The IPOL journal: a new publication way for reproducible research

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Pour une Recherche Reproductible Webinar
Grenoble

Outline

1.1 Reproducible research (1)

Reproducible research in Science

- *Theorical sciences* have proofs,

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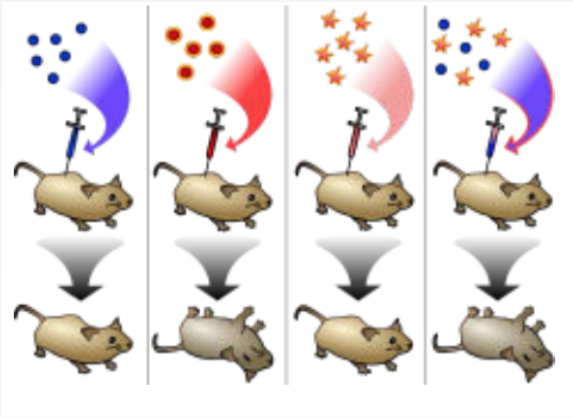
Reproducible research in Science

- *Theorical sciences* have proofs,
- *Experimental sciences* have procedures.



1.1 Reproducible research (1)

Reproducible research in Science

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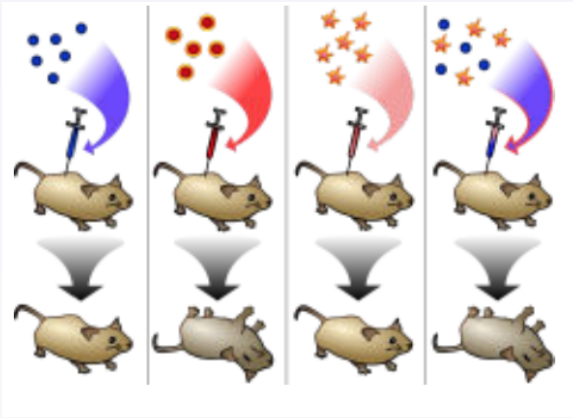
- *Experimental sciences* have procedures.
- *Computer science?*



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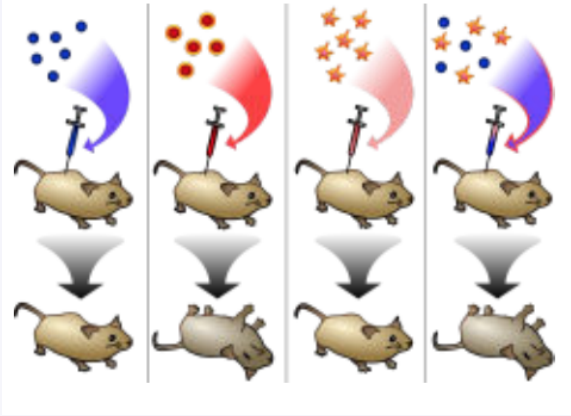

Computer science:

- Descriptions of methods/algorithms
- Descriptions usually short (number of pages limited!)
- Parameters not always given or properly described
- Pre/post processing steps might have been omitted

1.1 Reproducible research (2)

Computer science

1. New idea
2. Demonstration, implementation

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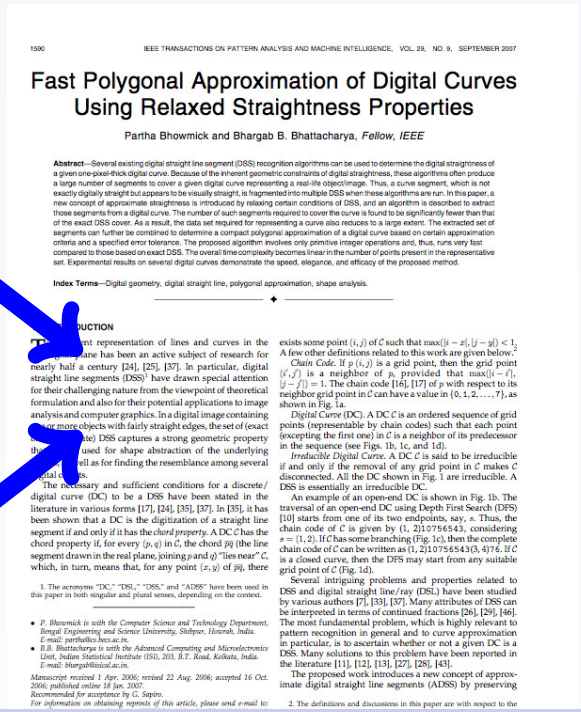
3. Publication of an article



