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CERN, IT Department

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EASITrain Lectures Spring 2018, CERN, Geneva, March 07, 2018

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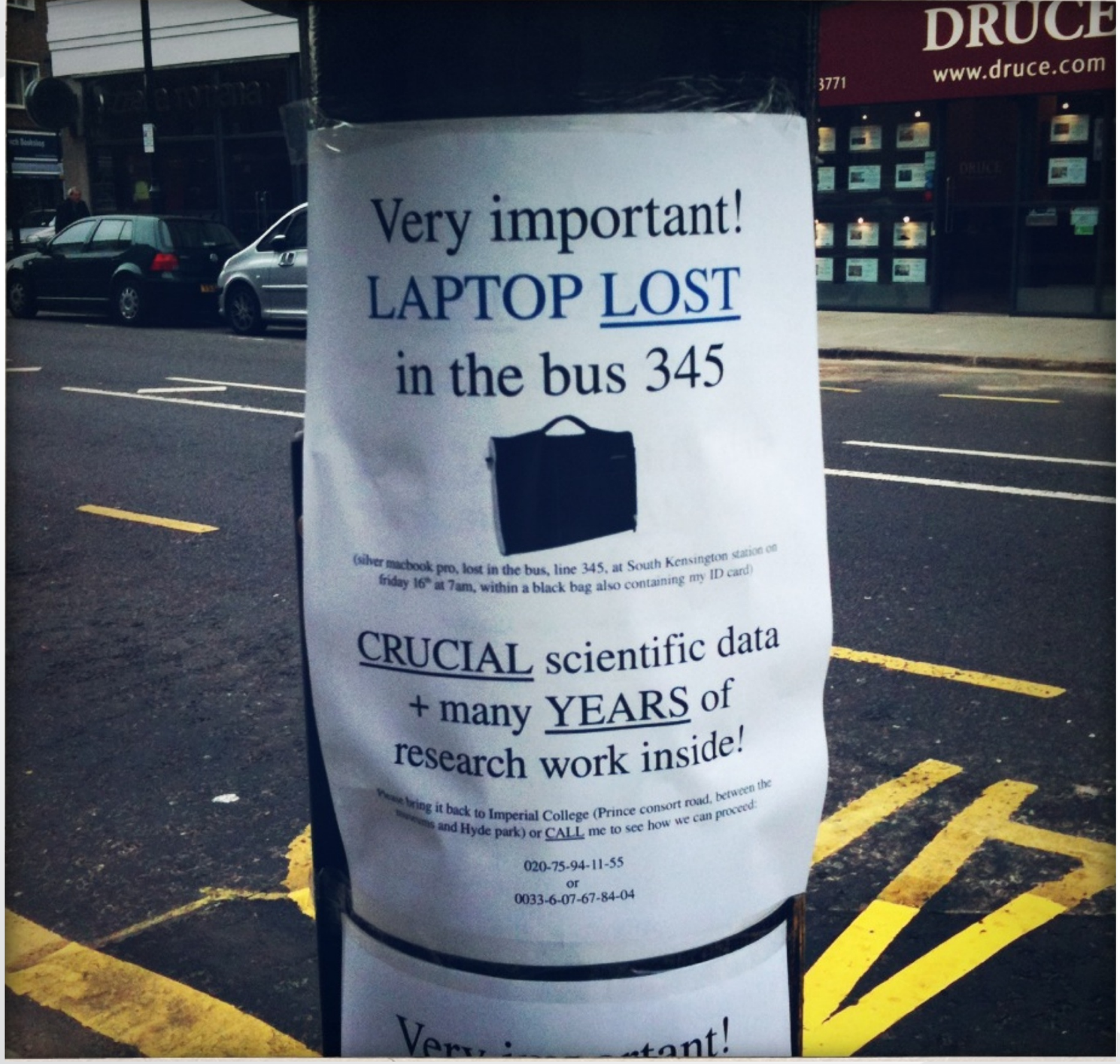

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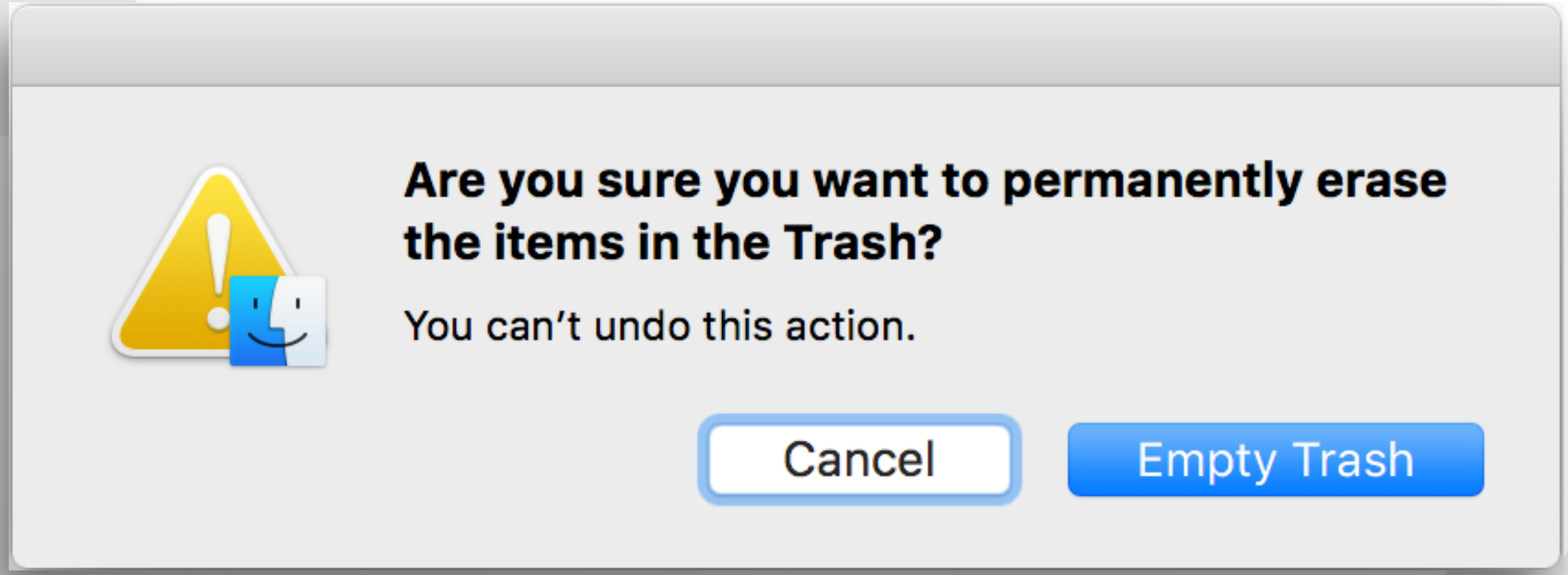
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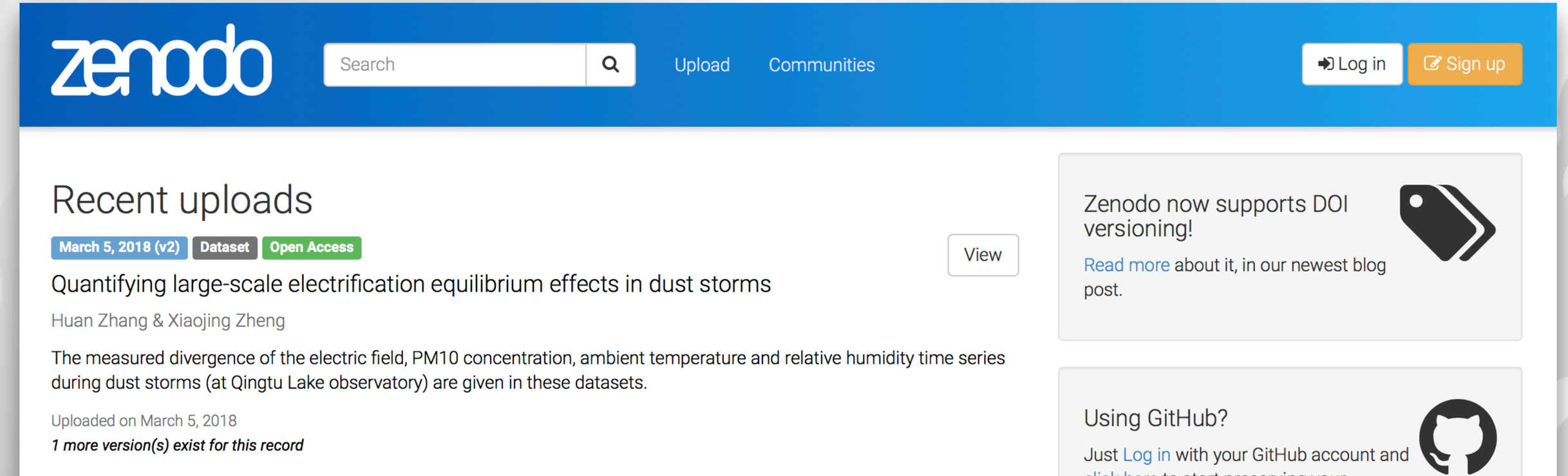

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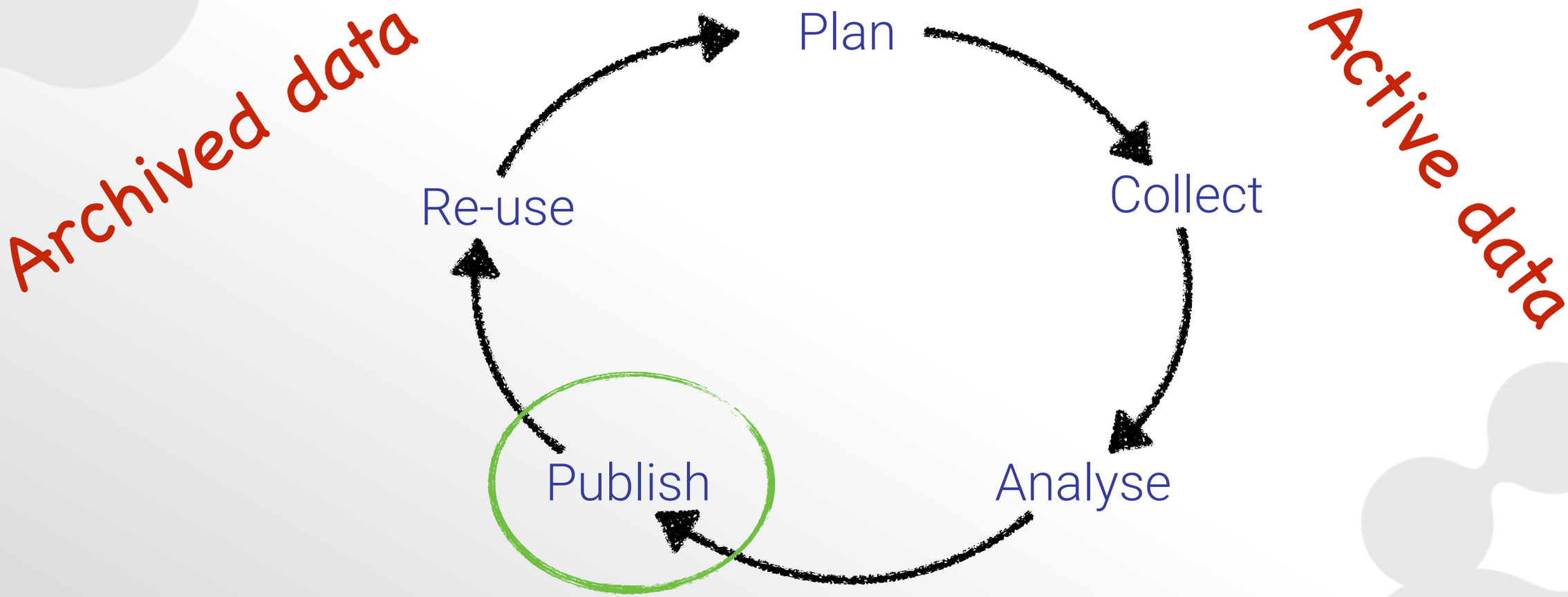

