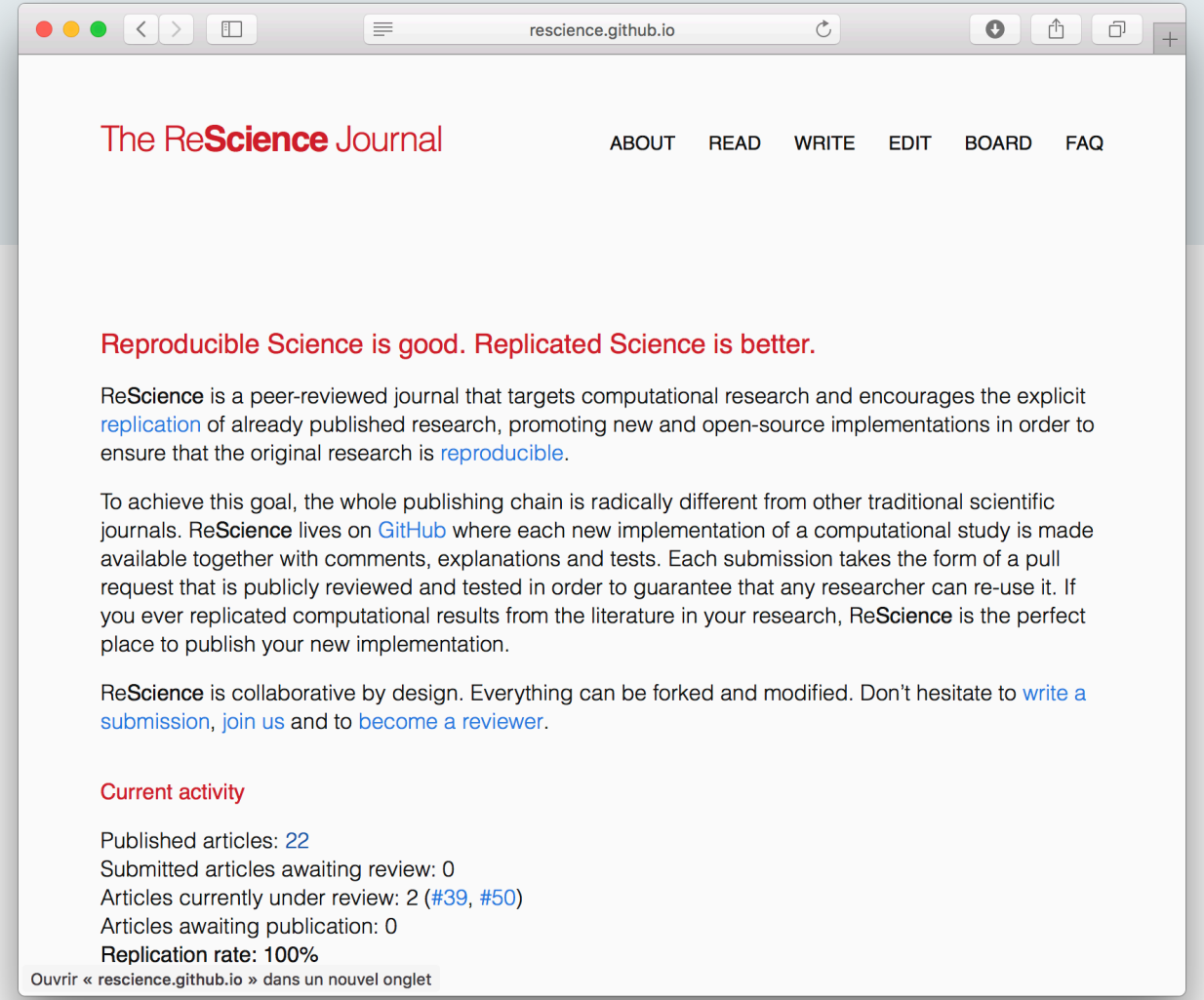
Details:

- Origin: first volume in 2015.
- Editorial Board:
  - Editors-in-Chief:
    - Konrad Hinsen (Molecular Biophysics - Python, C, Racket, Clojure).
    - Nicolas P. Rougier (Comp. Neuroscience, Computer Science - Python, C/C++).
  - 11 Associate Editors with roles in: Bioinformatics; Cognitive Modelling; Computational Ecology; Computational Physics; Image processing; Ecology, High-Performance Computing; Physics; Robotics; Signal Processing

3.2 ReScience Journal: short overview

Characteristics

- Same presentation as in a "classic" journal.