1590 IEEE TRANSACTIONS ON PATTERN ANALYSIS AND MACHINE INTELLIGENCE, VOL. 29, NO. 9, SEPTEMBER 2007

Fast Polygonal Approximation of Digital Curves Using Relaxed Straightness Properties

Partha Bhowmick and Bhargab B. Bhattacharya, *Fellow, IEEE*

Abstract—Several existing digital straight line segment (DSS) recognition algorithms can be used to determine the digital straightness of a given one-pixel-thick digital curve. Because of the inherent geometric constraints of digital straightness, these algorithms often produce a large number of segments to cover a given digital curve representing a real-life object/image. Thus, a curve segment, which is not exactly digitally straight but appears to be visually straight, is fragmented into multiple DSS when these algorithms are run. In this paper, a new concept of approximate straightness is introduced by relaxing certain conditions of DSS, and an algorithm is described to extract those segments from a digital curve. The number of such segments required to cover the curve is found to be significantly fewer than that of the exact DSS cover. As a result, the data set required for representing a curve also reduces to a large extent. The extracted set of segments can further be combined to determine a compact polygonal approximation of a digital curve based on certain approximation criteria and a specified error tolerance. The proposed algorithm involves only primitive integer operations and, thus, runs very fast compared to those based on exact DSS. The overall time complexity becomes linear in the number of points present in the representative set. Experimental results on several digital curves demonstrate the speed, elegance, and efficacy of the proposed method.

Index Terms—Digital geometry, digital straight line, polygonal approximation, shape analysis.

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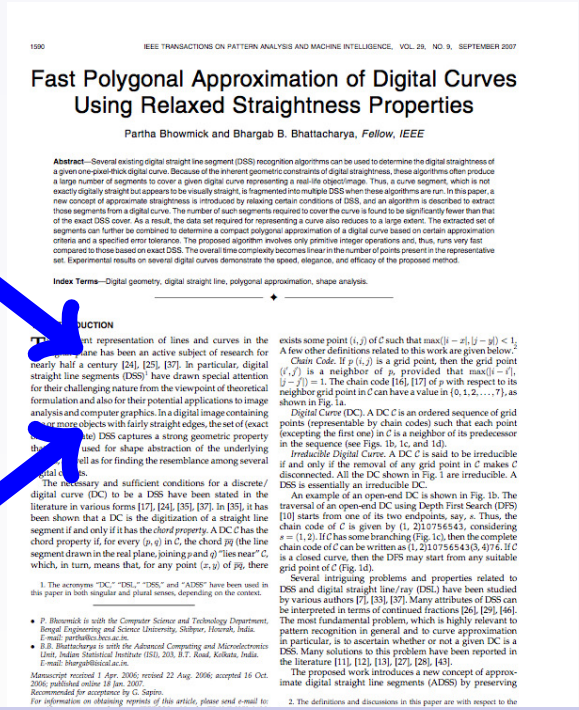
2. Demonstration, implementation
3. Publication of an article

Scientific reuse

1. Scientifically interesting article
2. Reimplement the algorithm



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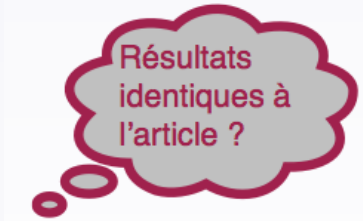