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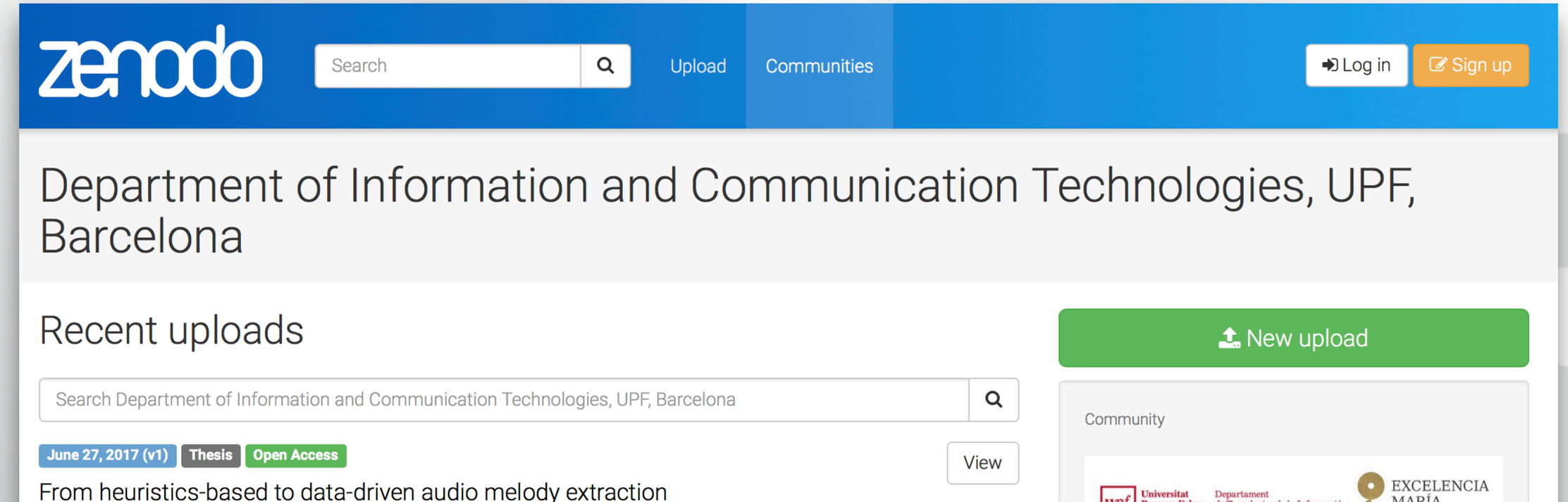

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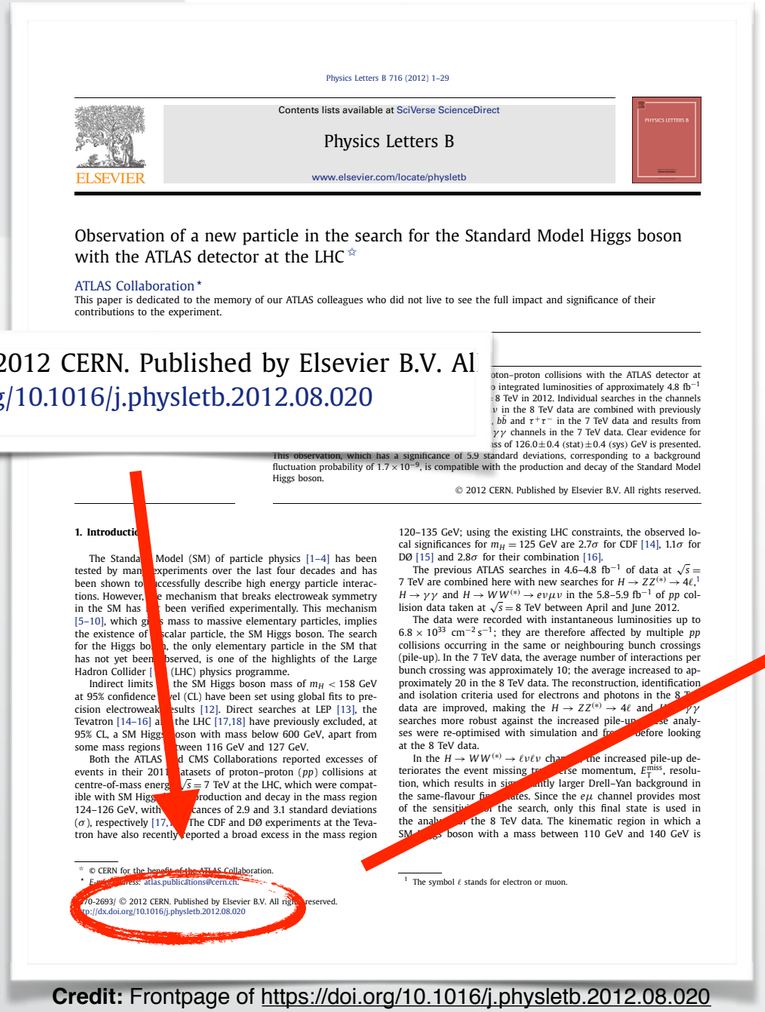

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Observation of a new particle in the search for the Standard Model Higgs boson with the ATLAS detector at the LHC ☆

ATLAS Collaboration *

This paper is dedicated to the memory of our ATLAS colleagues who did not live to see the full impact and significance of their contributions to the experiment.

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http://dx.doi.org/10.1016/j.physletb.2012.08.020

This observation, which has a significance of 5.9 standard deviations, corresponding to a background fluctuation probability of 1.7×10^{-9}, is compatible with the production and decay of the Standard Model Higgs boson.

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1. Introductio

The Standa Model (SM) of particle physics [1–4] has been tested by man experiments over the last four decades and has been shown to successfully describe high energy particle interactions. However, e mechanism that breaks electroweak symmetry in the SM has t been verified experimentally. This mechanism [5–10], which g s mass to massive elementary particles, implies the existence of scalar particle, the SM Higgs boson. The search for the Higgs bo on, the only elementary particle in the SM that has not yet been observed, is one of the highlights of the Large Hadron Collider (LHC) physics programme.

Indirect limits the SM Higgs boson mass of $m_H < 158$ GeV at 95% confidence el (CL) have been set using global fits to precision electroweak results [12]. Direct searches at LEP [13], the Tevatron [14–16] a the LHC [17,18] have previously excluded, at 95% CL, a SM Higgs oson with mass below 600 GeV, apart from some mass regions tween 116 GeV and 127 GeV.

Both the ATLAS nd CMS Collaborations reported excesses of events in their 201 datasets of proton–proton (pp) collisions at centre-of-mass energ $\sqrt{s} = 7$ TeV at the LHC, which were compatible with SM Higg production and decay in the mass region 124–126 GeV, with ficances of 2.9 and 3.1 standard deviations (σ), respectively [17,1 The CDF and DØ experiments at the Tevatron have also recently reported a broad excess in the mass region 120–135 GeV; using the existing LHC constraints, the observed local significances for $m_H = 125$ GeV are 2.7σ for CDF [14], 1.1σ for DØ [15] and 2.8σ for their combination [16].

The previous ATLAS searches in 4.6–4.8 fb^{-1} of data at $\sqrt{s} = 7$ TeV are combined here with new searches for $H \to ZZ^{(*)} \to 4\ell$,[1] $H \to \gamma\gamma$ and $H \to WW^{(*)} \to e\nu\mu\nu$ in the 5.8–5.9 fb^{-1} of pp collision data taken at $\sqrt{s} = 8$ TeV between April and June 2012.

The data were recorded with instantaneous luminosities up to 6.8×10^{33} cm^{-2} s^{-1}; they are therefore affected by multiple pp collisions occurring in the same or neighbouring bunch crossings (pile-up). In the 7 TeV data, the average number of interactions per bunch crossing was approximately 10; the average increased to approximately 20 in the 8 TeV data. The reconstruction, identification and isolation criteria used for electrons and photons in the 8 TeV data are improved, making the $H \to ZZ^{(*)} \to 4\ell$ and $H \to \gamma\gamma$ searches more robust against the increased pile-up. These analyses were re-optimised with simulation and frozen before looking at the 8 TeV data.

In the $H \to WW^{(*)} \to \ell\nu\ell\nu$ channel, the increased pile-up deteriorates the event missing transverse momentum, $E_T^{\rm miss}$, resolution, which results in significantly larger Drell–Yan background in the same-flavour final states. Since the $e\mu$ channel provides most of the sensitivity for the search, only this final state is used in the analysis of the 8 TeV data. The kinematic region in which a SM Higgs boson with a mass between 110 GeV and 140 GeV is

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[1] The symbol ℓ stands for electron or muon.

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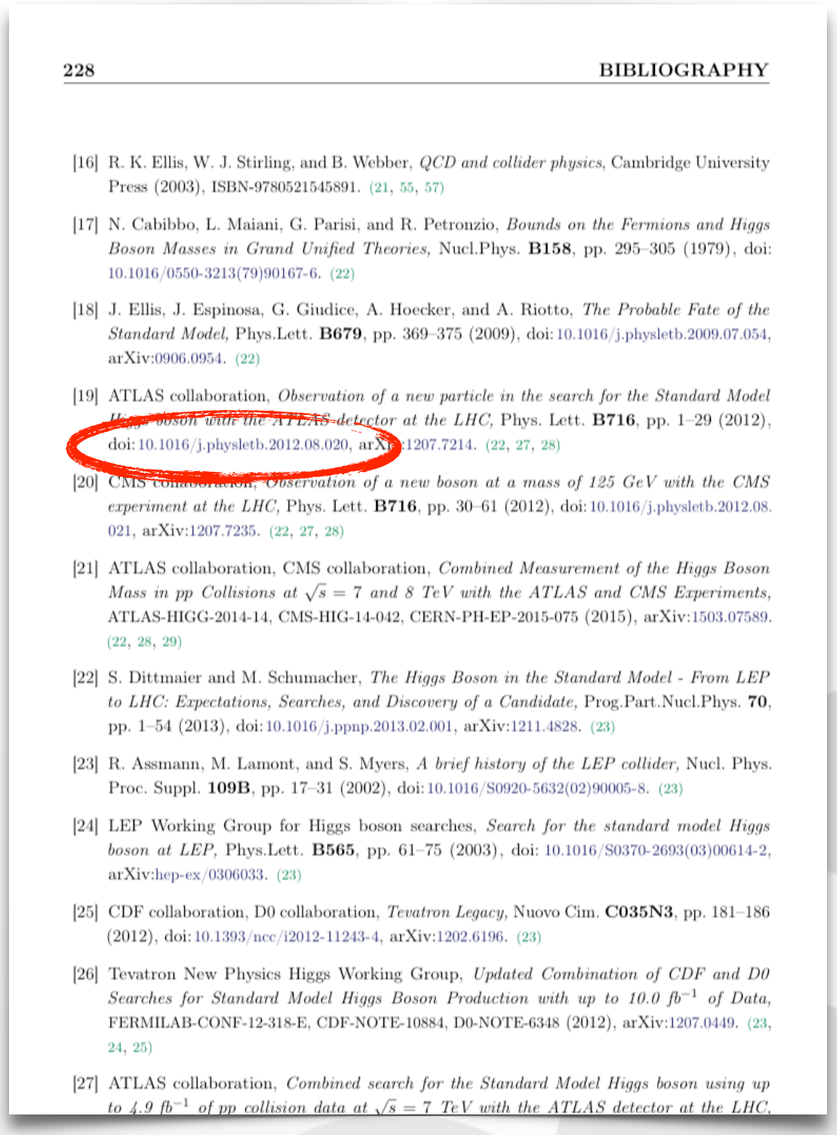