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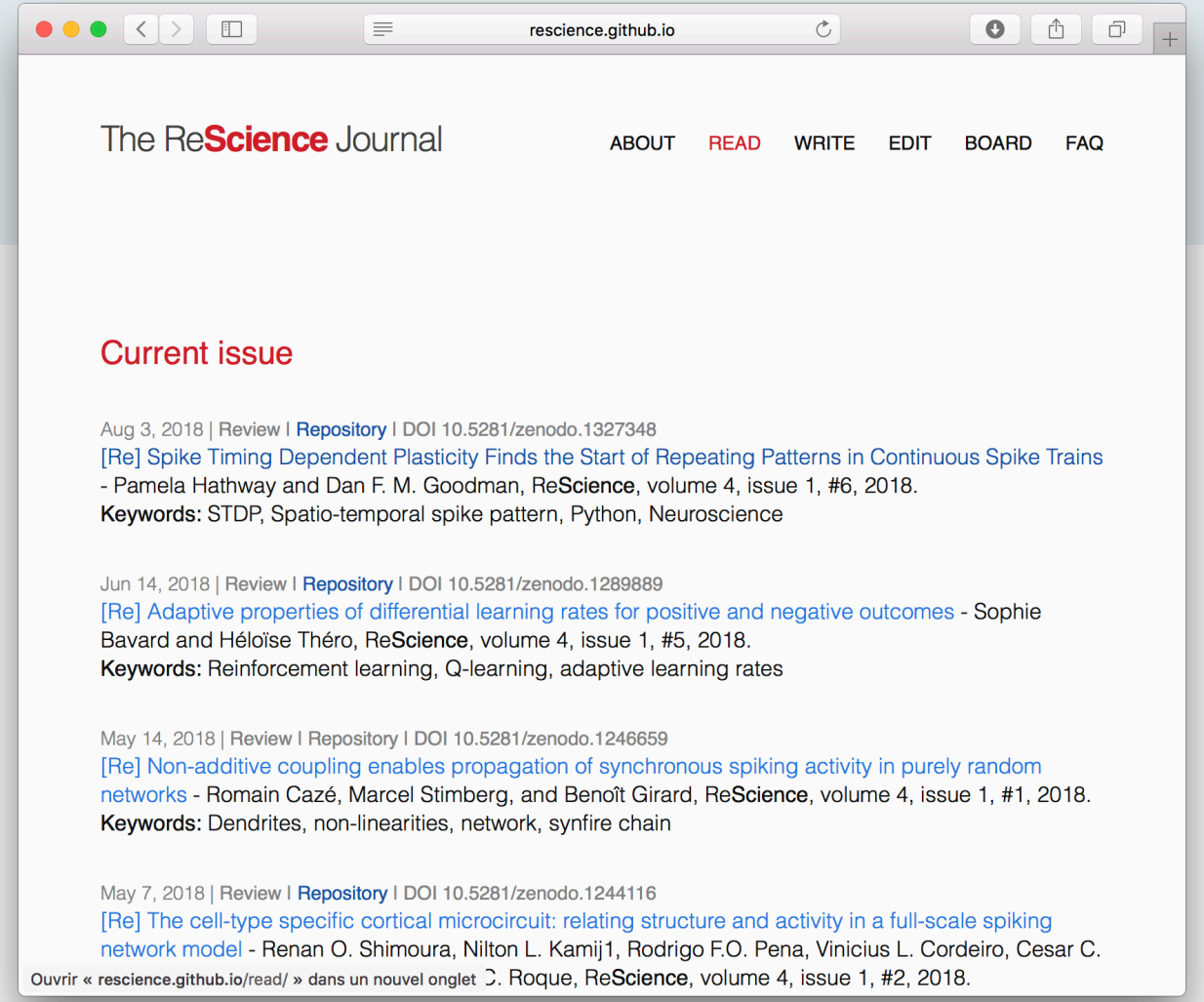

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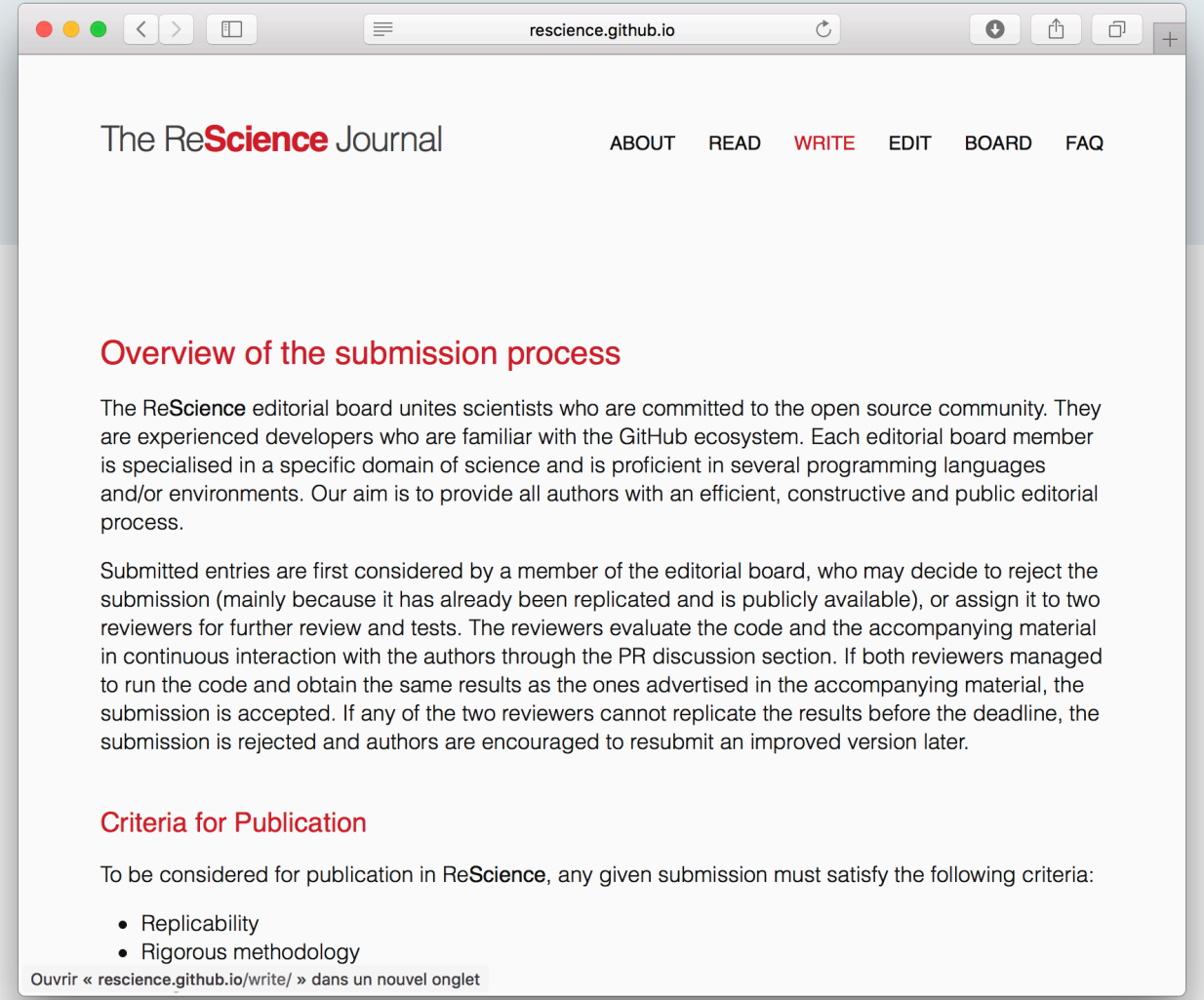