1.1 Reproducible research (2)

Computer science

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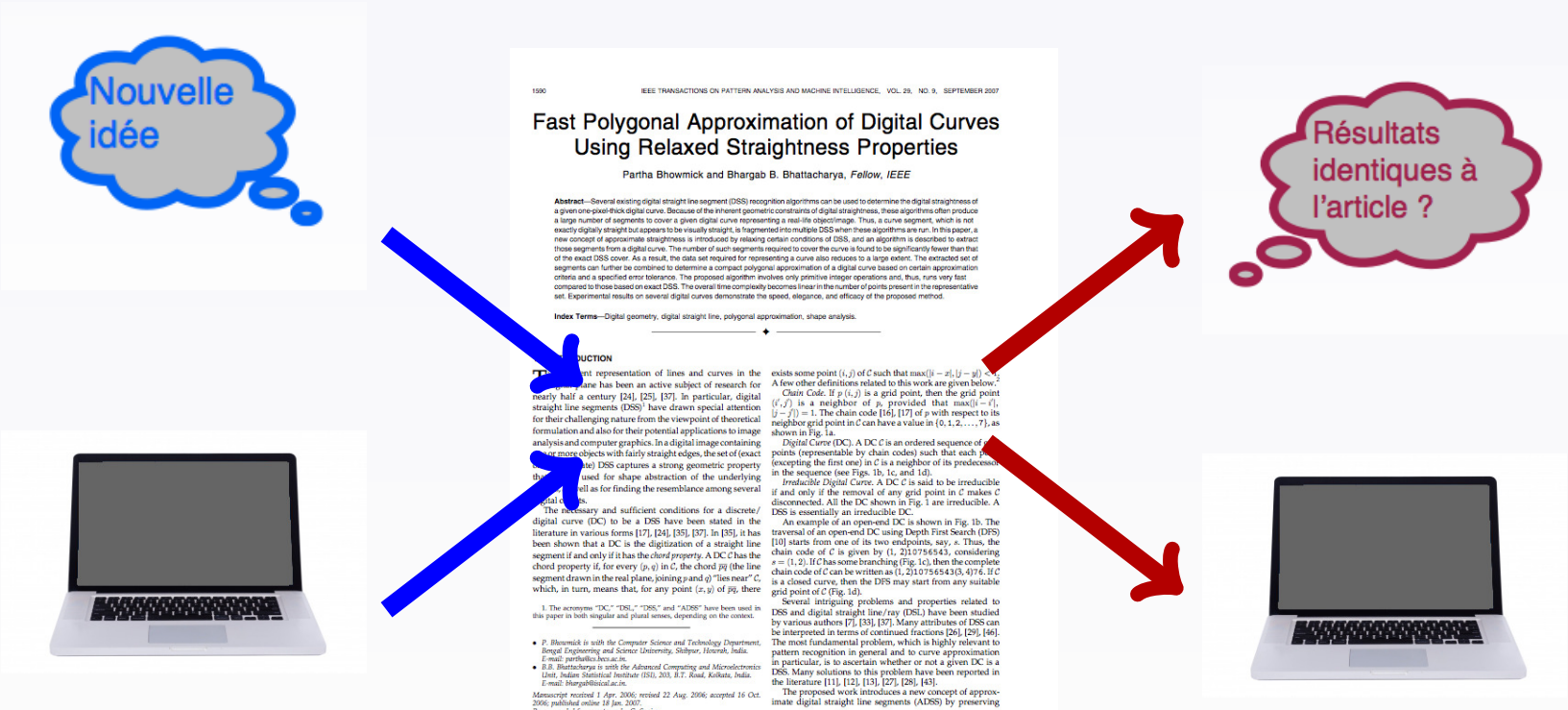
2. Demonstration, implementation
3. Publication of an article

Scientific reuse

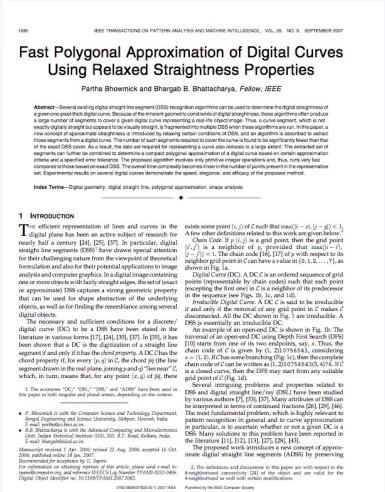
1. Scientifically interesting article
2. Reimplement the algorithm
3. Matching the results with the ones published in the original work



1.1 Reproducible research (3)

Typical difficulties

- Code might not be available (or perhaps not peer reviewed)
- Data might not be available (not FAIR: Findable, Accessible, Interoperable, Reusable)
- Not detailed enough descriptions in the article: impossible to obtain an equivalent implementation



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1 Introduction

The efficient representation of lines and curves in the digital plane has been an active subject of research for nearly half a century [24], [25], [37]. In particular, digital straight line segments (DSS)[1] have drawn special attention for their challenging nature from the viewpoint of theoretical formulation and also for their potential applications to image analysis and computer graphics. In a digital image containing one or more objects with fairly straight edges, the set of (exact or approximate) DSS captures a strong geometric property that can be used for shape abstraction of the underlying objects, as well as for finding the resemblance among several digital objects.

The necessary and sufficient conditions for a discrete/digital curve (DC) to be a DSS have been stated in the literature in various forms [17], [24], [35], [37]. In [35], it has been shown that a DC is the digitization of a straight line segment if and only if it has the *chord property*. A DC C has the chord property if, for every (p, q) in C, the chord pq (the line segment drawn in the real plane, joining p and q) "lies near" C, which, in turn, means that, for any point (x, y) of pq, there exists some point (i, j) of C such that $\max(|i - x|, |j - y|) < 1$. A few other definitions related to this work are given below.

Chain Code. If $p\,(i, j)$ is a grid point, then the grid point (i', j') in a neighbor of p, provided that $\max(|i - i'|, |j - j'|) = 1$. The chain code [16], [17] of p with respect to its neighbor grid point in C can have a value in $\{0, 1, 2, \ldots, 7\}$, as shown in Fig. 1a.

