Transcending the Limitations of Traditional Research Dissemination

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NeuroPoly

POLYTECHNIQUE MONTRÉAL

Declaration of Financial Interests or Relationships

Speaker Name: Mathieu Boudreau

I have no financial interests or relationships to disclose with regard to the subject matter of this presentation.

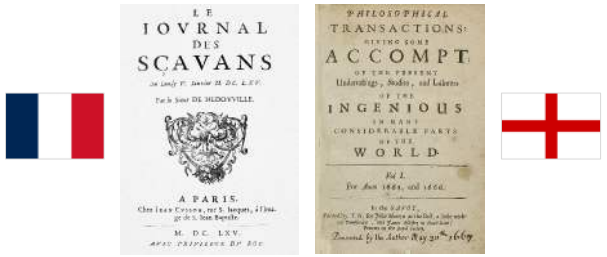
How did we get here?

History

“Traditional” research dissemination

Limitations

History of research dissemination practices



First scientific journals

1665

Industrial and print revolution

1800s

Internet and the digital revolution

2000s

Open science boom and social media

2010s

1700s

Age of enlightenment

179 8

First scientific conferences

1900s

Exponential growth of journals and conferences

1970s

Journals begin adopting peer review

Traditional Research Dissemination

Pitfalls

Academic thesis
Gathers dust, not readers

International conferences
Costly, closed, and ephemeral

Peer reviewed
Few eyes, lacks transparency

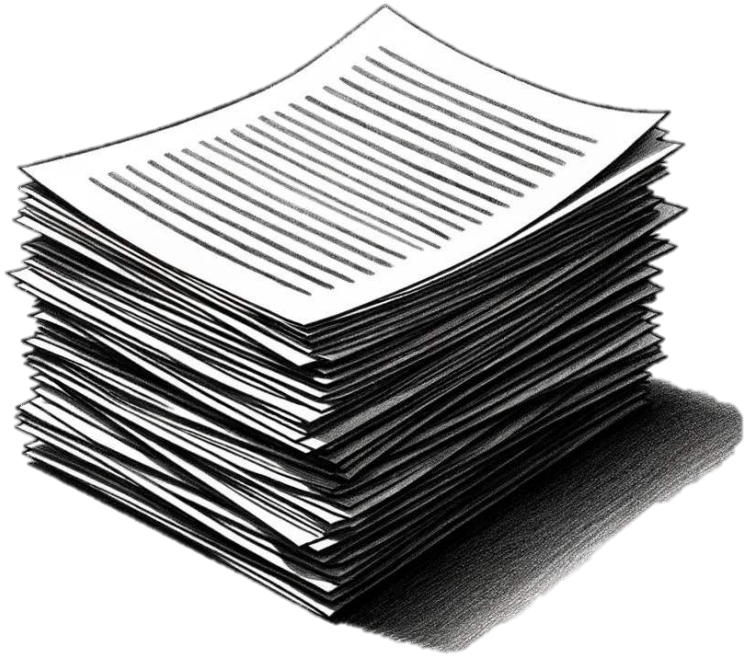
Subscription-based journals
Slow, accessibility inequity, static

University press releases
Short reach

Limitations of conventional papers

Figures are static

Complex research software and pipelines



Methodology detail constraints

Missing information about proprietary “black boxes”