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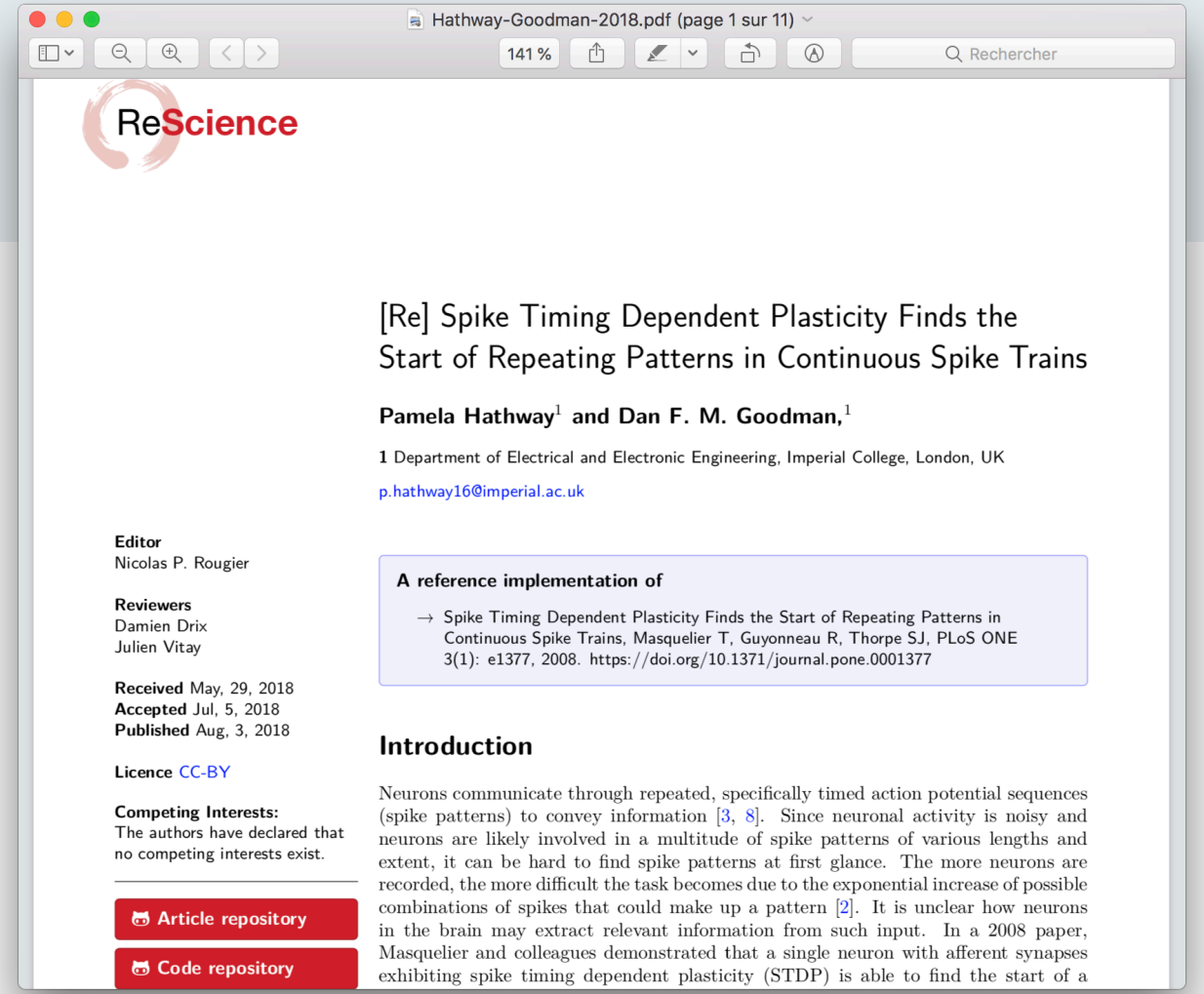

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- Same presentation as in a "classic" journal.
- Journal living on *GitHub*.
- Original submission process through *Pull Request* on *GitHub*.