Digital Curve (DC). A DC C is an ordered sequence of grid points (representable by chain codes) such that each point (excepting the first one) in C is a neighbor of its predecessor in the sequence (see Figs. 1b, 1c, and 1d).

Irreducible Digital Curve. A DC C is said to be irreducible if and only if the removal of any grid point in C makes C disconnected. All the DC shown in Fig. 1 are irreducible. A DSS is essentially an irreducible DC.

An example of an open-end DC is shown in Fig. 1b. The traversal of an open-end DC using Depth First Search (DFS) [10] starts from one of its two endpoints, say, s. Thus, the chain code of C is given by $(1, 2)1176545$, considering $s = (1, 2)$. If C has some branching (Fig. 1c), then the complete chain code of C can be written as $(1, 2)1176543(5, 4)76$. If C is a closed curve, then the DFS may start from any suitable grid point of C (Fig. 1d).

Several intriguing problems and properties related to DSS and digital straight line/ray (DSL) have been studied by various authors [7], [33], [37]. Many attributes of DSS can be interpreted in terms of continued fractions [26], [29], [46]. The most fundamental problem, which is highly relevant to pattern recognition in general and to curve approximation in particular, is to ascertain whether or not a given DC is a DSS. Many solutions to this problem have been reported in the literature [11], [12], [13], [27], [28], [43].

The proposed work introduces a new concept of approximate digital straight line segments (ADSS) by preserving

1. The acronyms "DC," "DSL," "DSS," and "ADSS" have been used in this paper in both singular and plural senses, depending on the context.

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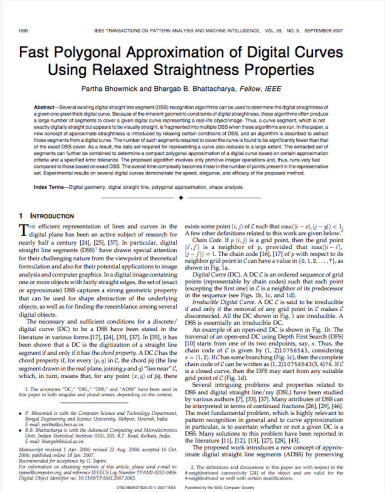

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1. The definitions and discussions in this paper are with respect to the 8-neighborhood connectivity [24] of the object and are valid for the 4-neighborhood as well with certain modifications.

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Consequences

- Hard or impossible to compare
- Limits the diffusion of research
- Might a waste of time for the reader