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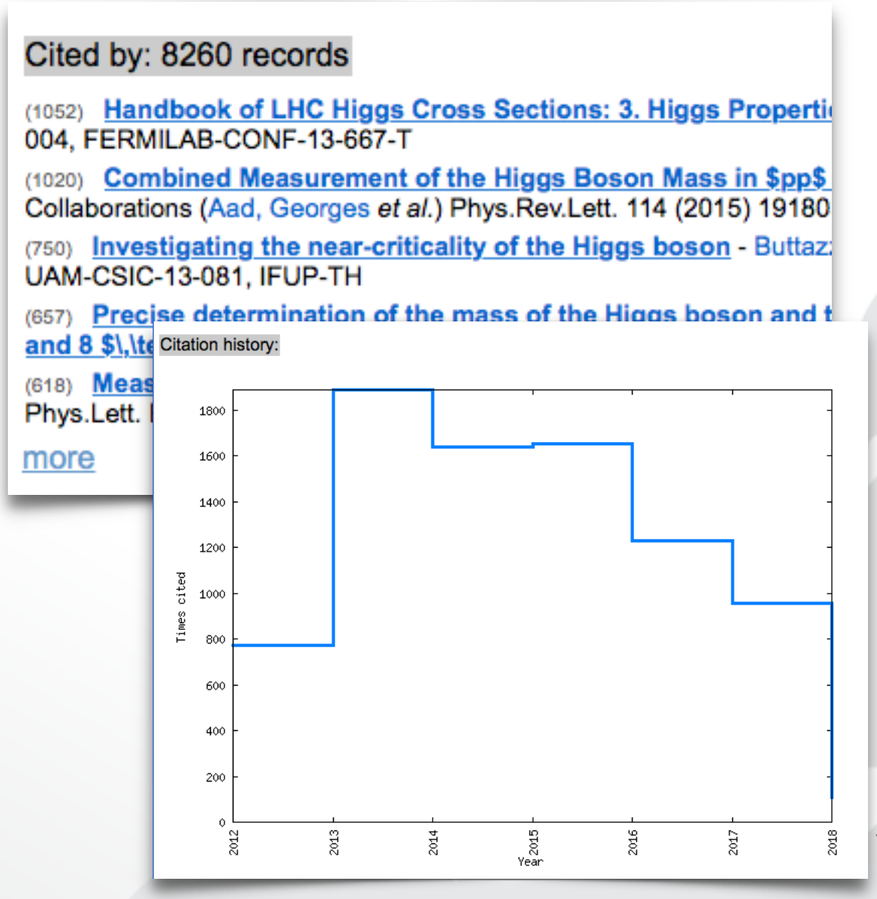

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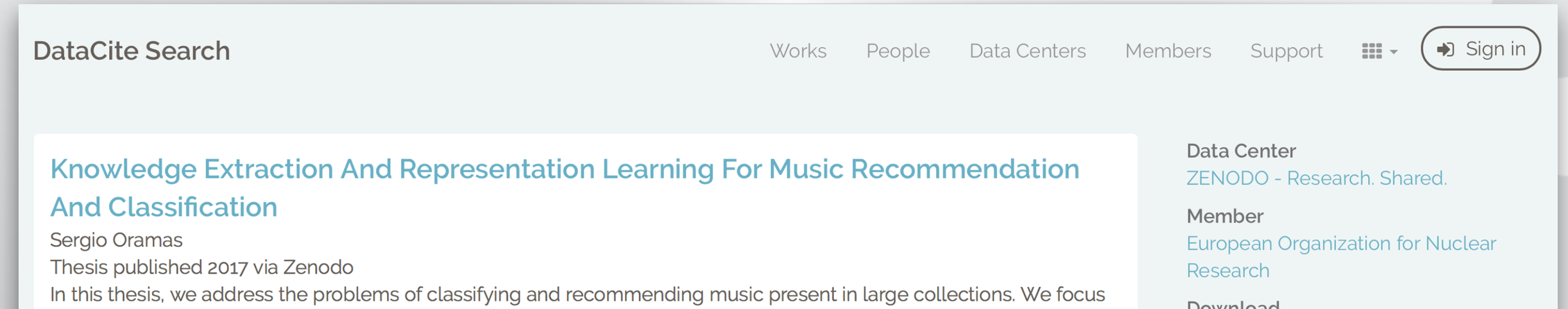

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Polyphonic Pitch Estimation and Instrument Identification by Joint Modeling of Sustained and Attack Sounds

6
Author(s)

Jun Wu ; E. Vincent ; S. A. Raczynski ; T. Nishimoto ; N. Ono ; S. Sagayama

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Abstract:
Polyphonic pitch estimation and musical instrument identification are some of the most challenging ta
(MIR). While existing approaches have focused on the modeling of harmonic partials, we design a joi
partials and the inharmonic attack of each note. This model encodes the power of each partial over time as we
attack part. We derive an expectation-maximization (EM) algorithm to estimate the pitch and the parameter
features both from the harmonic and the attack part via principal component analysis (PCA) over the estima
instrument recognition for each estimated note is finally carried out with a support vector machine (SVM) c
mixtures of isolated notes as well as real-world polyphonic music show higher accuracy over state-of-th
harmonic partials only.

Published in: IEEE Journal of Selected Topics in Signal Processing (Volume: 5, Issue: 6, Oct. 201)

Page(s): 1124 - 1132

INSPEC Accession Number: 12228466

Date of Publication: 31 May 2011

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Polyphonic Pitch Estimation and Instrument Identification by Joint Modeling of Sustained and Attack Sounds

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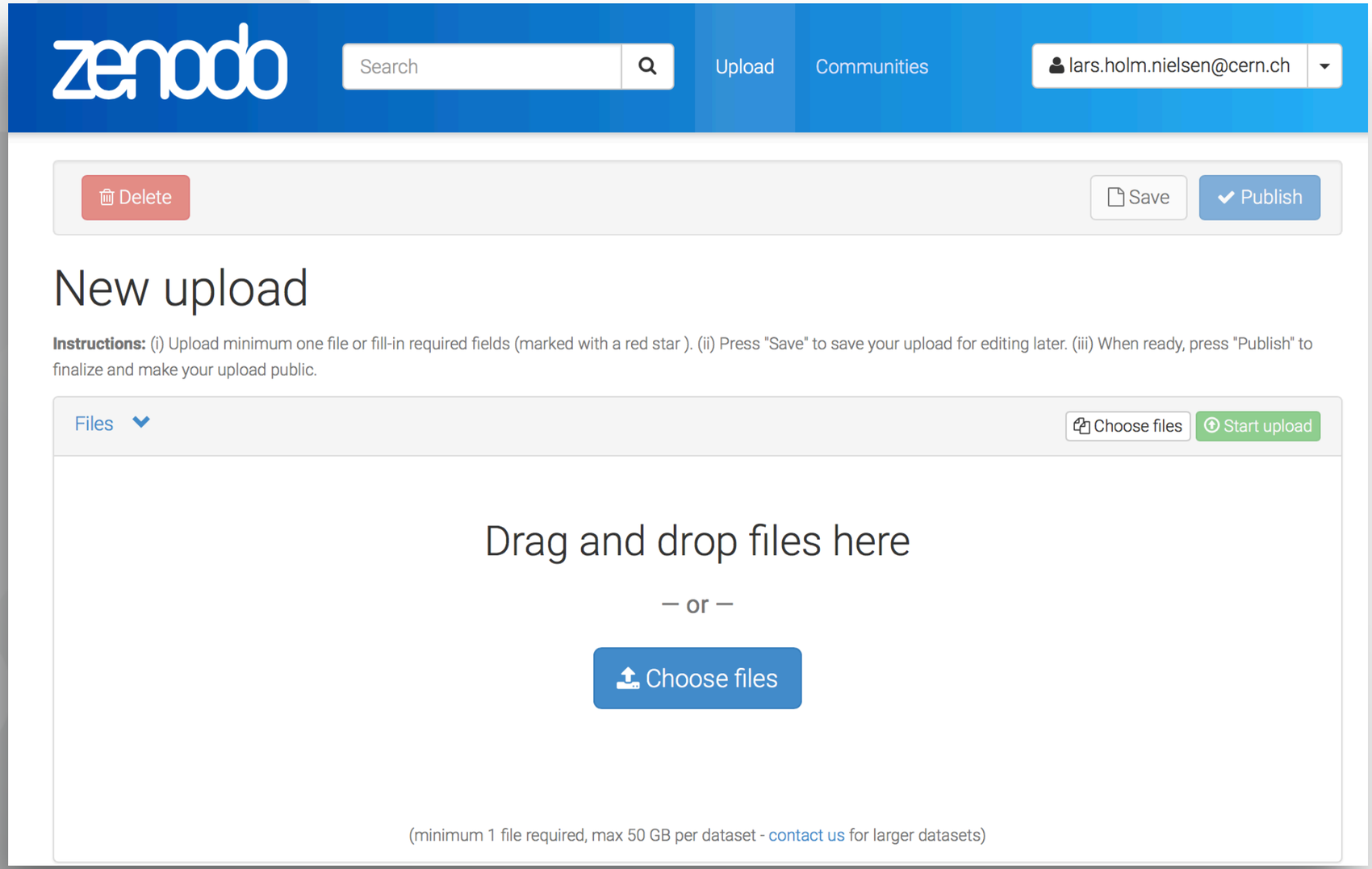