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- Same presentation as in a "classic" journal.
- Journal living on *GitHub*.
- Original submission process through *Pull Request* on *GitHub*.
- Peer reviewed journal (reviews and reviewer name given in the paper).

3.2 ReScience Journal: example of publication process

Example of publication [Rougier 17]

- Already published work "Weighted Voronoi Stippler" [Secord 02]
- Code no more available on author webpage: `https://mrl.nyu.edu/~ajsecord/stipples.html`.

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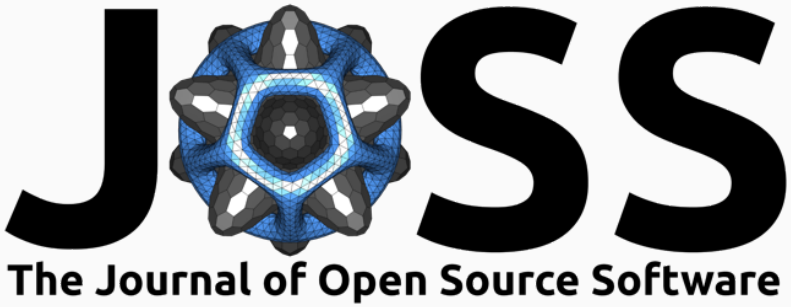
Conclusion of ReScience Journal

- Original new way of publish replication.
- Contains actually 22 published papers and 2 under review.
- Author of original work can not submit their own replication.
- Can potentially present works that were not successfully replicated ...
  $\rightarrow$ not yet present

3.3 JOSS Journal

Journal of Open Source Software (`https://joss.theoj.org`)

- Origin: founded by Arfon M. Smith in May 2016.
- Free and Open Access.
- Peer reviewing.
- Motivated by the fact that [Smith *et al.* 17]: *"Current publishing and citation do not acknowledge software as a first-class research output"*.



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Details

- Design: defined in the current merit system of science.
- Aim: can be considered as a "journal for research software packages".
- Editorial Board:
  - Arfon Smith (@arfon), Editor-in-Chief.
  - 19 Topic Editors: representing: Astronomy; Biodiversity Informatics; Bioinformatics; Computational Science; Data Science; Engineering, Computational Combustion; Computational Social Science; Fluid Dynamics; Energy Engineering; Geophysics; Geoscience; High Perf. Computing; Image; Information Sciences; Machine Learning; Neuroimaging; Nuclear Engineering; Open Science; Psychology; Semantic Web; Social Sciences; Software Deployment; Reproducible Research.

3.3 JOSS Journal: motivations

Motivation of JOSS Editor in chief [Smith *et al.* 17]:

- Software more and more present in numerous disciplines:
  $\Rightarrow$ from a 2014 survey 90% mention to use software and 70% indicates that they were obligatory [Hettrick *et al.* 14].
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Specific form:

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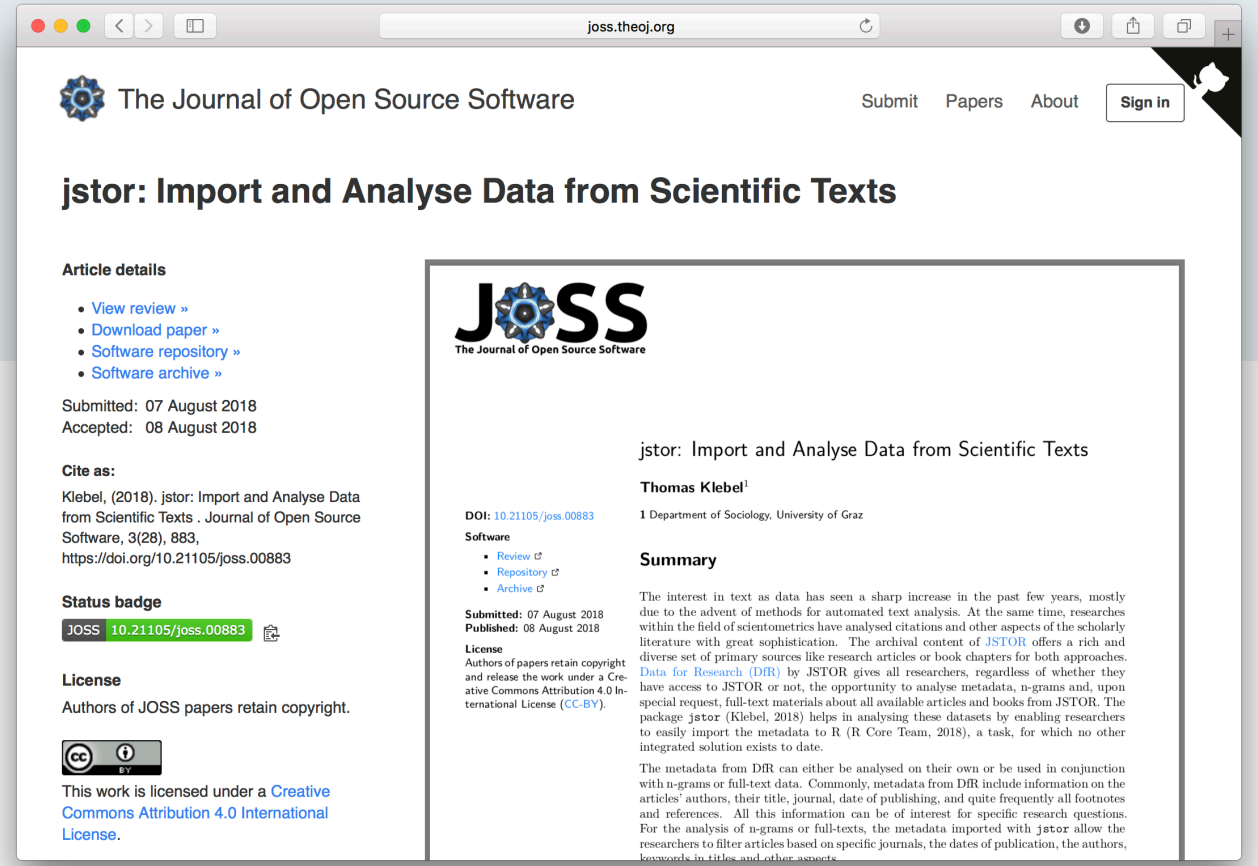

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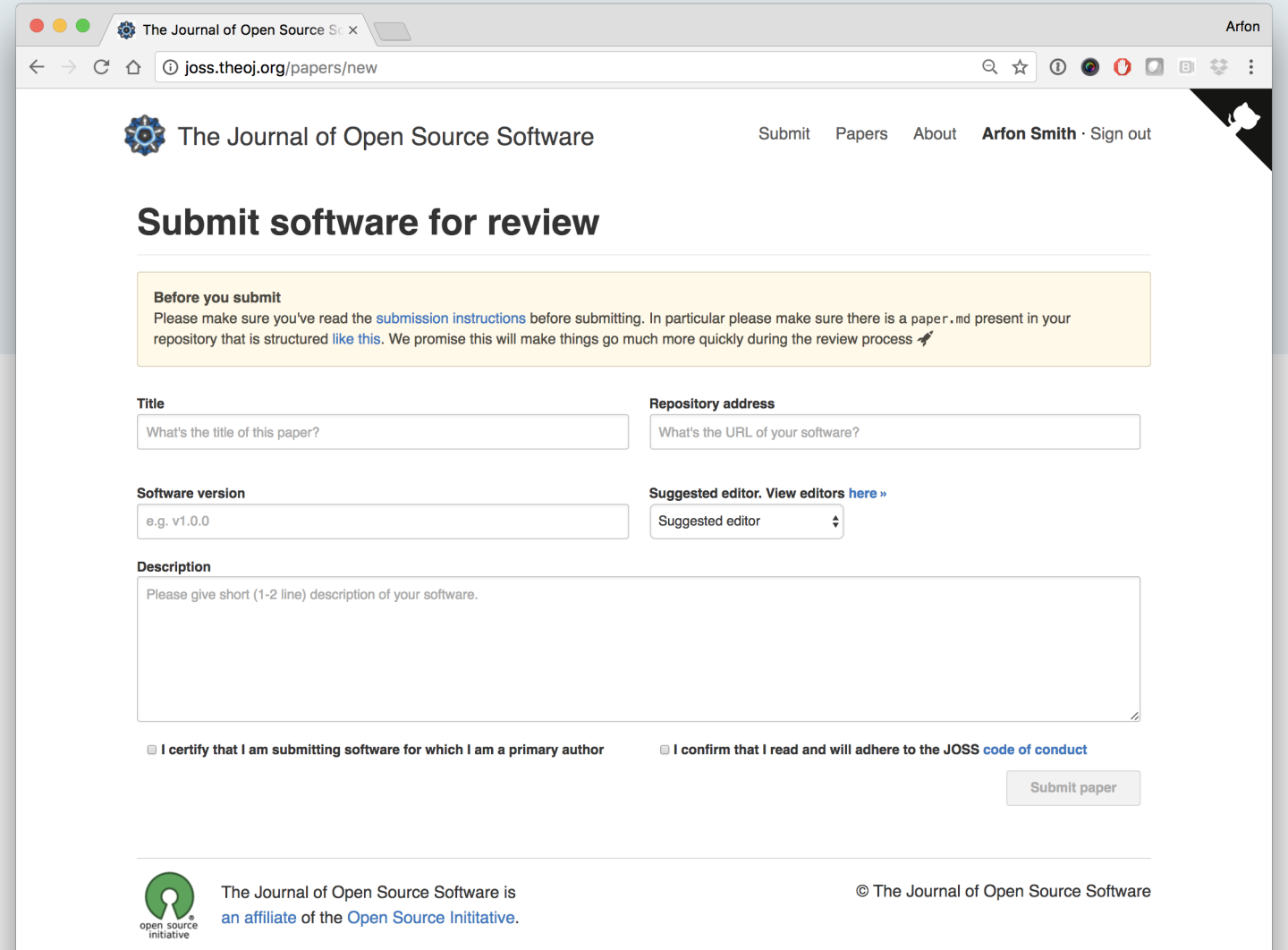
Content requested:

- Software need to be open source.
- Research application.
- Submitter needs to be main software contributor.
- Significant new contribution.
- Feature-complete (not partial).

3.3 JOSS Journal: publication process and cost (1)

Review Process

- Submission page: simple web application.



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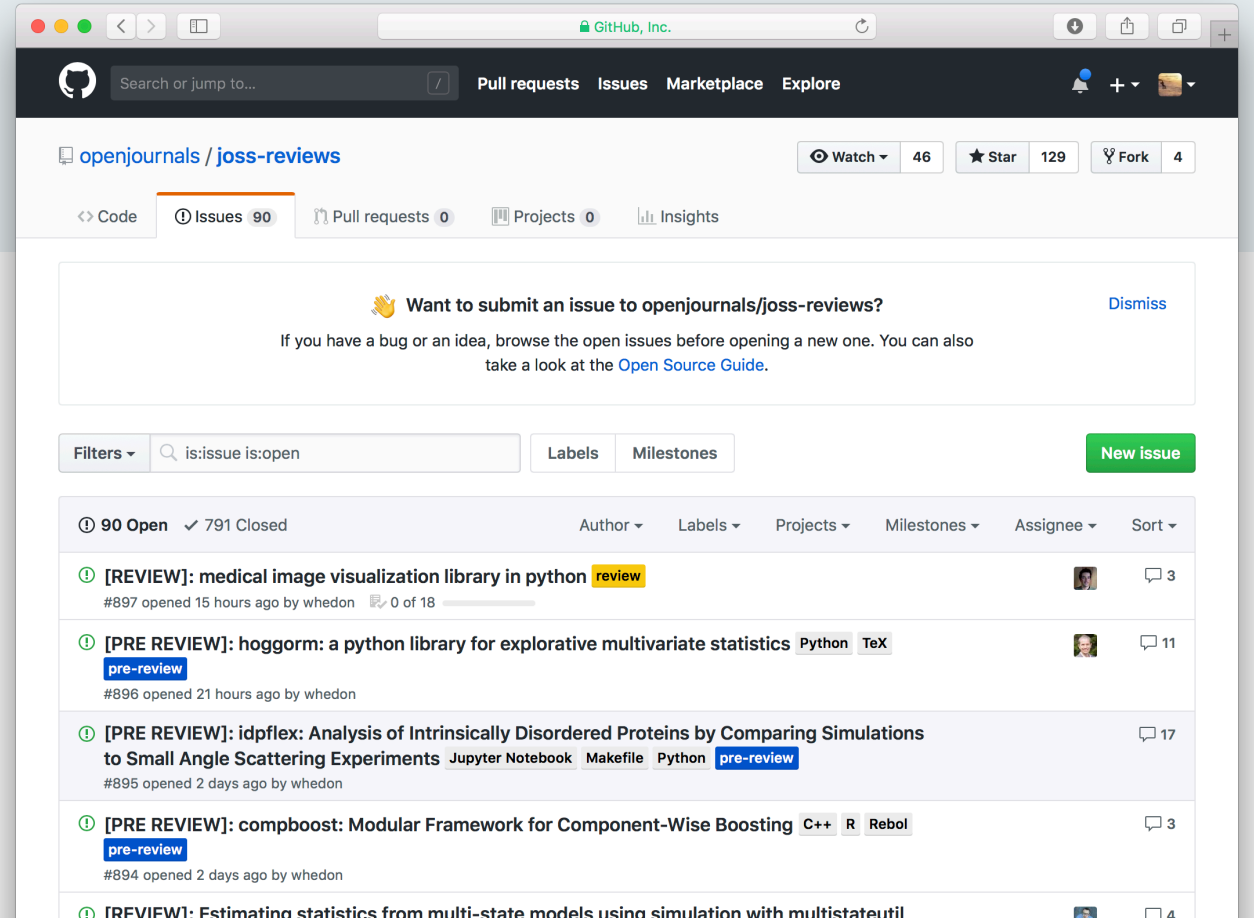