Tools

and

Platforms

Document Writing

Code and Data Sharing

Containerization

Interactivity

Citeable hosting

Social Media

Modern Tools and Platforms for Research Dissemination

Generally open-science related

Promote reproducibility

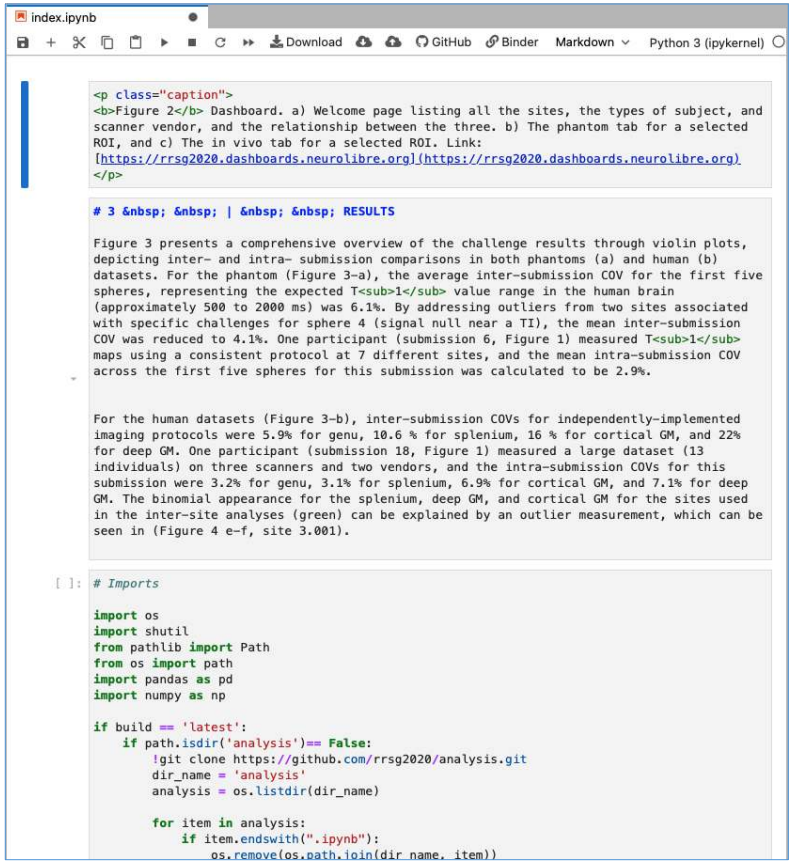
Interactivity

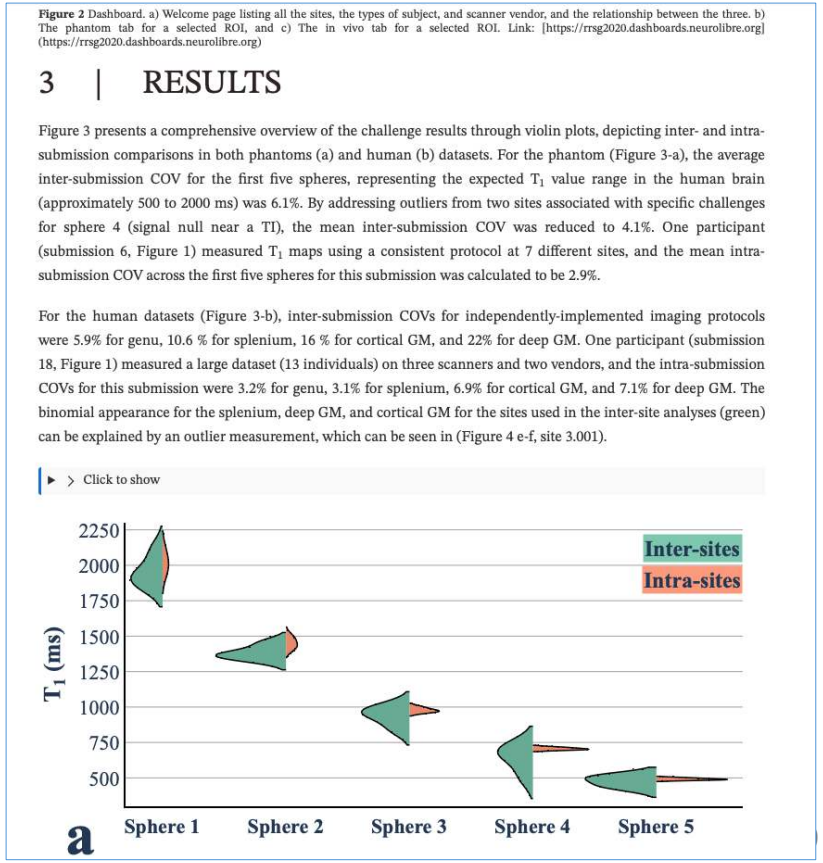
Web-focused

Modern Tools and Platforms for Research Dissemination

Document Writing Tools

jupyter{book}





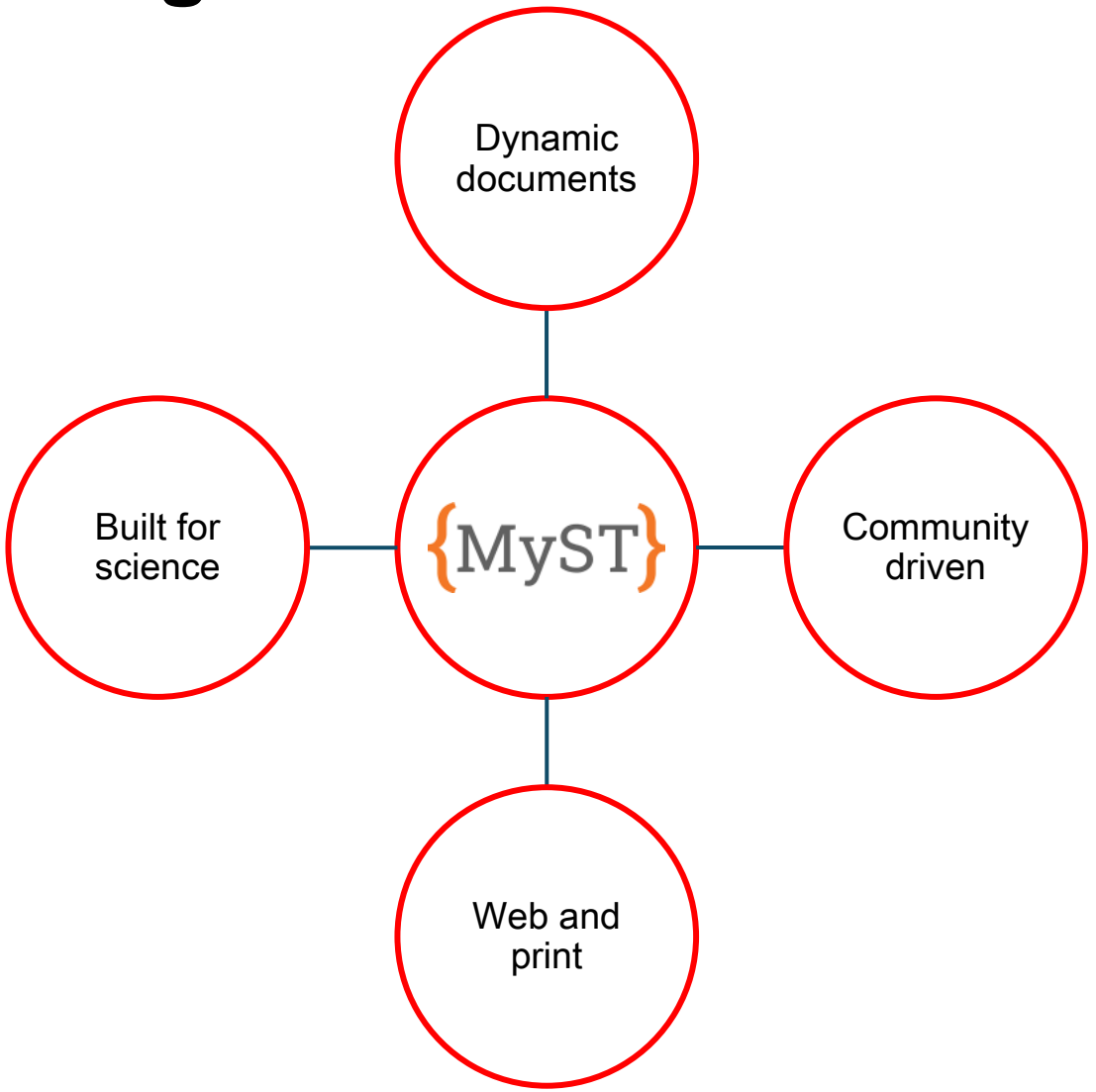
Modern Tools and Platforms for Research Dissemination

Document Writing Tools

{MyST} : Markdown framework for technical documentation and scientific publication