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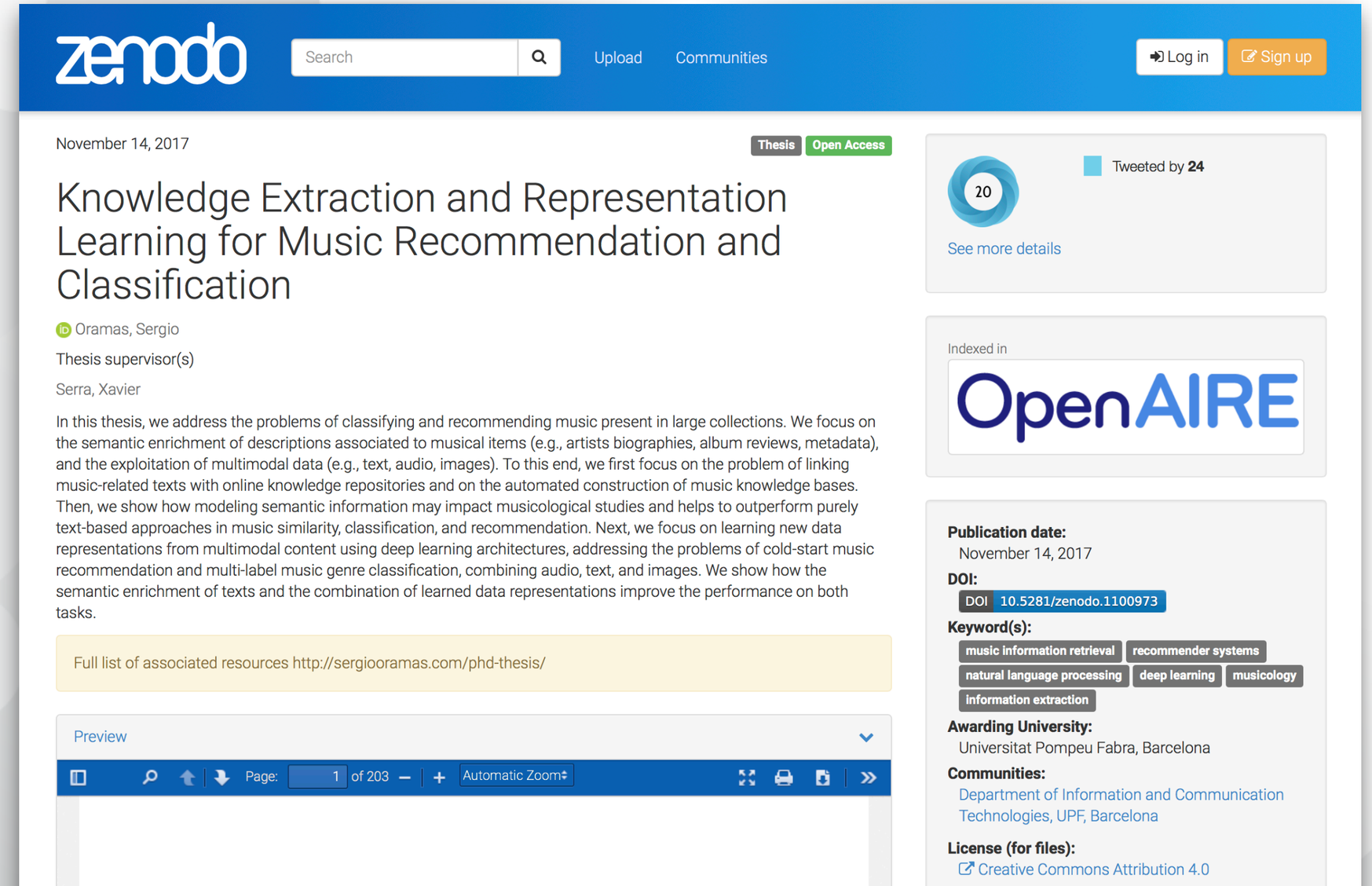

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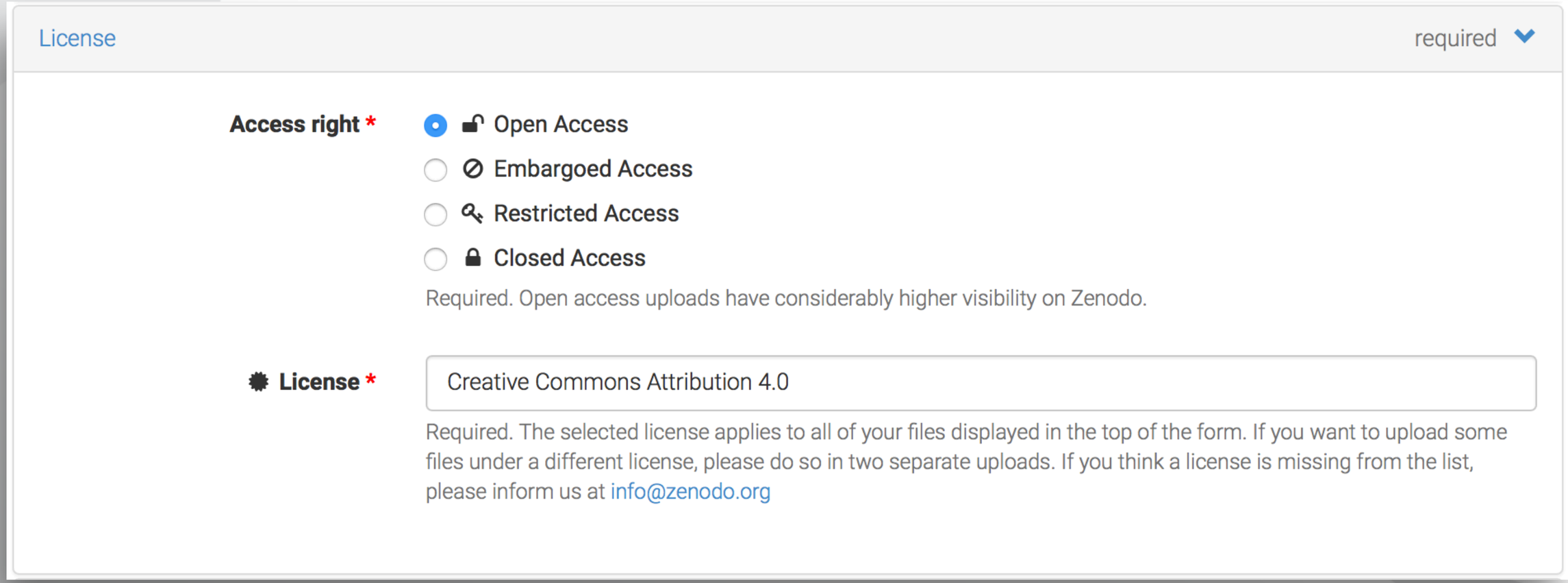

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Early detection of human glioma sphere xenografts in mouse brain using diffusion MRI at 14.1 T

Porcari, P; Hegi, M E; Lei, H; Hamou, M-F; Vassallo, I; Capuani, S; Gruetter, R; Mlynarik, V

Glioma models have provided important insights into human brain cancers. Among the investigative tools, MRI has allowed their characterization and diagnosis. In this study, we investigated whether diffusion MRI might be a useful technique for early detection and characterization of slow-growing and diffuse infiltrative gliomas, such as the proposed new models, LN-2669GS and LN-2540GS glioma sphere xenografts. Tumours grown in these models are not visible in conventional T2 -weighted or contrast-enhanced T1 -weighted MRI at 14.1 T. Diffusion-weighted imaging and diffusion tensor imaging protocols were optimized for contrast by exploring long diffusion times sensitive for probing the microstructural alterations induced in the normal brain by the slow infiltration of glioma sphere cells. Compared with T2 -weighted images, tumours were properly identified in their early stage of growth using diffusion MRI, and confirmed by localized proton MR spectroscopy as well as immunohistochemistry. The first evidence of tumour presence was revealed for both glioma sphere xenograft models three months after tumour implantation, while no necrosis, oedema or haemorrhage were detected either by MRI or by histology. Moreover, different values of diffusion indices, such as mean diffusivity and fractional anisotropy, were obtained in tumours grown from LN-2669GS and LN-2540GS glioma sphere lines. These observations highlighted diverse tumour microstructures for both xenograft models, which were reflected in histology. This study demonstrates the ability of diffusion MRI techniques to identify and investigate early stages of slow-growing, invasive tumours in the mouse brain, thus providing a potential imaging biomarker for early detection of tumours in humans.

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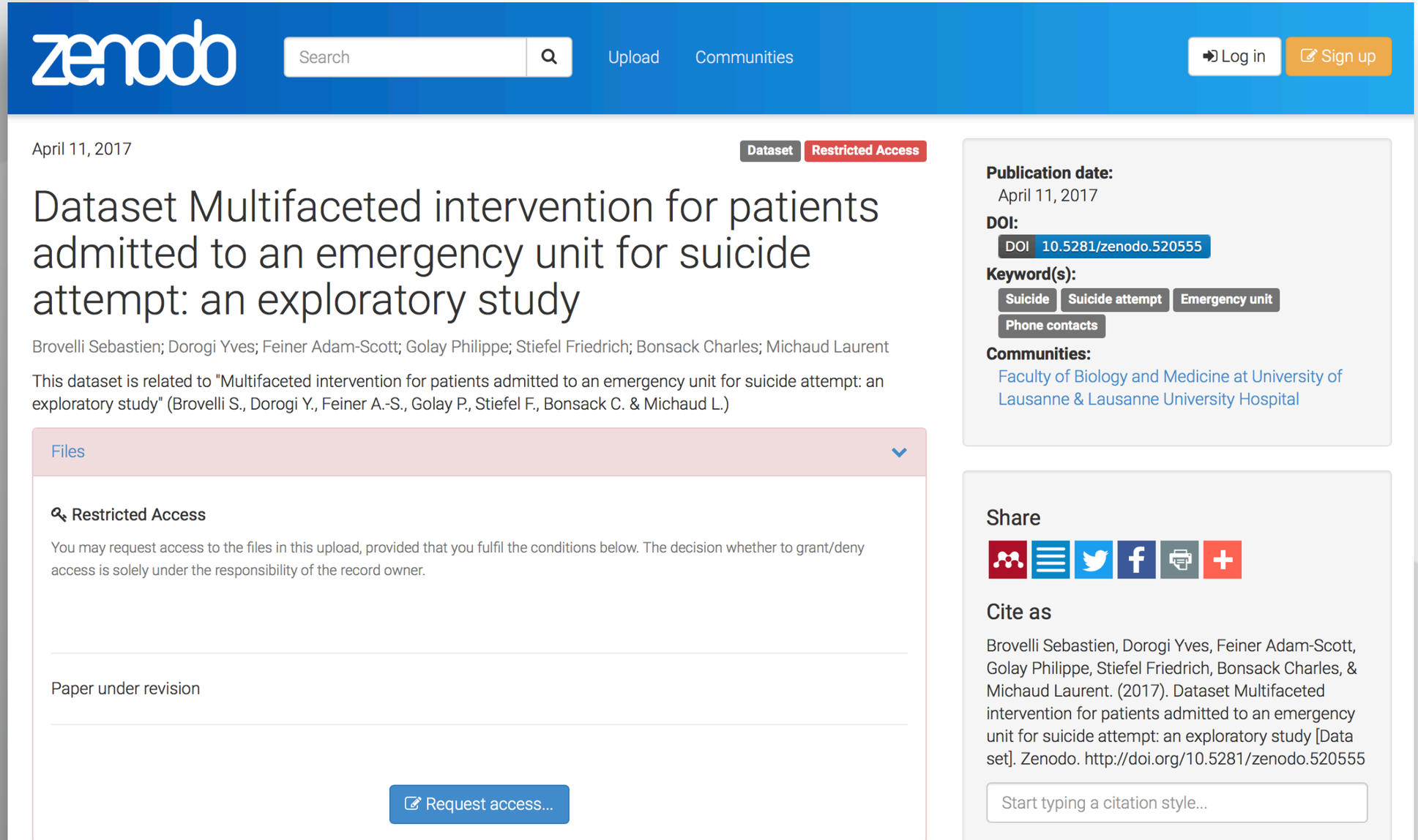