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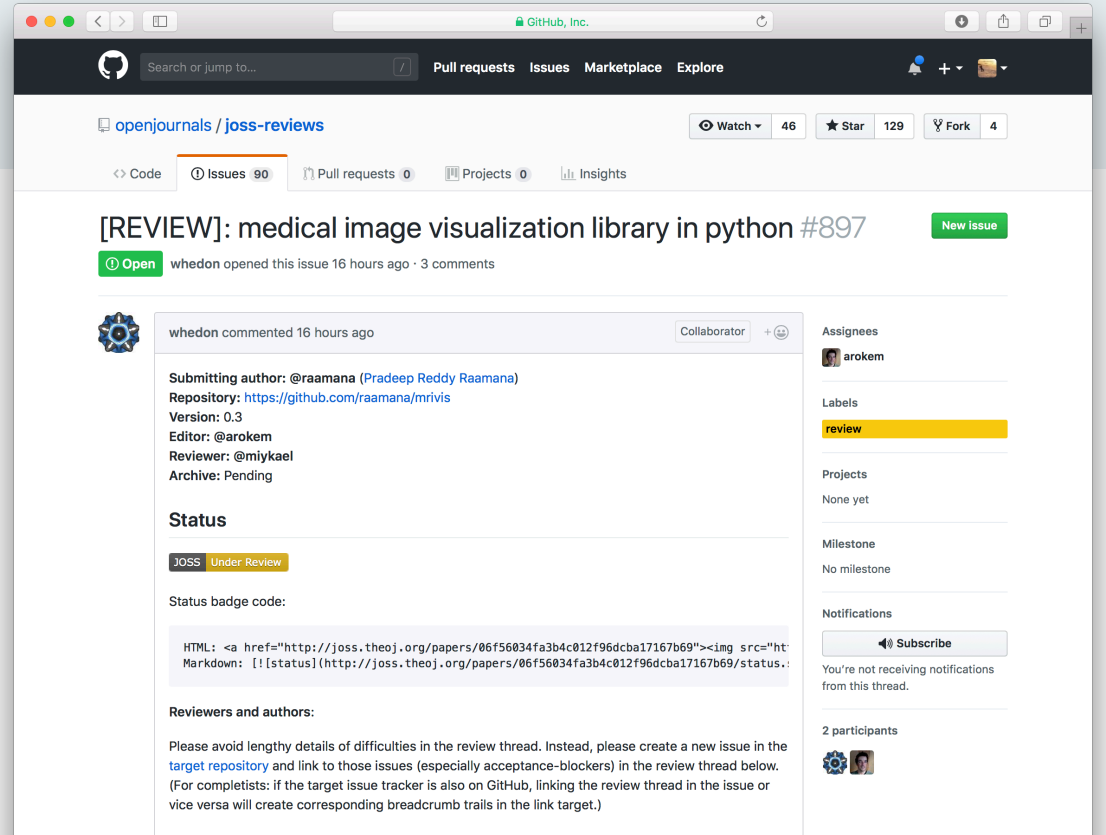

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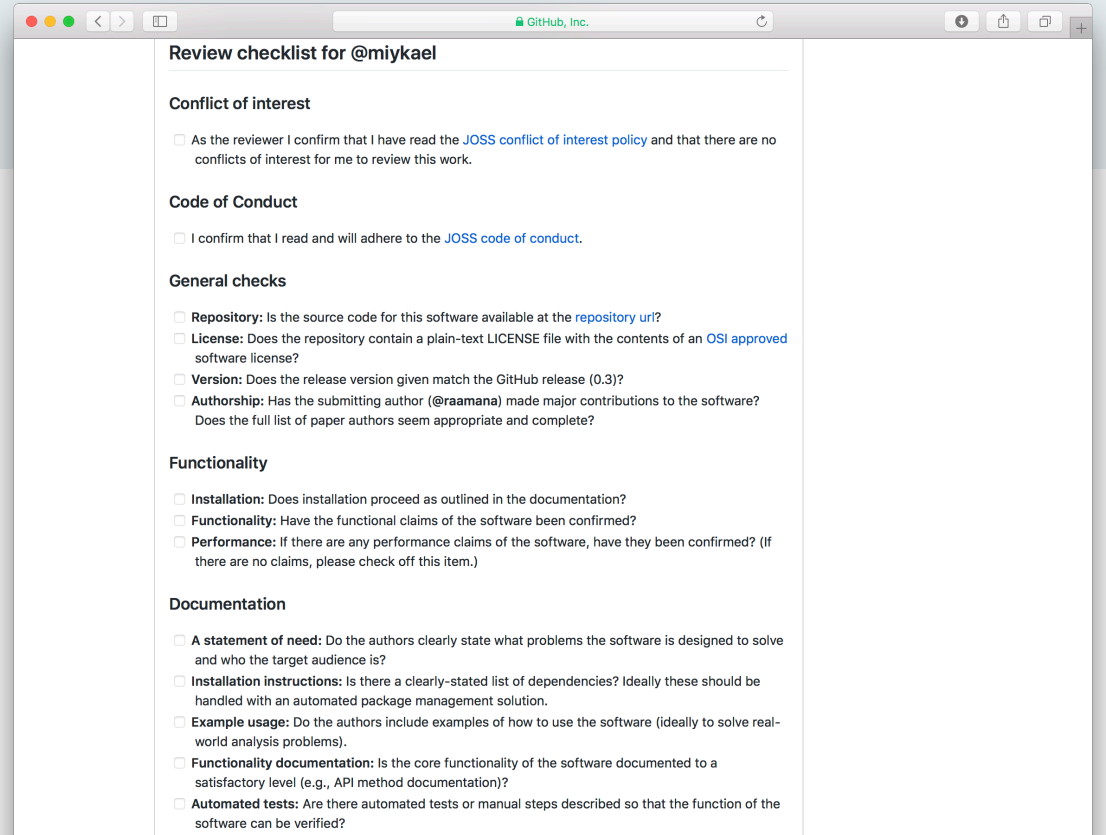

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  `https://github.com/openjournals/joss-reviews`
- Review interface: `joss-review` *GitHub* repository
- Submission handled by a collection tools from a RubyGem library: `Whedon`.
  `https://github.com/openjournals/whedon`

3.3 JOSS Journal: publication process and cost (2)

Main review steps

- Mainly handled from issue labels.
- Example of review flow (extracted from [Smith *et al.* 17]).