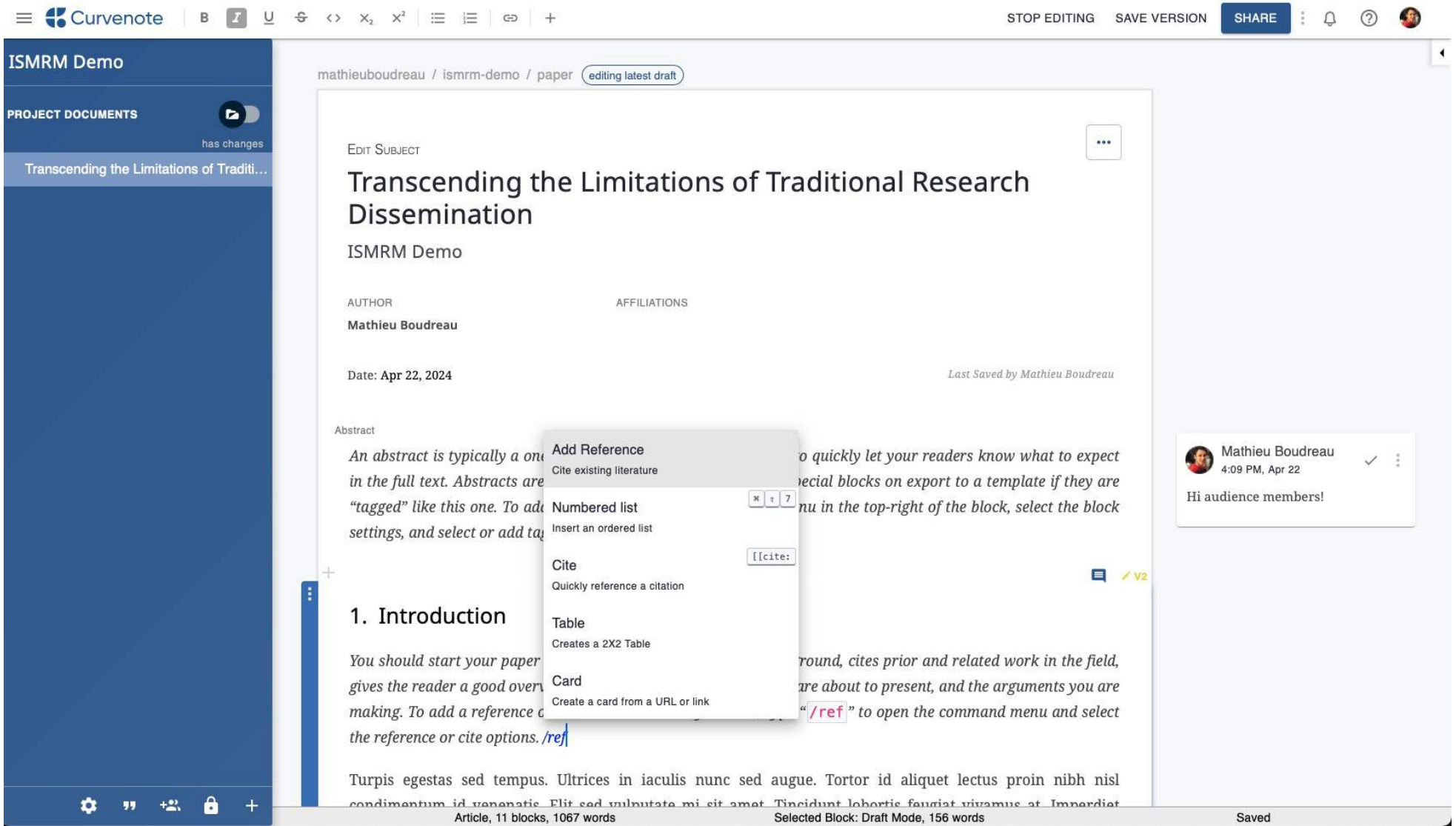
Journal articles, book chapters, tutorials, and blog posts

PDF, Web/HTML, LaTeX, Docx



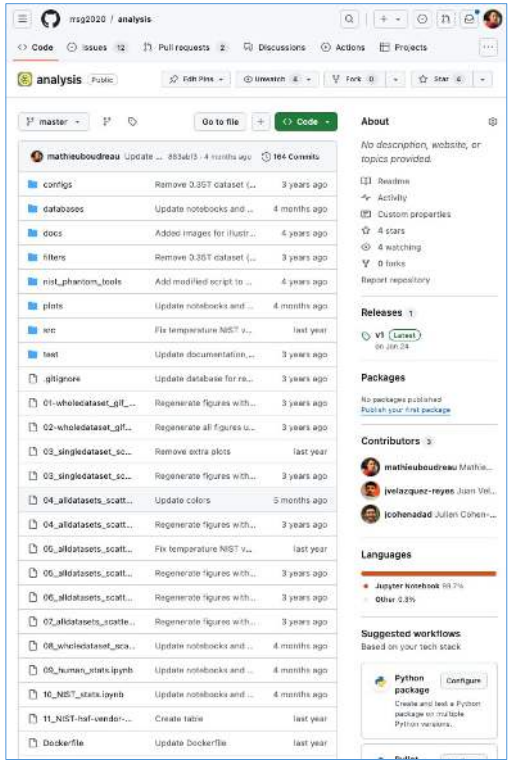
Modern Tools and Platforms for Research Dissemination