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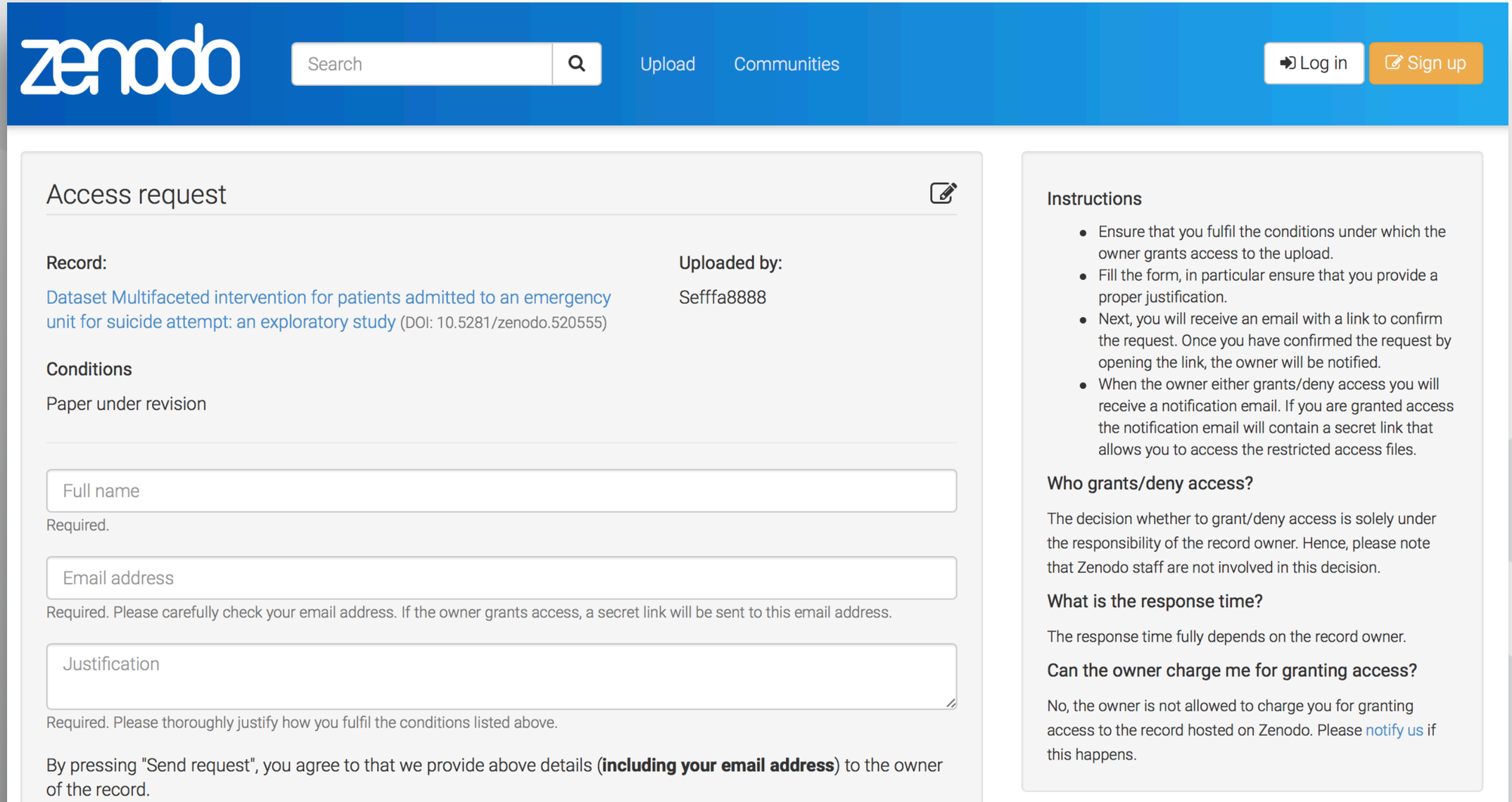

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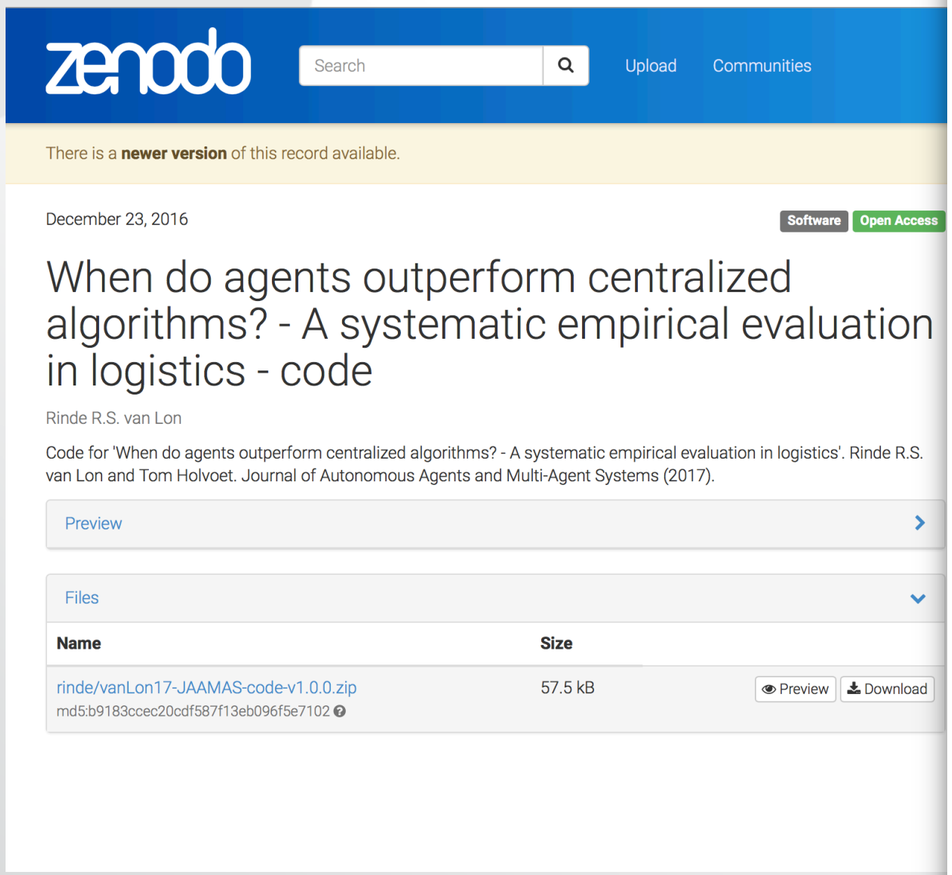
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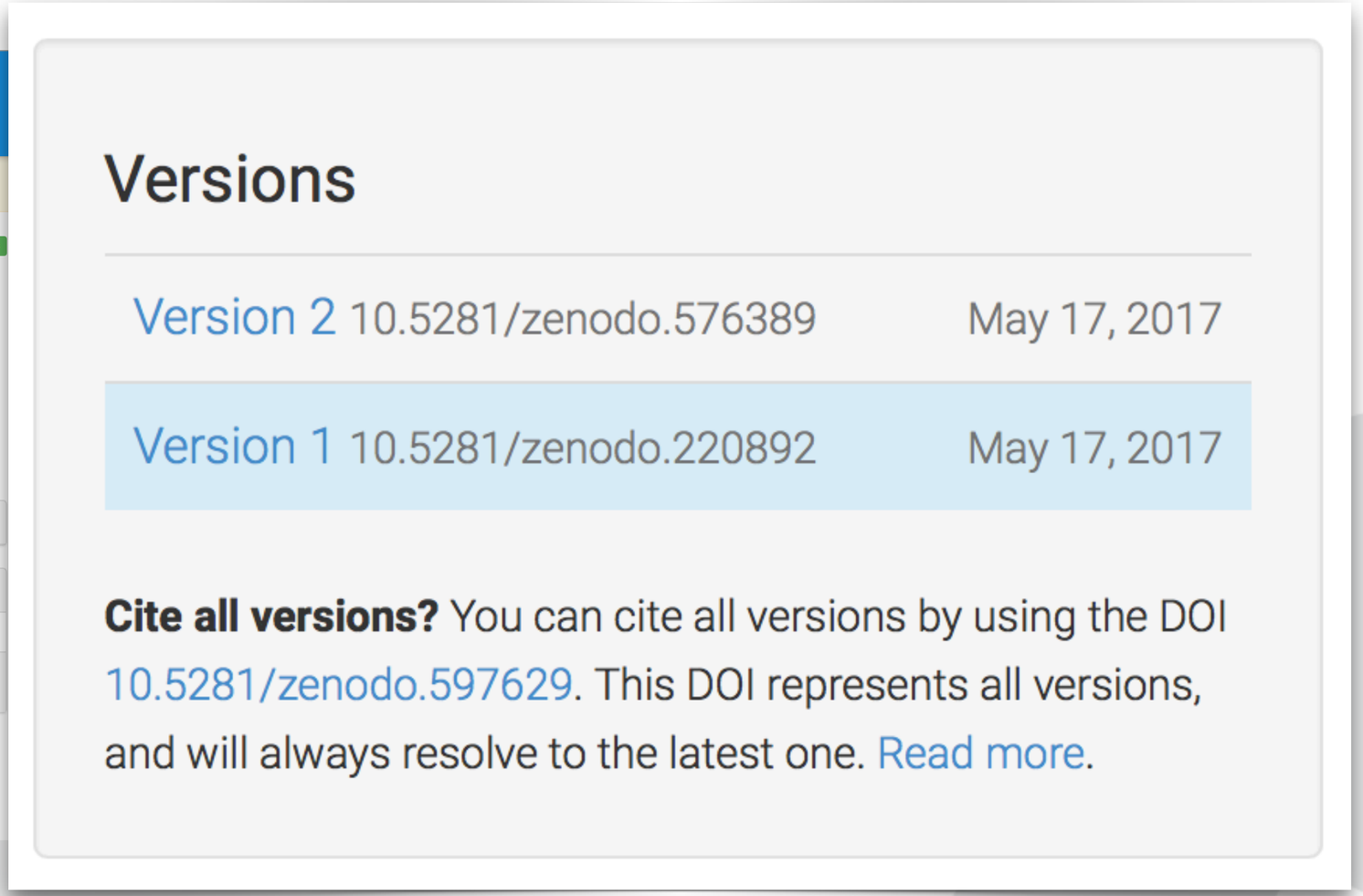
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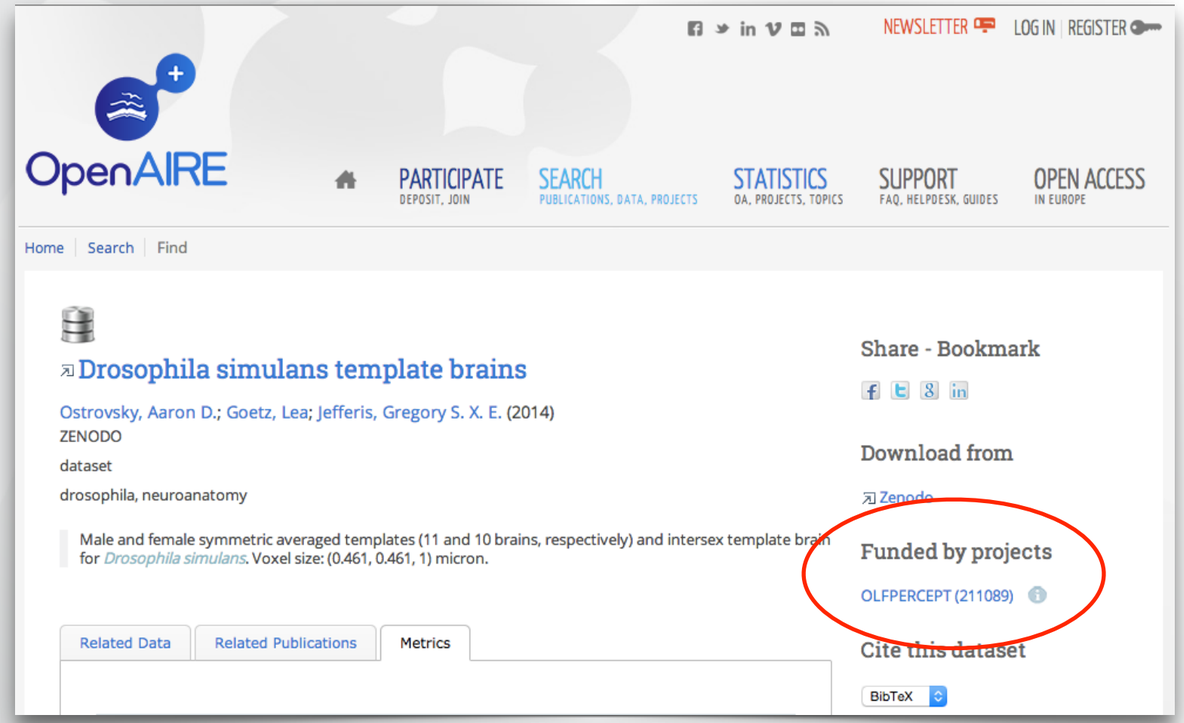
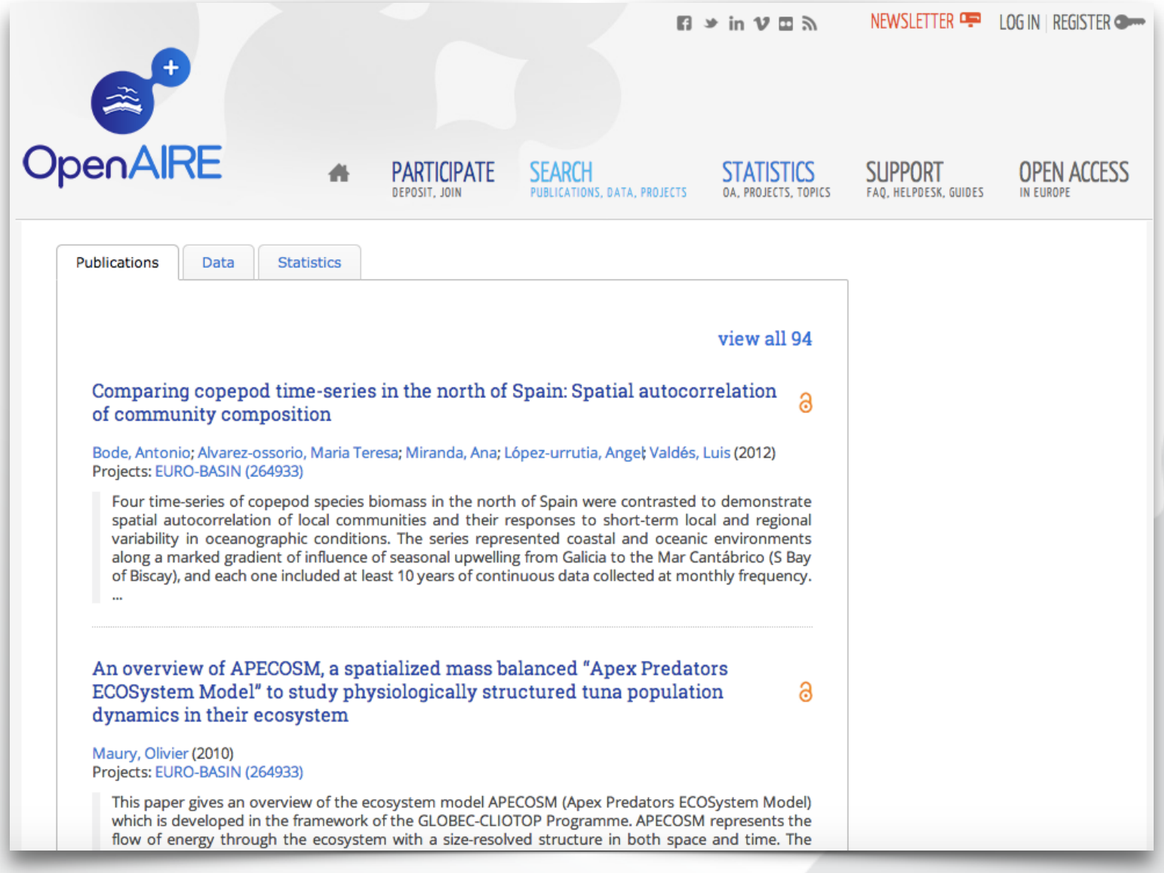
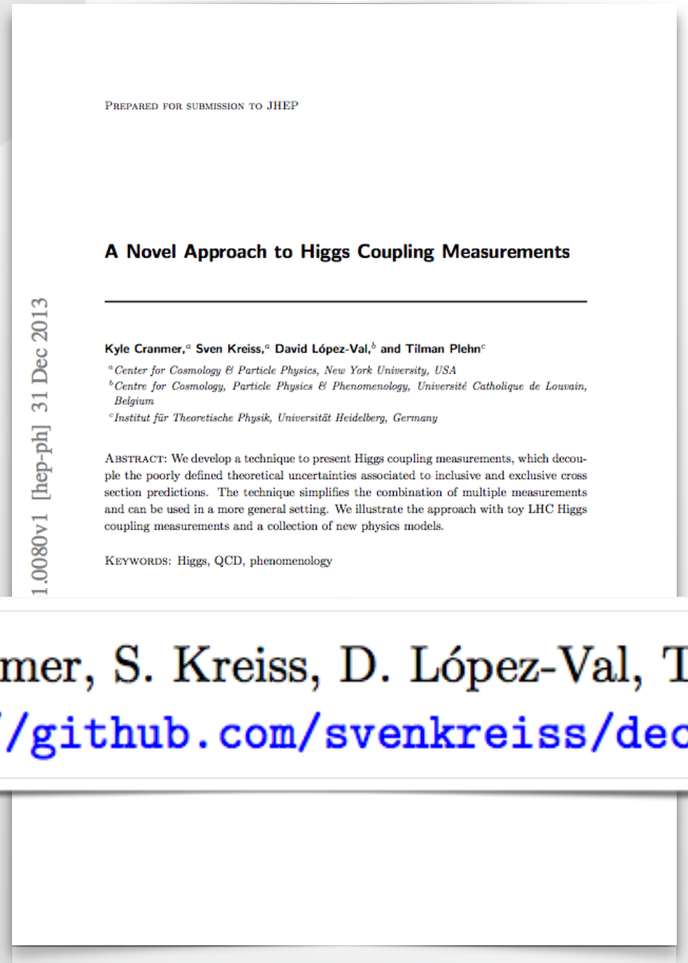