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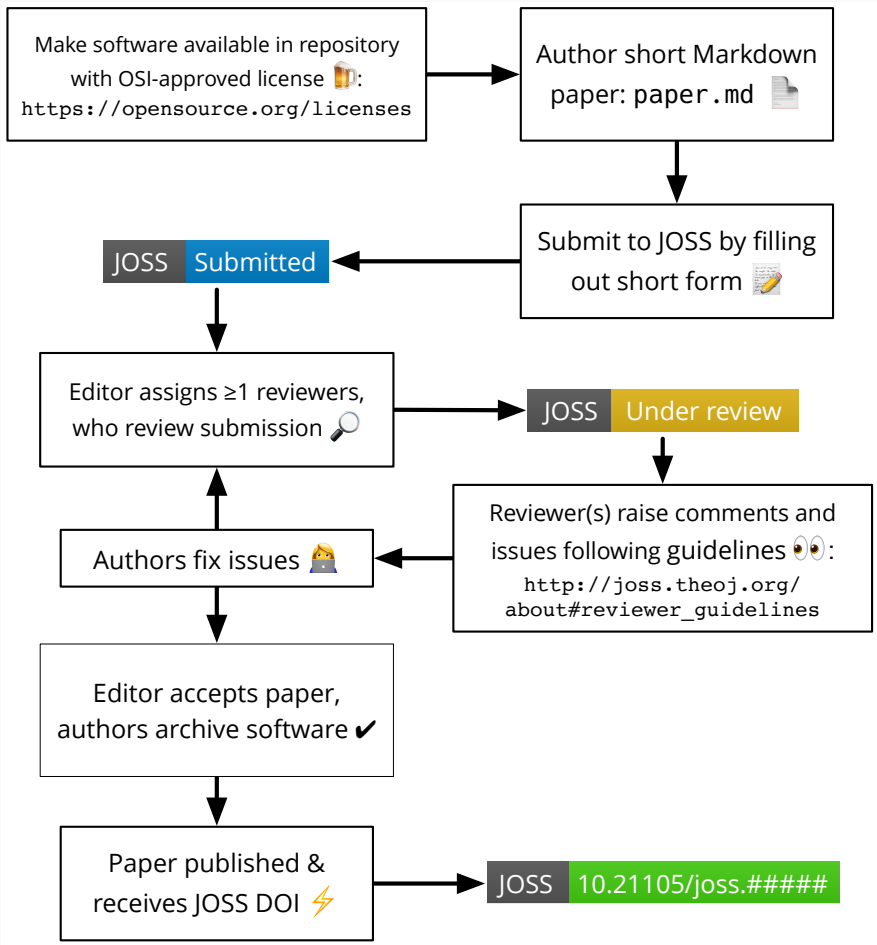

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Cost [Smith *et al.* 17]

- Minimum cost from volunteer editors and reviewers;
- Around 6$ per papers (with a base of 100 paper/year)
  $\rightarrow$ cross ref membership 275$ + crossref DOI 1$/paper + 19$/month.

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Comparisons with other journal

- Journal of Open Research Software (`openresearchsoftware.metajnl.com`)
- SoftwareX (`journals.elsevier.com/softwarex/`)

  $\rightarrow$ both journals review papers and software.

  $\rightarrow$ anonymous reviews in the contrary to the contrary public review and public authors/reviewers interaction in JOSS.

3.3 JOSS Journal: one year overview and future [Smith *et al.* 17]

Synthetic review of first year anniversary

- 110 published articles for the first year (actually 350).
- 45.6 days between submission and publication.
- 1.11 reviewers (total of reviewer count 93).

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Future plan and open orientations

- Complete the `Whedon` RubyGem library for an automatic final paper publication.
- Question about what to do to handle version number and publication ?
  $\rightarrow$ Select the `MAJOR` version from a normalized `MAJOR.MINOR.PATCH` ?
- JOSS is now under *NumFOCUS* (charity supporting "world-class, innovative, open source scientific computing.").
- Make more adverts in various communities like in Pattern Recognition.

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Reproducible Research in Science

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- In particular in Computational Science.
- Motivated by the credibility crisis pointed out by Donoho.
- Allows to follow the scientific method: claims can be verified (and eventually disproved).

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Evolution

- Development of several platforms and journals.
- New tools allows comparisons and establish the real state of the art.
- New metric of assessing the impact of the research (instead classic citation indices).
- Increasing interest in this area.

References

Thank you for your attention!

感谢您的关注!

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