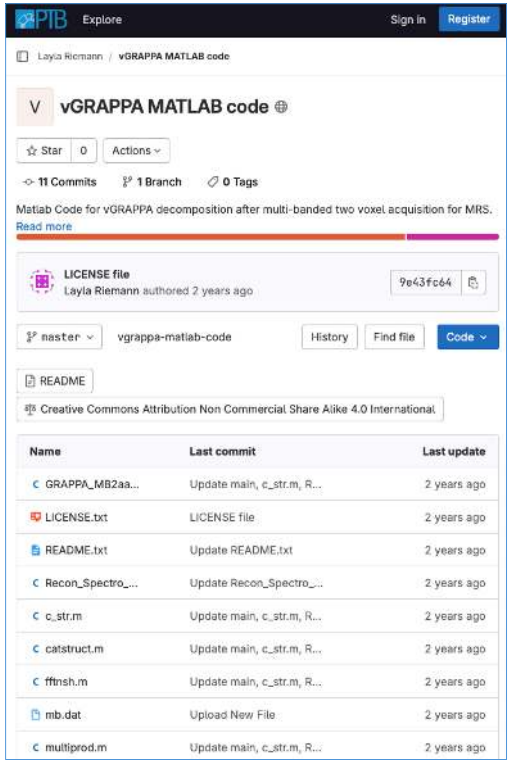
Document Writing Tools

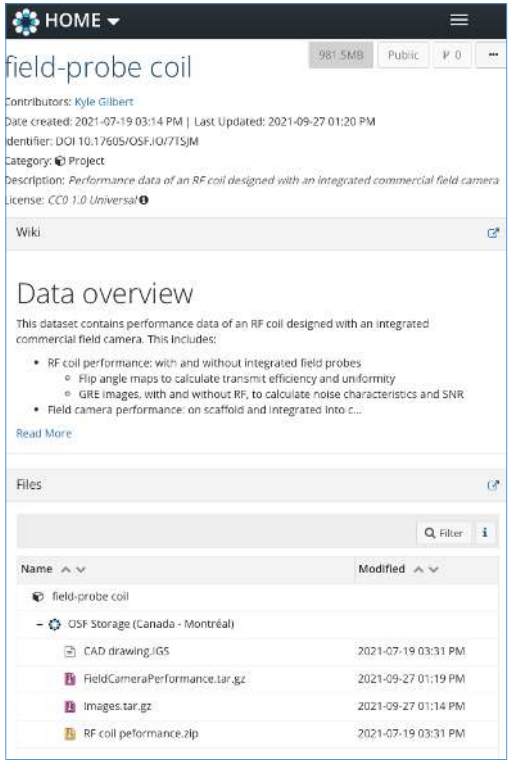


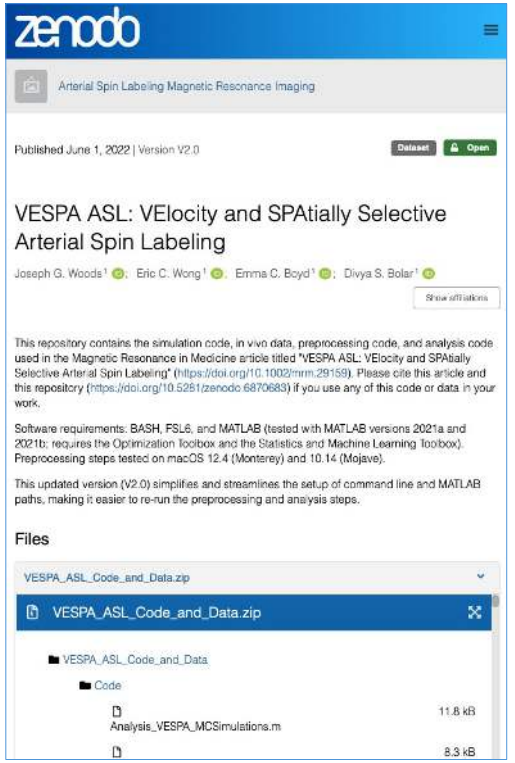
Modern Tools and Platforms for Research Dissemination