GitHub



Prepared for submission to JHEP

A Novel Approach to Higgs Coupling Measurements

Kyle Cranmer,[a] Sven Kreiss,[a] David López-Val,[b] and Tilman Plehn[c]

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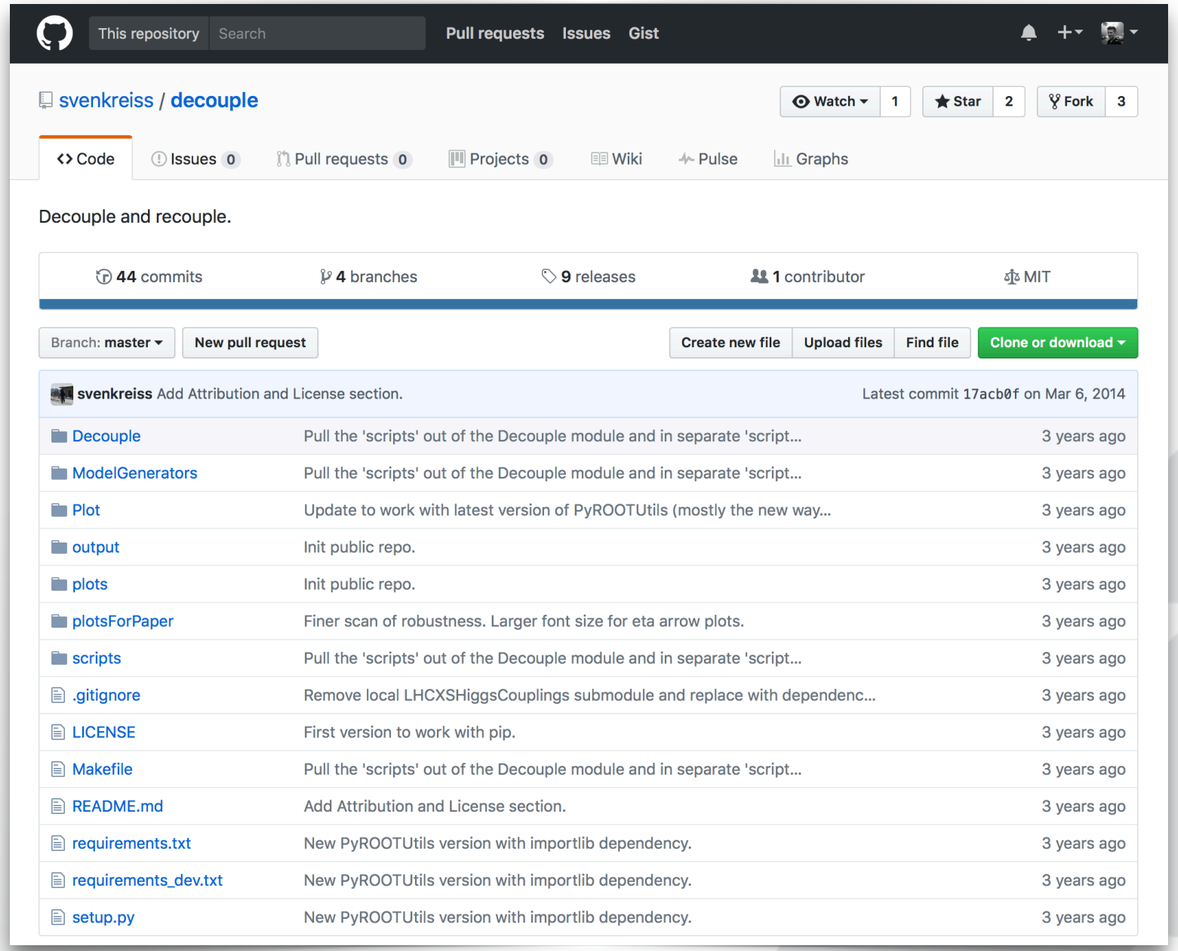
[b] *Centre for Cosmology, Particle Physics & Phenomenology, Université Catholique de Louvain, Belgium*
[c] *Institut für Theoretische Physik, Universität Heidelberg, Germany*

Abstract: We develop a technique to present Higgs coupling measurements, which decouple the poorly defined theoretical uncertainties associated to inclusive and exclusive cross section predictions. The technique simplifies the combination of multiple measurements and can be used in a more general setting. We illustrate the approach with toy LHC Higgs coupling measurements and a collection of new physics models.