1.1 Reproducible research (4)

Distribution of code and data

- ⊕ Added value to the publication
- ⊕ Increases the impact, since it allows for easy comparison
- ⊖ Software not really given the value it deservers (2022: CNRS is changing this! :)
- ⊖ Important effort (documentation, tests, maintenance)

```
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#include "DGtal/base/Common.h"
#include "DGtal/io/readers/VolReader.h"
#include "DGtal/io/Display3D.h"

#include "DGtal/io/DrawWithDisplay3DModifier.h"
#include "DGtal/images/ImageSelector.h"
#include "DGtal/images/imagesSetsUtils/SetFromImage.h"
#include "DGtal/helpers/StdDefs.h"
#include "ConfigExamples.h"


using namespace std;
using namespace DGtal;
using namespace Z3i;


int main( int /*argc*/, char** /*argv*/ )
{
  std::string inputFilename = examplesPath + "samples/Al.100.vol";
  //! [ExampleDisplay3DToOFF]
  Display3D<Space, KSpace> viewer;
  typedef ImageSelector < Z3i::Domain, int>::Type Image;
  Image image = VolReader<Image>::importVol(inputFilename);
  Z3i::DigitalSet set3d (image.domain());
  SetFromImage<Z3i::DigitalSet>::append<Image>(set3d, image, 0,255);

  viewer << set3d ;
  viewer >> "exportMeshToOFF.off";
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Diffusion of software