Code and Data Sharing Platforms





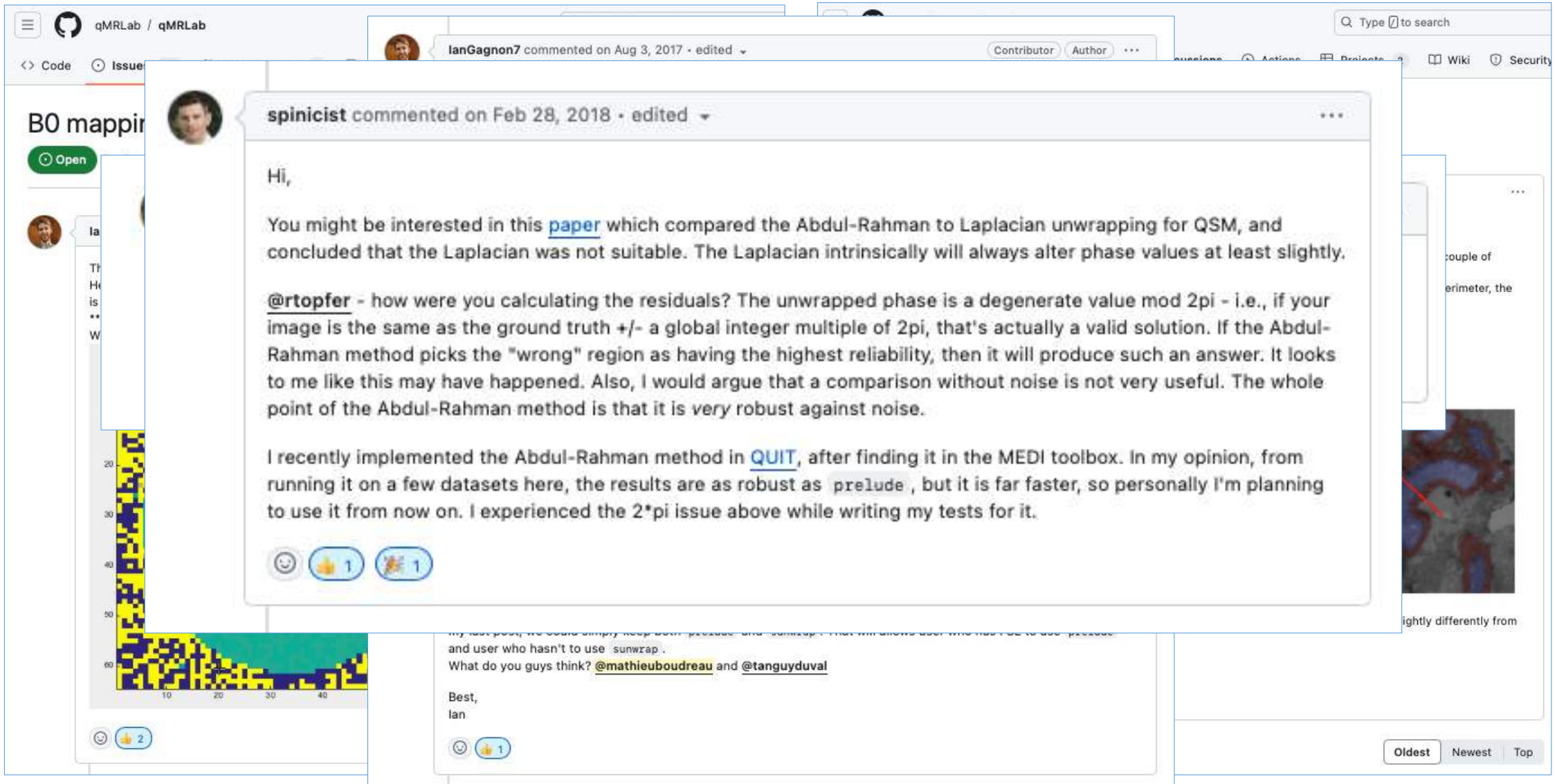




GitHub GitLab OSF zenodo

Modern Tools and Platforms for Research Dissemination

Code and Data Sharing Platforms



Modern Tools and Platforms for Research Dissemination

Computational Environment Containerization

environment.yml

```yaml
name: ads_venv
dependencies:
  - python=3.8
  - h5py=2.10.0
  - numpy
  - scipy
  - scikit-learn=1.1.1
  - scikit-image=0.19.3
  - tabulate<
  - pandas
  - matplotlib
  - mpld3
  - tqdm
  - requests
  - pillow!=9.0.0
  - imageio<2.28.0
  - pytest
  - pytest-cov
  - prettytable
  - jupyter
  - openpyxl
  - qtconsole<5.4.2
  - pip
  - pip:
    - nibabel==3.2.*
    - raven
    - napari
    - protobuf==3.20.1
    - ivadomed @ git+https://github.com/ivadomed/iv
    - onnxruntime<1.16.0
```

runtime.txt

```
python-3.8
```

requirements.txt

```
jupyter-book==0.13.0
plotly
matplotlib==3.5.1
numpy==1.21.6
pandas
nibabel==3.2.2
scipy
markdown
wget
jupyterlab-mathjax3
repo2data
osfclient
seaborn
```

postBuild

```
#!/bin/bash
git clone --depth=1 https://github.com/rrsg2020/analysis.git content/analysi
```

data_requirement.json

```
{
    "src": "https://github.com/rrsg2020/analysis/releases/download/v1/rrsg-2
    "dst": "../data",
    "projectName": "rrsg-2020-note"
}
```

Dockerfile

```
FROM jupyter/base-notebook:latest

USER root

RUN apt-get update &&            \
    apt-get install -y --no-install-recommends \
        build-essential\
        git \
        python3-dev &&\
    apt-get clean && \
    apt-get autoremove && \
    rm -rf /var/lib/apt/lists/* /tmp/* /var/tmp/*

RUN cd $HOME/work;         \
    pip install --upgrade pip --ignore-installed certifi;  \
    pip install jupyter-book  \
                scipy \
                plotly \
                flask \
                ipywidgets \
                nbconvert \
                jupyterlab  \
                jupytext\
                matplotlib \
                chart_studio;   \
    git clone https://github.com/qMRLab/t1_book.git;      \
    cd t1_book/;\
    git checkout neurolibre-plots-only; \
    chmod -R 777 $HOME/work/t1_book/;

WORKDIR $HOME/work/t1_book

USER $NB_UID
```