Keywords: Higgs, QCD, phenomenology

[25] K. Cranmer, S. Kreiss, D. López-Val, T. Plehn, https://github.com/svenkreiss/decouple.



This repository Search Pull requests Issues Gist

svenkreiss / decouple

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Code Issues 0 Pull requests 0 Projects 0 Wiki Pulse Graphs

Decouple and recouple.

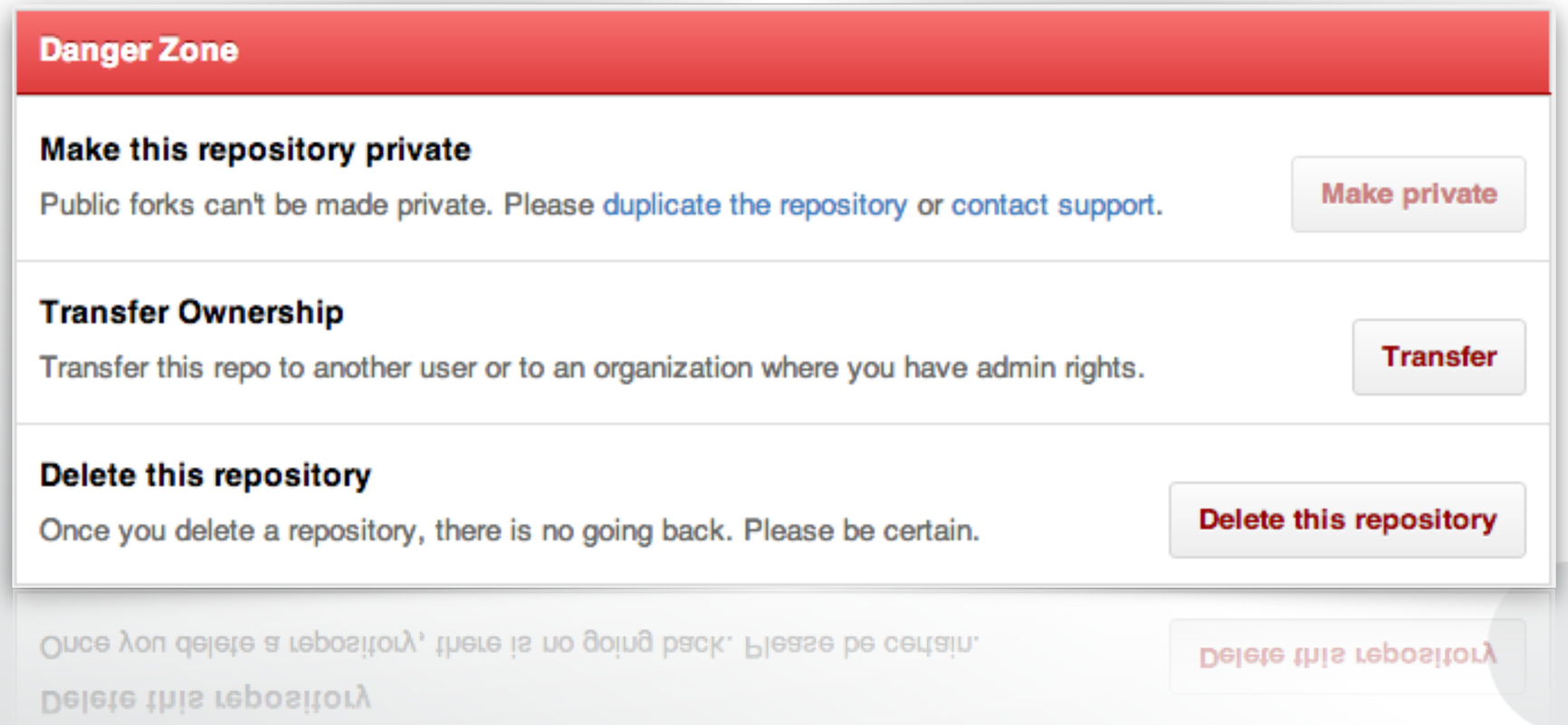
44 commits 4 branches 9 releases 1 contributor MIT

Branch: master New pull request Create new file Upload files Find file Clone or download

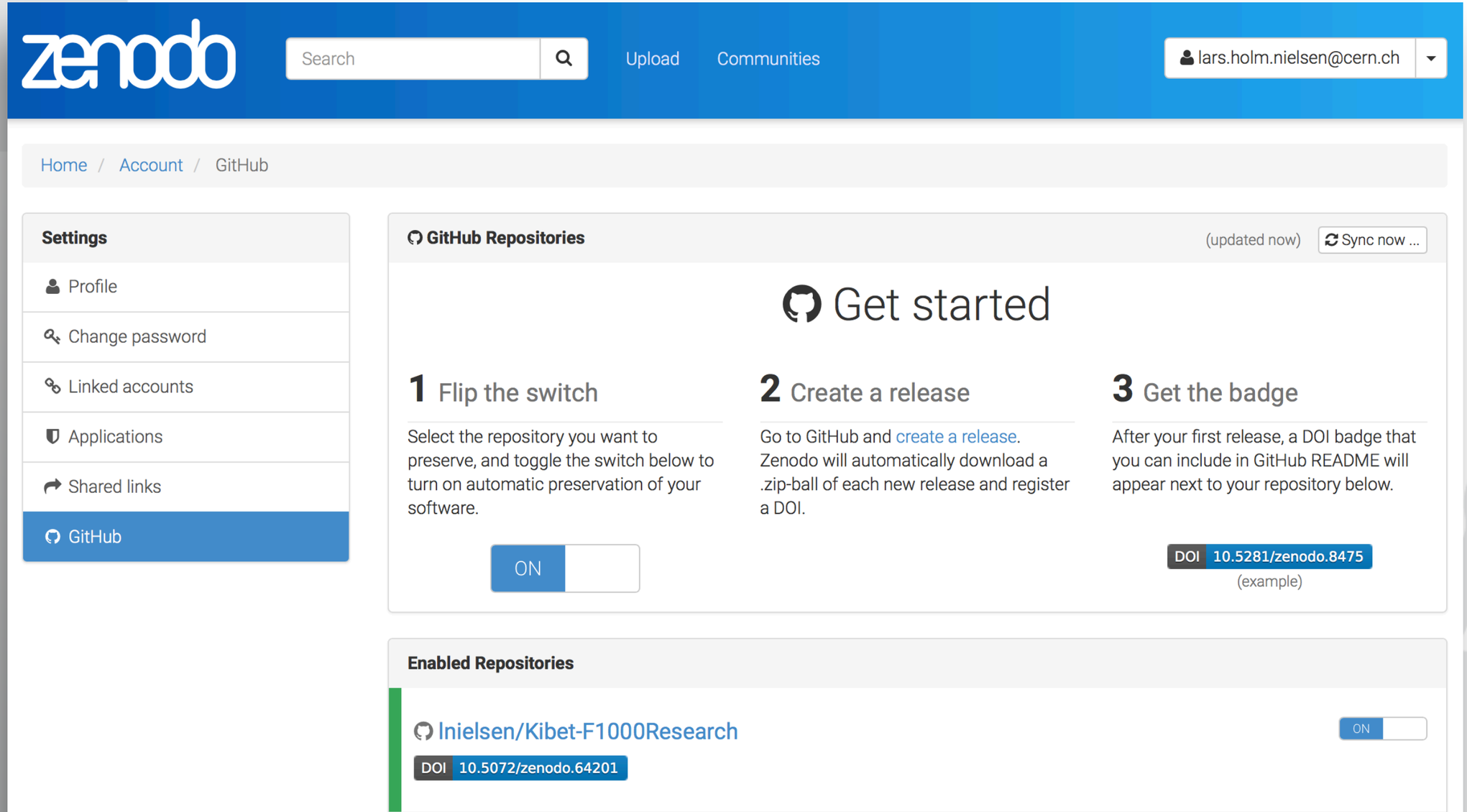
svenkreiss Add Attribution and License section. Latest commit 17acb0f on Mar 6, 2014

Decouple	Pull the 'scripts' out of the Decouple module and in separate 'script...	3 years ago
ModelGenerators	Pull the 'scripts' out of the Decouple module and in separate 'script...	3 years ago
Plot	Update to work with latest version of PyROOTUtils (mostly the new way...	3 years ago
output	Init public repo.	3 years ago
plots	Init public repo.	3 years ago
plotsForPaper	Finer scan of robustness. Larger font size for eta arrow plots.	3 years ago
scripts	Pull the 'scripts' out of the Decouple module and in separate 'script...	3 years ago
.gitignore	Remove local LHCXSHiggsCouplings submodule and replace with dependenc...	3 years ago
LICENSE	First version to work with pip.	3 years ago
Makefile	Pull the 'scripts' out of the Decouple module and in separate 'script...	3 years ago
README.md	Add Attribution and License section.	3 years ago
requirements.txt	New PyROOTUtils version with importlib dependency.	3 years ago
requirements_dev.txt	New PyROOTUtils version with importlib dependency.	3 years ago
setup.py	New PyROOTUtils version with importlib dependency.	3 years ago

GitHub + Research



GitHub + Zenodo



GitHub + Zenodo

lnielsen/decouple

ON

DOI 10.5281/zenodo.582569

GitHub / Releases

Create release ...

v50 lnielsen/decouple: Test release

Published

DOI: 10.5281/zenodo.582569

8 months ago

Test release

Payload | Metadata

JSON Export

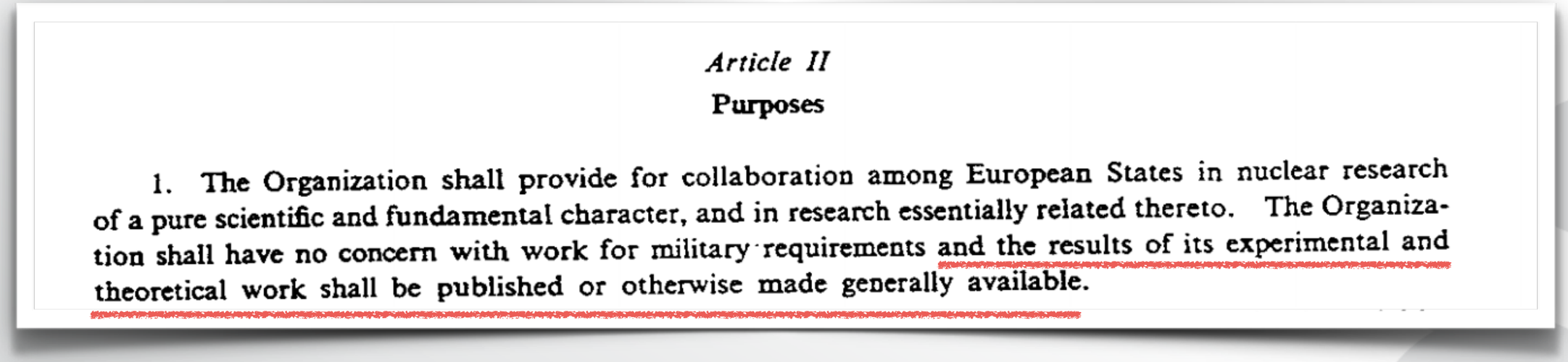
Zenodo automatically extracts metadata about your repository from GitHub APIs. For example, the authors are determined from the repository's contributor statistics. The automatic extraction is **solely a best guess**. Add a `.zenodo.json` file the root of your repository to explicit define the metadata. The format of file is the same as for our REST API (use e.g. below JSON to get started).

```
{
    "description": "This repository contains the software implementation for our paper A Novel Appro
ach to Higgs Coupling Measurements (Cranmer, Kreiss, Lopez-Val, Plehn), arXiv:1401.0080 [hep-ph]. It
 contains tools to apply the discussed methods to new models and contains a Makefile to recreate the
```

CERN?