- Some journals specialized in software and algorithms:
  Source Code for Biology and Medicine, Journal of Open Research Software, Computing in Science and Engineering, ...
- Diffusion platforms:
  RunMyCode / Run&Share, Figshare, DataDryad, Harvard Dataverse, Ubiquity Metajournals, Zenodo (avec doi) ...

⇒ No peer-reviewed

1.2 Origin of the IPOL journal

Origine

- **Started** around October **2009**.
- The initiative of the **Image Processing group** at CMLA, ENS Cachan. Now: Centre Borelli.
- **First article** published in **2010**

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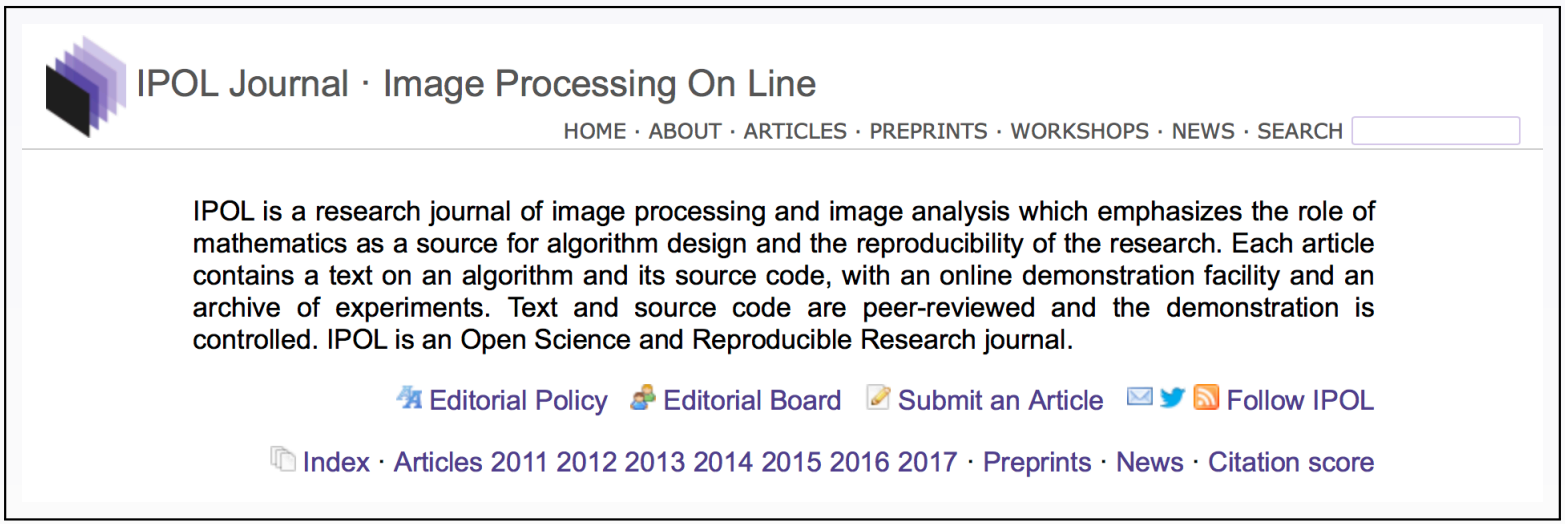
Motivation [Limare & Morel 2009]

- **Reproducible research**.
- A **new way of publishing**: **article** + **source code** + **data** as a **whole**, under the same DOI
- **Allow everybody** to **test** the **algorithms**:
  $\Rightarrow$ **with their own data**.
- **Independent** from the **platform** (allow to test the methods without having to download the code or executing them locally)

2.1 Principles of the IPOL journal

Characteristics

- **Research journal** on **algorithms** (mainly images, video, 3D, audio, but also time series, or any other!)
- Each publication contains the description **of an algorithm** and also the actual **code source** and any **associated data**