CONDA®

repo2docker

docker

Modern Tools and Platforms for Research Dissemination

Interactivity

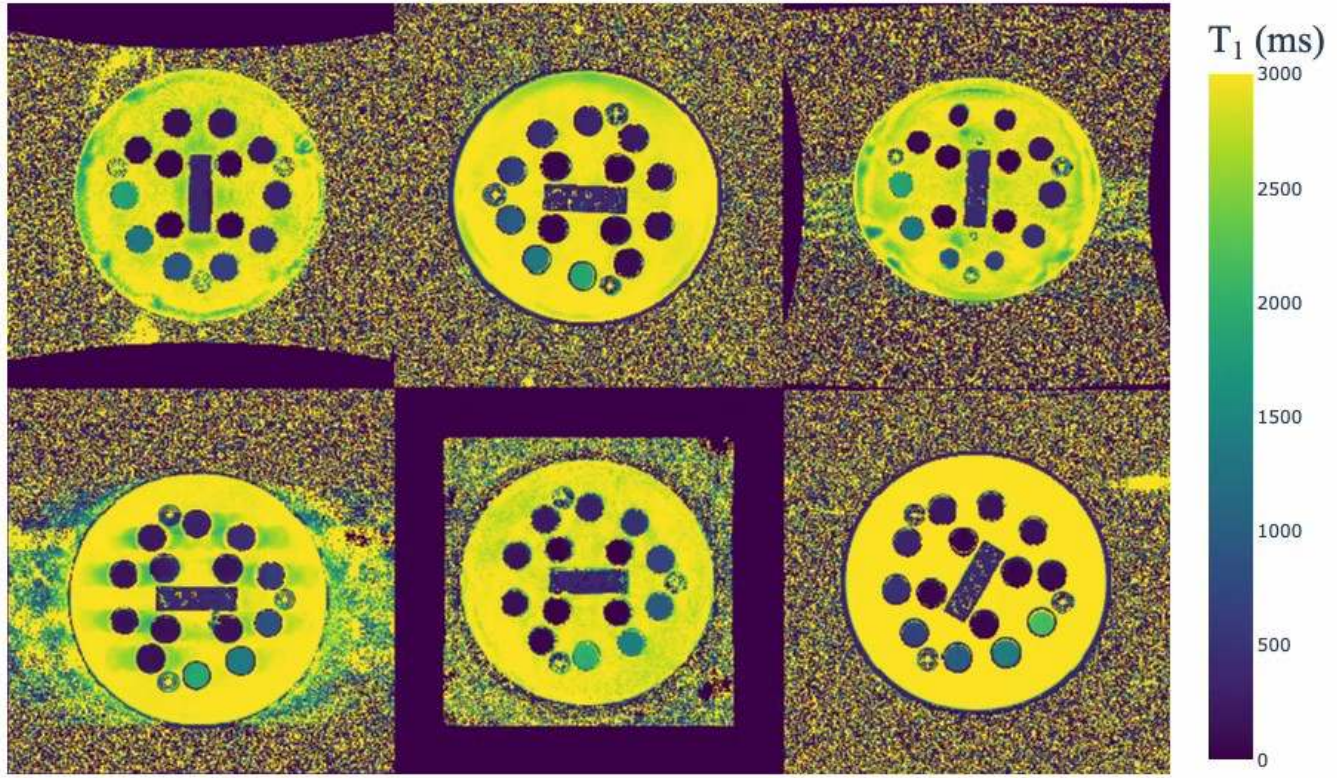


Figure 4 Example T1 maps that were generated from submitted data. Note the differences in acquisitions (e.g. FOV (top middle), orientation (bottom right, gradient distortion correction (top left and right) and resulting artifacts in the T1 maps (e.g. ghosting (bottom left), ringing (bottom middle), noise profiles (top left and bottom right), deformation/slice mispositioning (top right)) resulting from the independently-implemented acquisition protocols.

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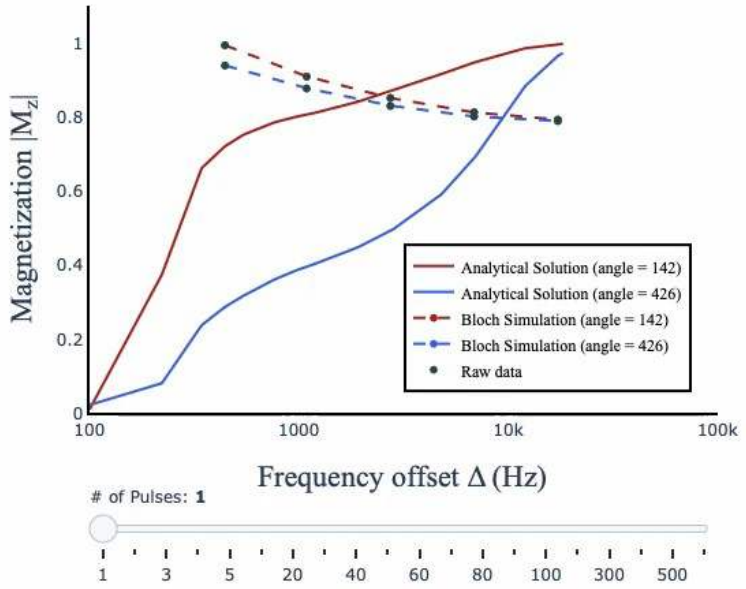
Modern Tools and Platforms for Research Dissemination

Interactivity

Figure 4. Z-spectrum simulated using Bloch simulations (dashed lines) for a number of MT pulses ranging from 1 to 600. Bloch simulations are compared with the Z-spectrum obtained from the analytical solution (solid lines).



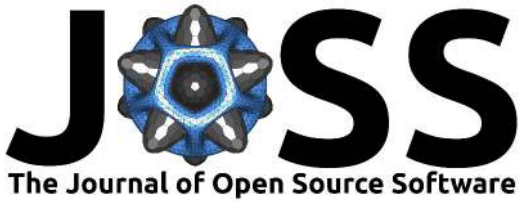
Data Fitting

In qMT imaging, the biophysical model relates the parameters observed in the two-pool tissue model to physical quantities such as the fractional size of the pools, relaxation times and