Zenodo is offered by CERN as part of its mission to

make available the results of its work

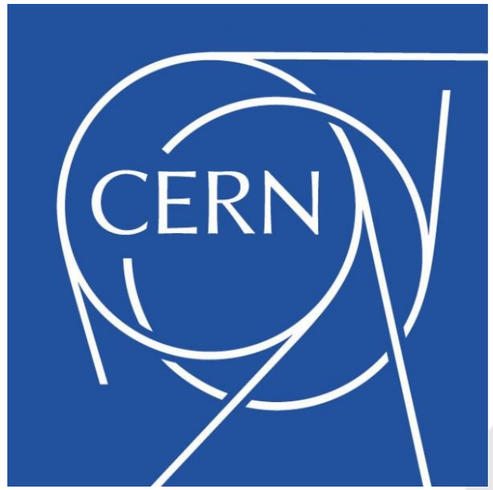


Article II

Purposes

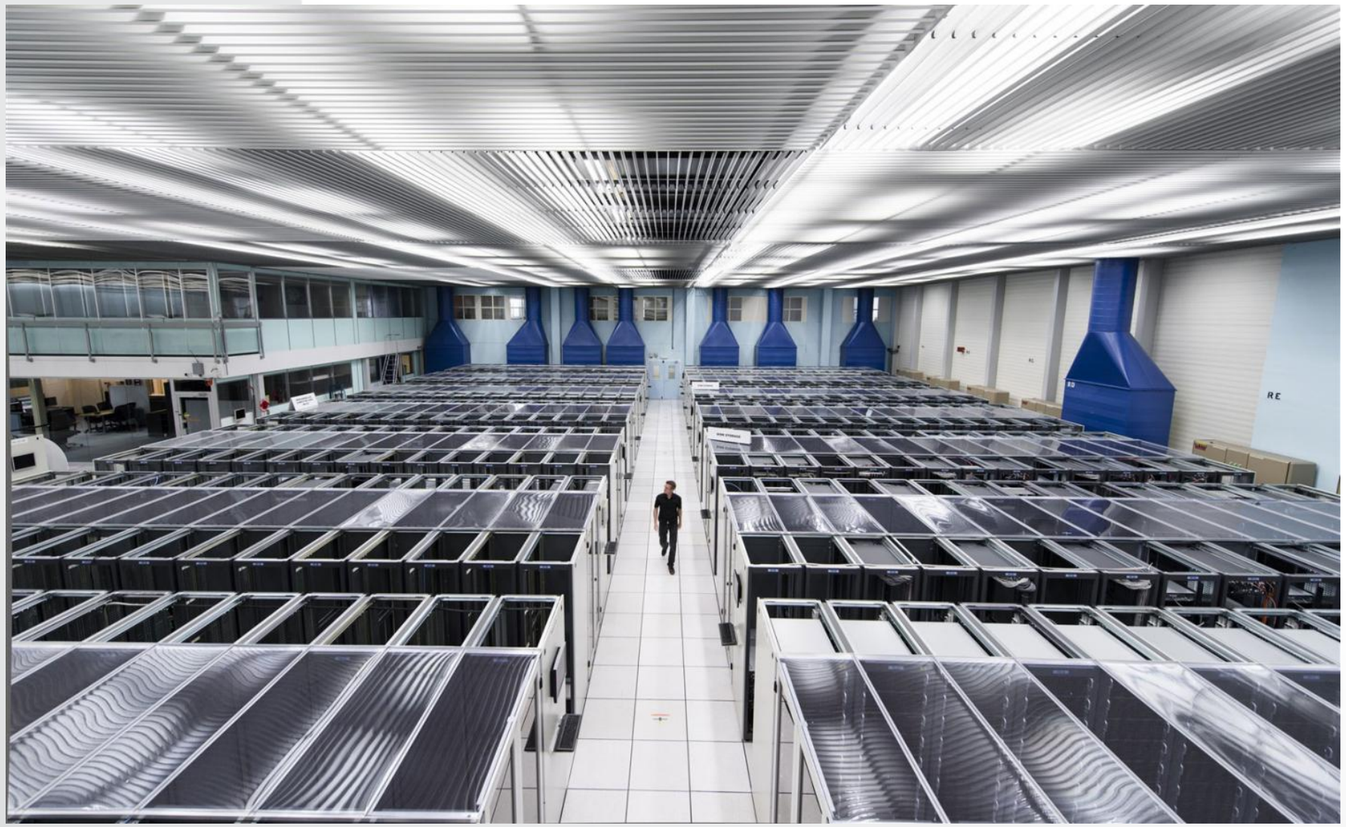
1. The Organization shall provide for collaboration among European States in nuclear research of a pure scientific and fundamental character, and in research essentially related thereto. The Organization shall have no concern with work for military requirements and the results of its experimental and theoretical work shall be published or otherwise made generally available.

Funded by



Alfred P. Sloan
FOUNDATION

Behind Zenodo



<u>CERN Data Centre</u>

- ~300PB disk
- ~200PB tape
- ~110k CPUs

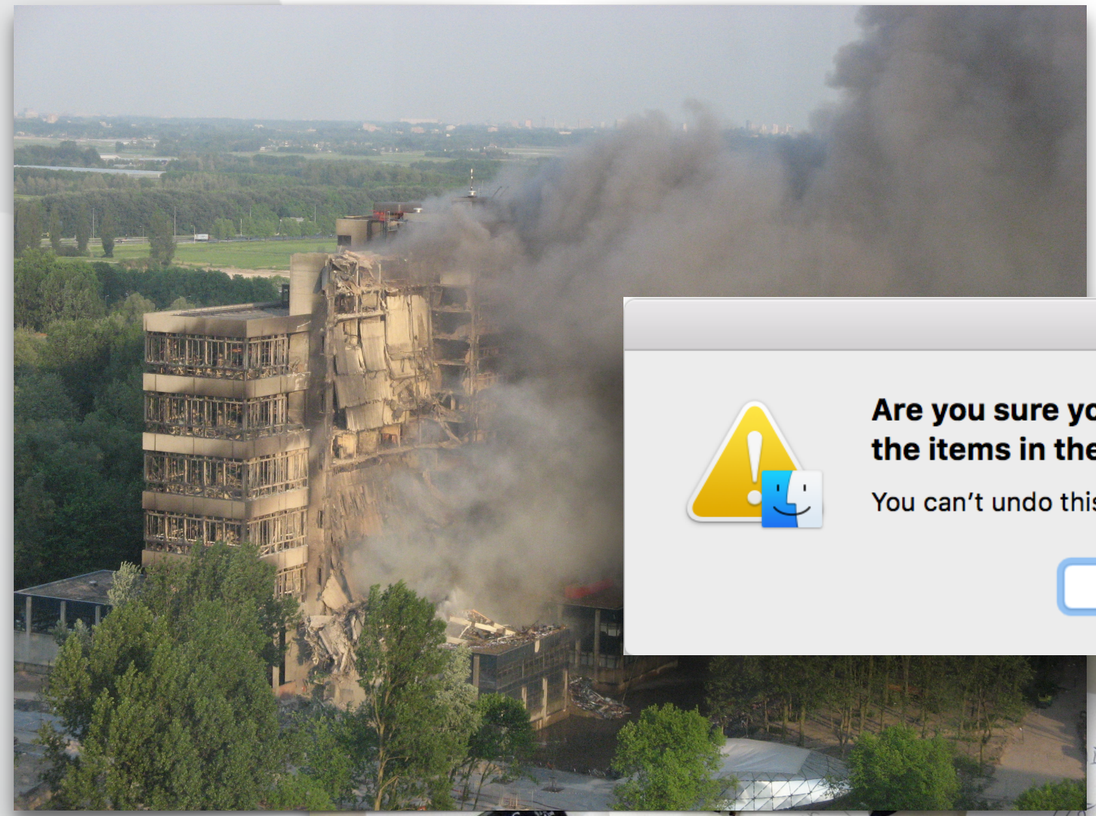
<u>Services</u>

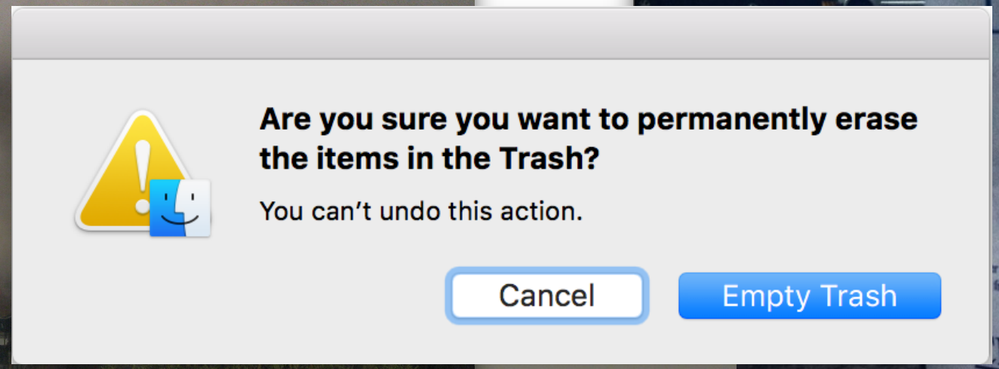
- Digital repositories
- Data preservation for High-Energy Physics.

Zenodo: Open in every sense!

Built by Science.
For Science.

Don’t do it yourself





Credit: (see earlier slides)

Start early

Ask for help

Include DOIs in citations

Thank You!

www.zenodo.org

Start early

Ask for help

Include DOIs in citations

DIY time

- Account:
  - Get an ORCID: http://orcid.org
  - Log in on Zenodo: https://sandbox.zenodo.org
- Upload:
  - Files: Format, Description.
  - Creators, Version, DOI
  - License: Choose standard license (never sign a Copyright Transfer Agreement)
  - Linking: Grants, Other resources

Start early

Jupyter Notebook

Initialize the API client and make a query

Using our just created helper classes we can now create a Zenodo API client:

In [2]:
```
api = ZenodoClient()
```

Simple search

Using the API client we can now execute queries against Zenodo search API:

In [3]:
```
result = api.search('North Carolina State University')
result.total
```

Out[3]: 105681

Phrase search

The query string is exactly like you would type in the Zenodo search box. The underlying search engine on Zenodo is Elasticsearch, which has a powerful query syntax. Above, we are searching for 4 terms, let's instead make it into a phrase search:

In [4]:
```
result = api.search('"North Carolina State University"')
result.total
```

Out[4]: 1504

Field search

In [5]:
```
ncsu_query = '+creators.affiliation:("NCSU" "NC State University" "North Carolina State University") +doi:10.5281*'
result = api.search(ncsu_query)
result.total
```

Out[5]: 63

Notice the query string. Here is a couple of points:

Resources

http://www.datacarpentry.org

https://software-carpentry.org