https://qmrlab.org/jekyll/2022/05/23/qMT-mapping-spgr.html

Modern Tools and Platforms for Research Dissemination

Citeable non-print platforms



Distill

NeuroLibre
A preprint server for interactive data analyses

Modern Tools and Platforms for Research Dissemination

Social Media

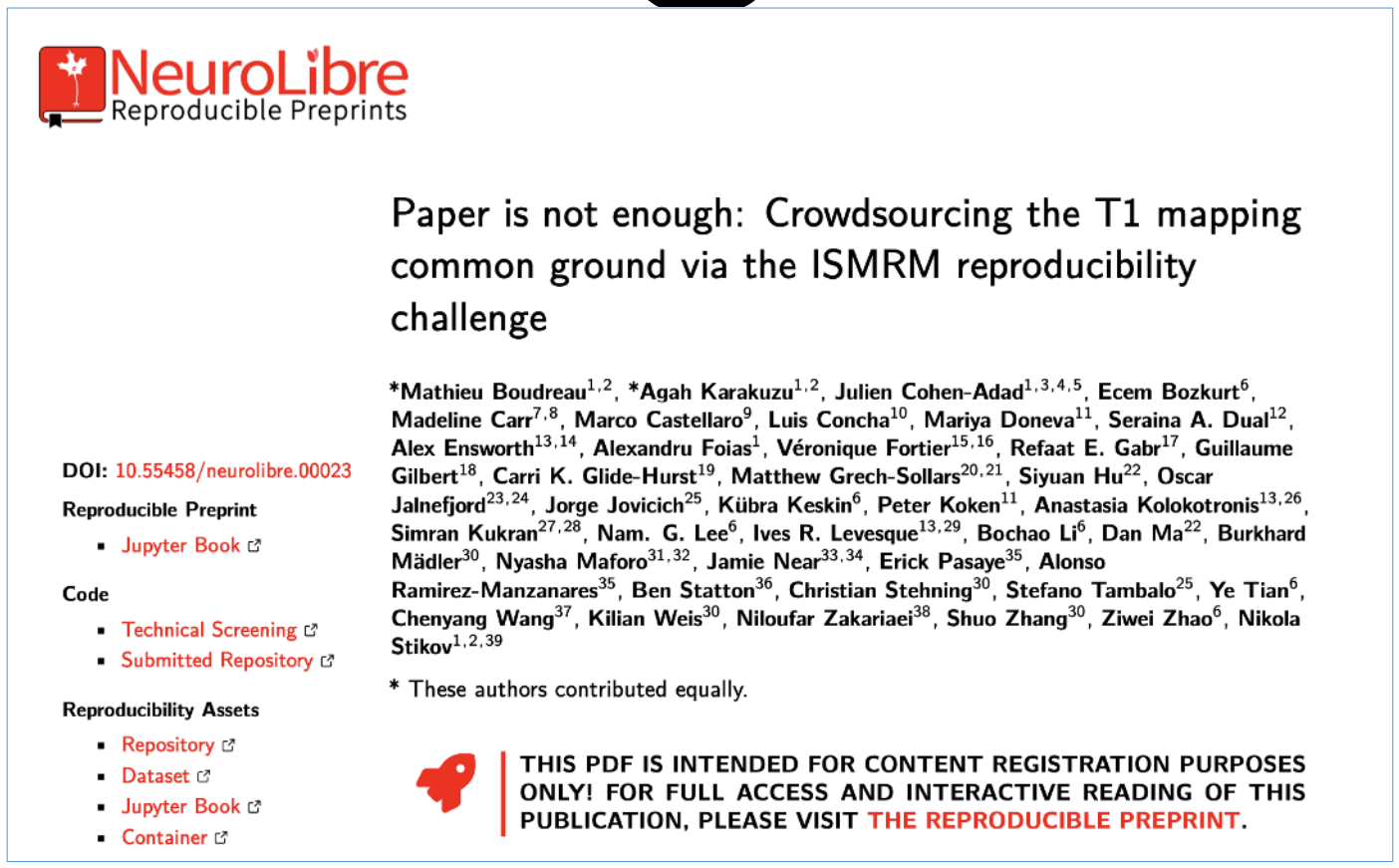
TikTok

(or, the social media platform formally known as twitter)

LinkedIn

Instagram

Example



NeuroLibre Reproducible Preprints

Paper is not enough: Crowdsourcing the T1 mapping common ground via the ISMRM reproducibility challenge

*Mathieu Boudreau[1,2], *Agah Karakuzu[1,2], Julien Cohen-Adad[1,3,4,5], Ecem Bozkurt[6], Madeline Carr[7,8], Marco Castellaro[9], Luis Concha[10], Mariya Doneva[11], Seraina A. Dual[12], Alex Ensworth[13,14], Alexandru Foias[1], Véronique Fortier[15,16], Refaat E. Gabr[17], Guillaume Gilbert[18], Carri K. Glide-Hurst[19], Matthew Grech-Sollars[20,21], Siyuan Hu[22], Oscar Jalnefjord[23,24], Jorge Jovicich[25], Kübra Keskin[6], Peter Koken[11], Anastasia Kolokotronis[13,26], Simran Kukran[27,28], Nam. G. Lee[6], Ives R. Levesque[13,29], Bochao Li[6], Dan Ma[22], Burkhard Mädler[30], Nyasha Maforo[31,32], Jamie Near[33,34], Erick Pasaye[35], Alonso Ramirez-Manzanares[35], Ben Statton[36], Christian Stehning[30], Stefano Tambalo[25], Ye Tian[6], Chenyang Wang[37], Kilian Weis[30], Niloufar Zakariaei[38], Shuo Zhang[30], Ziwei Zhao[6], Nikola Stikov[1,2,39]

* These authors contributed equally.

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Reproducible Preprint

- Jupyter Book

Code

- Technical Screening
- Submitted Repository

Reproducibility Assets

- Repository
- Dataset
- Jupyter Book
- Container

THIS PDF IS INTENDED FOR CONTENT REGISTRATION PURPOSES ONLY! FOR FULL ACCESS AND INTERACTIVE READING OF THIS PUBLICATION, PLEASE VISIT THE REPRODUCIBLE PREPRINT.

Example: T1 challenge NeuroLibre preprint

Technical Details: Preprint

Manuscript written in a **Jupyter Notebook**

Written in **Markdown + HTML**

Coded in **Python**

Interactive figures via **Plotly**

Web version created with **Jupyter Book**

Environment reproducibility via a **Docker** container

Published on the **NeuroLibre** platform

NeuroLibre 10.55458/neurolibre.00023

Example: T1 challenge NeuroLibre preprint

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[*]Authors MB and AK contributed equally to this work

[1]NeuroPoly Lab, Polytechnique Montréal, Montreal, Quebec, Canada, [2]Montreal Heart Institute, Montreal, Quebec, Canada, [3]Unité de Neuroimagerie Fonctionnelle (UNF), Centre de recherche de l'Institut Universitaire de Gériatrie de Montréal (CRIUGM), Montreal, Quebec, Canada, [4]Mila - Quebec AI Institute, Montreal, QC, Canada, [5]Centre de recherche du CHU Sainte-Justine, Université de Montréal, Montreal, QC, Canada, [6]Magnetic Resonance Engineering Laboratory (MREL), University of Southern California, Los Angeles, California, USA, [7]Medical Physics, Ingham Institute for Applied Medical Research, Liverpool, Australia, [8]Department of Medical Physics, Liverpool and Macarthur Cancer Therapy Centres, Liverpool, Australia, [9]Department of Information Engineering, University of Padova, Padova, Italy, [10]Institute of Neurobiology, Universidad Nacional Autónoma de México Campus Juriquilla, Querétaro, México, [11]Philips Research Hamburg, Germany, [12]Department of Radiology, Stanford University, Stanford, California, United States, [13]Medical Physics Unit, McGill University, Montreal, Canada, [14]University of British Columbia, Vancouver, Canada, [15]Department of Medical Imaging, McGill University Health Centre, Montreal, Quebec, Canada [16]Department of Radiology, McGill University, Montreal, Quebec, Canada, [17]Department of Diagnostic and Interventional Imaging, University of Texas Health Science Center at Houston, McGovern Medical School, Houston, Texas, USA, [18]MR Clinical Science, Philips Canada, Mississauga, Ontario, Canada, [19]Department of Human Oncology, University of Wisconsin-Madison, Madison, Wisconsin, USA, [20]Centre for Medical Image Computing, Department of Computer Science, University College London, London, UK, [21]Lysholm Department of Neuroradiology, National Hospital for Neurology and Neurosurgery, University College London Hospitals NHS Foundation Trust, London, UK, [22]Department of Biomedical Engineering, Case Western Reserve University, Cleveland, Ohio, USA, [23]Department of Medical Radiation Sciences, Institute of Clinical Sciences, Sahlgrenska Academy, University of Gothenburg, Gothenburg, Sweden, [24]Biomedical Engineering, Sahlgrenska University Hospital, Gothenburg, Sweden, [25]Center for Mind/Brain Sciences, University of Trento, Italy, [26]Hopital Maisonneuve-Rosemont, Montreal, Canada, [27]Bioengineering, Imperial College London, UK, [28]Radiotherapy and Imaging, Insitute of Cancer Research, Imperial College London, UK, [29]Research Institute of the McGill University Health Centre, Montreal, Canada, [30]Clinical Science, Philips Healthcare, Germany, [31]Department of Radiological Sciences, University of California Los Angeles, Los Angeles, CA, USA, [32]Physics and Biology in Medicine IDP, University of California Los Angeles, Los Angeles, CA, USA, [33]Douglas Brain Imaging Centre, Montreal, Canada, [34]Sunnybrook Research Institute, Toronto, Canada, [35]Computer Science Department, Centro de Investigación en Matemáticas, A.C., Guanajuato, México, [36]Medical Research Council, London Institute of Medical Sciences, Imperial College London, London, United Kingdom, [37]Department of Radiation Oncology - CNS Service, The University of Texas MD Anderson Cancer Center, Texas, USA, [38]Department of Biomedical Engineering, University of British Columbia, British Columbia, Canada, [39]Center for Advanced Interdisciplinary Research, Ss. Cyril and Methodius University, Skopje, North Macedonia

NeuroLibre 10.55458/neurolibre.00023

Abstract

Example: T1 challenge NeuroLibre preprint

NeuroLibre
Reproducible Preprint Server

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Parting Thoughts

Maximizing Impact

Looking Ahead

Online Resources

Ten steps to innovative dissemination

Ross-Hellauer et al. (2020), PLOS Comp. Biol. https://doi.org/10.1371/journal.pcbi.1007704

Maximizing impact: do’s and don’ts

Do

- Leverage communication platforms that you’re active in
- Create interactive content
- Be open
- Follow FAIR practices **F**indable **A**ccessible **I**nteroperable **R**eusable

Don’t

- Spam content repeatedly / too frequently
- Overburden yourself

Looking Ahead

First scientific journals

1665

Industrial and print revolution

1800s

Internet and the digital revolution

2000s

Artificial Intelligence 2020-2030s

Open science boom and social media

2010s

1700s

Age of enlightenment

1665

1700s

1798

First scientific conferences

17

1900s

Exponential growth of journals and conferences

1970s

Journals begin adopting peer review

GPT, CodePilot

Multi-step AI is coming

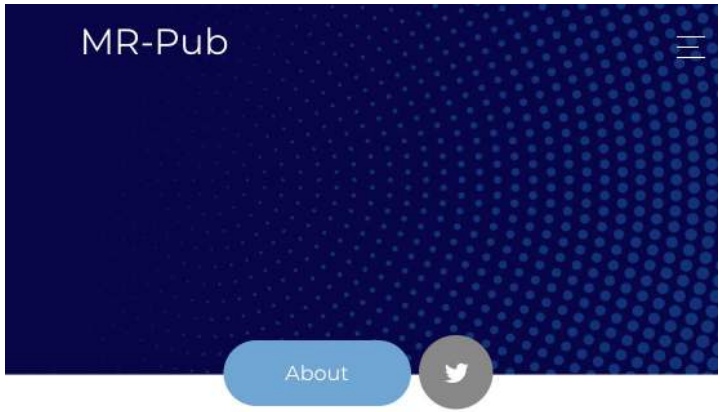
Auto-generated methods ?

AI-generated code/experiment setup from paper?

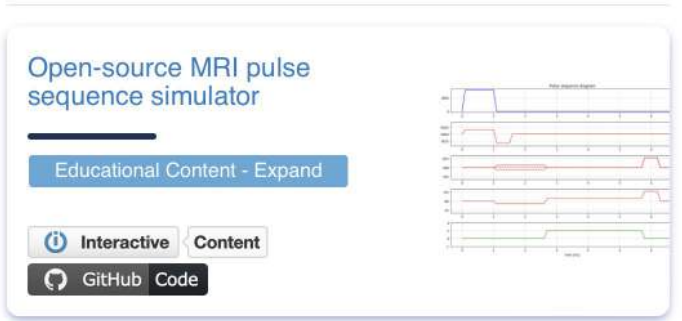
AI reviewers?

Online Resources

MR-Hub



open source imaging



Open Source in Lab Management

Julien Cohen-Adad

NeuroPoly

POLYTECHNIQUE MONTRÉAL

Thursday, 09 May 2024
07:00 - 08:00
Room 325-326

MRM Highlights

MRM Highlights Magazine & Blog

Q&A OSIPI LEADERSHIP: LAURA BELL, BEN DICKIE, PETRA VAN HOUDT, HENK MUTSAERTS, AND YURIKO SUZUKI

The road to the ISMRM OSIPI: A community-led initiative for reproducible perfusion MRI

INTERVIEW BY **MATHIEU BOUDREAU**

EDITOR'S PICK FOR JUNE This MRM Highlights Pick interview is with current and past members of the ISMRM Open Science Initiative for Perfusion Imaging (OSIPI) leadership, **Laura Bell** (Genentech), **Ben Dickie** (University of Manchester), **Petra van Houdt** (the Netherlands Cancer Institute), **Henk Mutsaerts** (Amsterdam University Medical Center), and **Yuriko Suzuki** (University of Oxford). Their first two-year roadmap has resulted in a collection of MRM publications

important effort. I gave them some feedback and ideas which they liked, apparently enough to want me to join the OSIPI leadership when I was the trainee representative of the ISMRM Perfusion Study Group.

Yuriko: I first started working in MRI as a clin

OSIPI

Clockwise from above: OSIPI logo, Laura Bell, Petra van Houdt, Yuriko Suzuki, Ben Dickie, Henk Mutsaerts.

Highlights Afterparty

May 9th at BluJaz Cafe, 11 Bali Ln,

Acknowledgements

Nikola Stikov

Julien Cohen-Adad

Agah Karakuzu

NeuroPoly

POLYTECHNIQUE MONTRÉAL

QBIN
QUEBEC BIO-IMAGING NETWORK

INSTITUT DE CARDIOLOGIE DE MONTRÉAL

qMR Lab
Quantitative MRI. Under one umbrella.

CONP PCNO

NeuroLibre
A preprint server for interactive data analyses