- Also, every article is associated with an **online demo** and an **archive** of experiments by users
- **Strict peer review** of the **article**'s text and also the **source code**
- An **Open Science** and **Reproducible Research** journal



2.1 Principles of the IPOL journal (2)

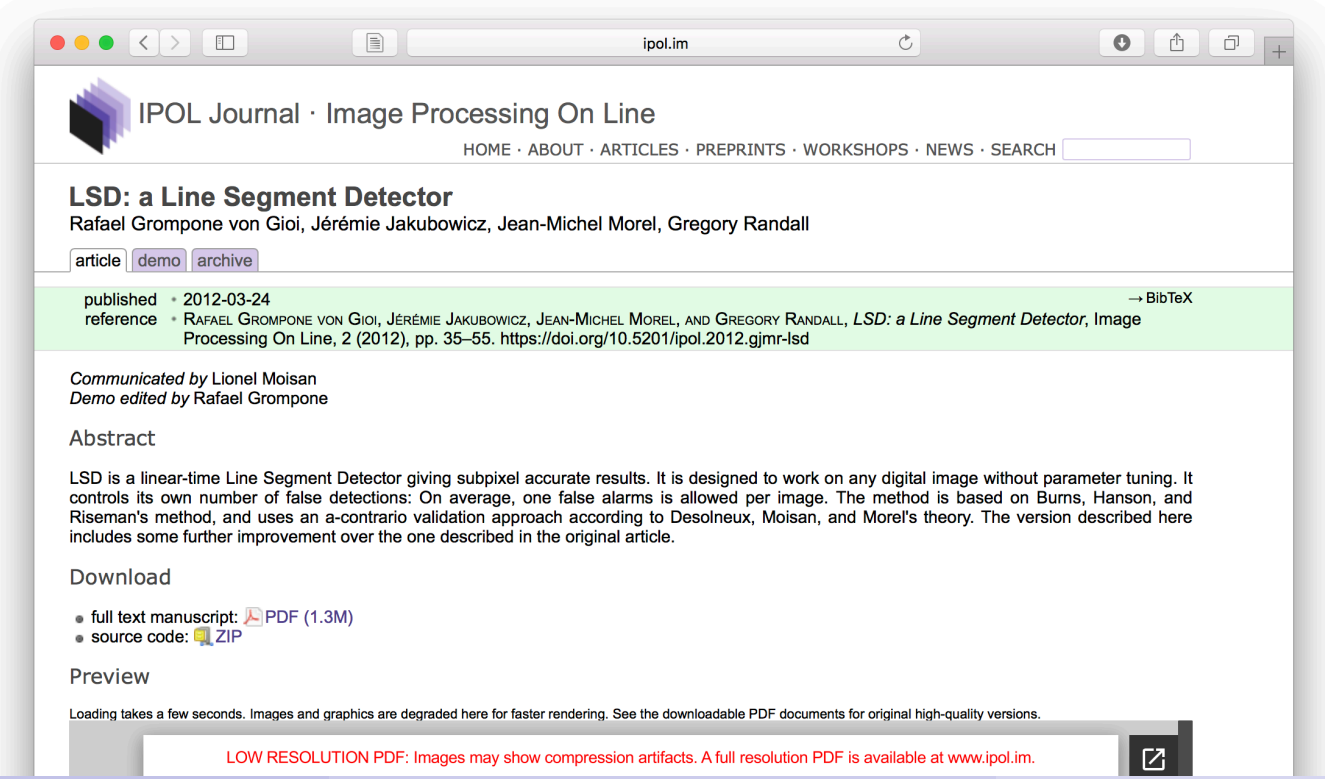
What IPOL is not:

- IPOL publishes algorithms and one implementation, not software
- IPOL is not a software library (like openCV and others)
- IPOL is not only a code diffusion platform

2.2 Current form

Contents of a typical publication:

- An online **PDF** of the article
- The **source code**
- The **data**



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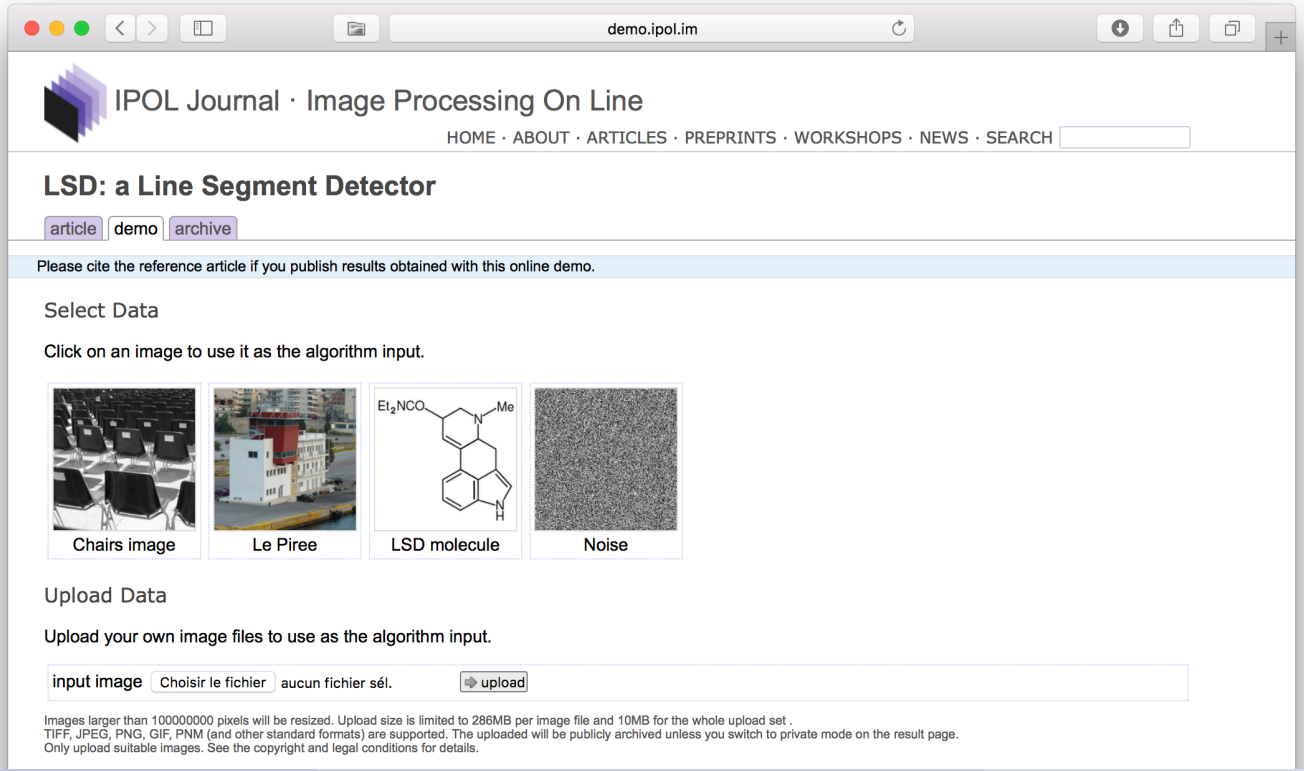

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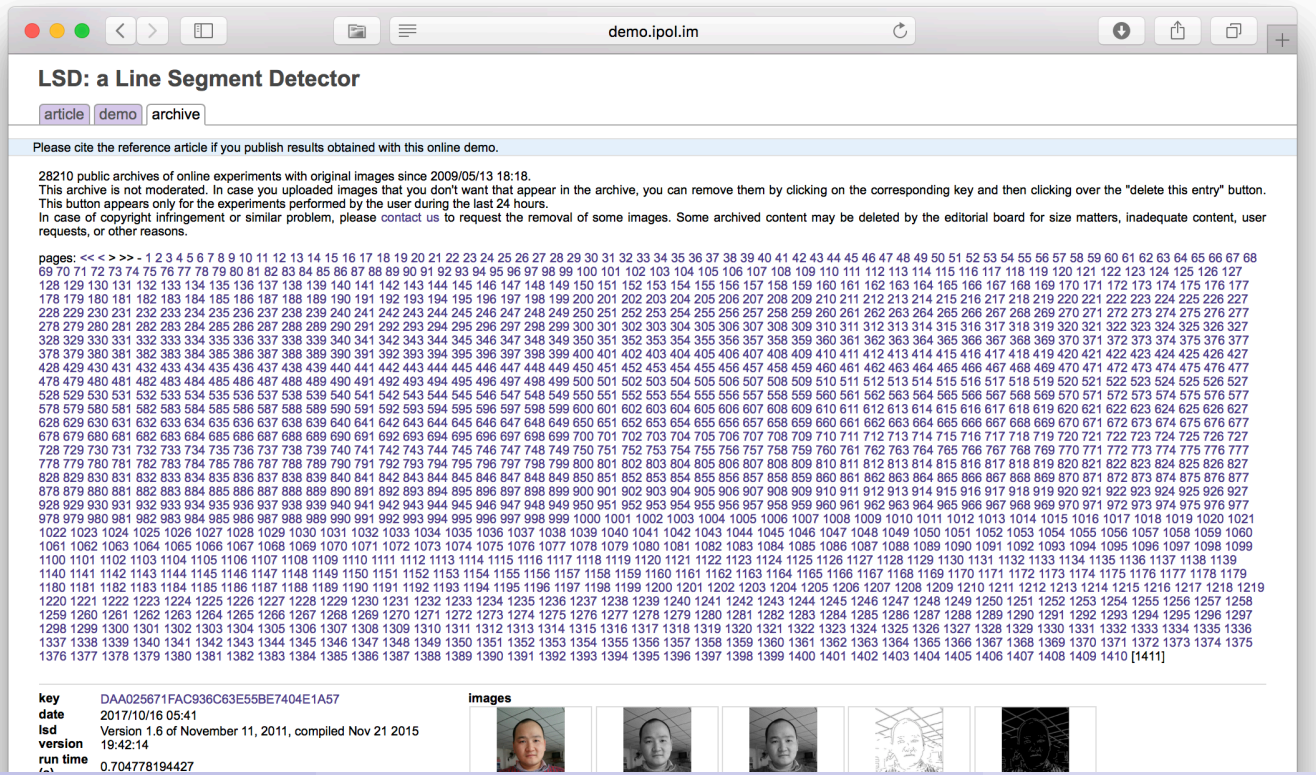
- The **data**
- A **demo** (supplementary material)
- An **archive** of experiments (supplementary material)



Let’s take a look!

2.2 Current form

As a typical journal, it has:

- Editorial board
- Articles, authors, editors
- Peer-review
- ISSN, DOI, SWHID
- Special editions (COVID, ...)
- Indexing metrics. Currently 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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Software aspects:

- Each article provides an **implementation**
- **Strict peer review** of the source code. Special focus on **reproducibility**.
- Reviewers: they **check** that the **pseudocode** and the **implementation match accurately**!

Sofware submission

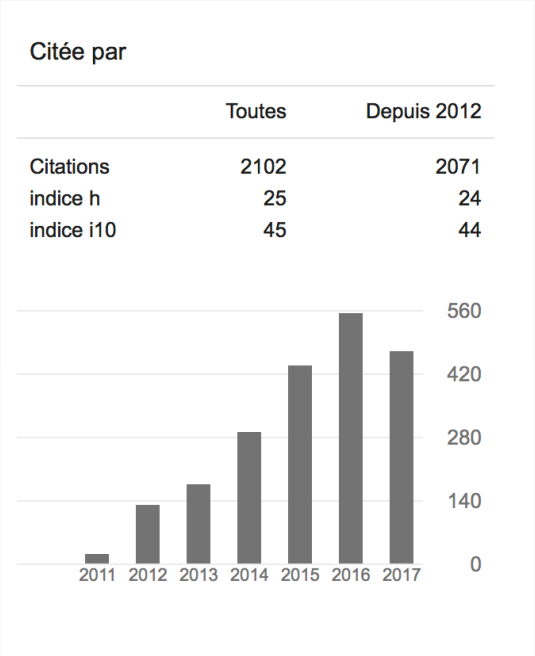
A typical submission:

- **Languages**: C/C++, Python, Octave. Recently **with Docker**: **any language** is **possible**
- **Command line**, non interactive
- **FOSS license**
- **Copyright**, **patent**
- **Install** instructions, essential documentation (README.txt, . . .)
- *Quality* **source code** with comments in English →" **EOSC report on quality research software**
- **Comments** for each function or any non-trivial parts of the code

3. Some numbers

Some numbers:

- 121 articles published after 2010. 2022: around 200 published.
- 20 in peer-review. 2022: +60 with the ML-Briefs workshop.
- 2000+ citations (Google Scholar). 2022: 7621 citations.



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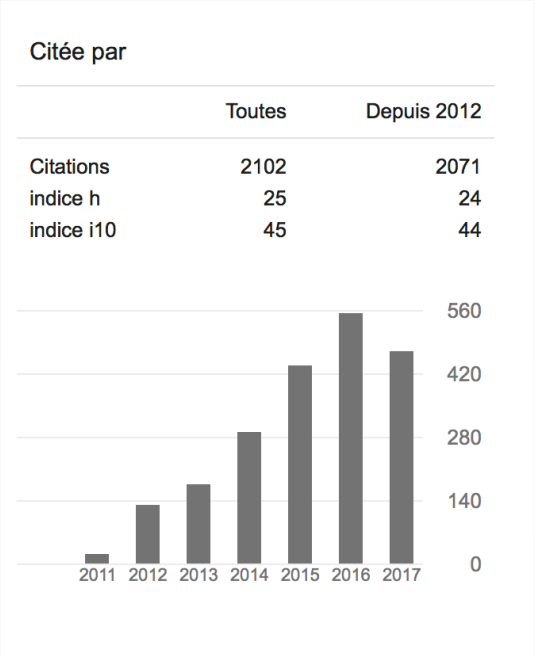

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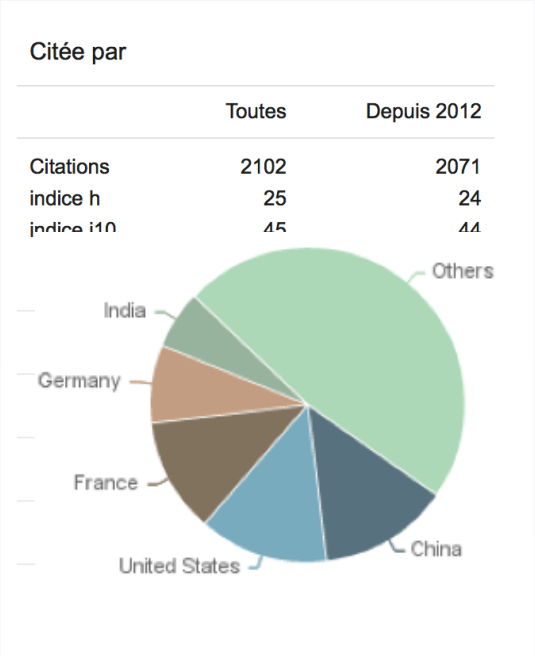
- 2022: About 500,000 exps. in 400 demos. About 700 Gb in the archives.



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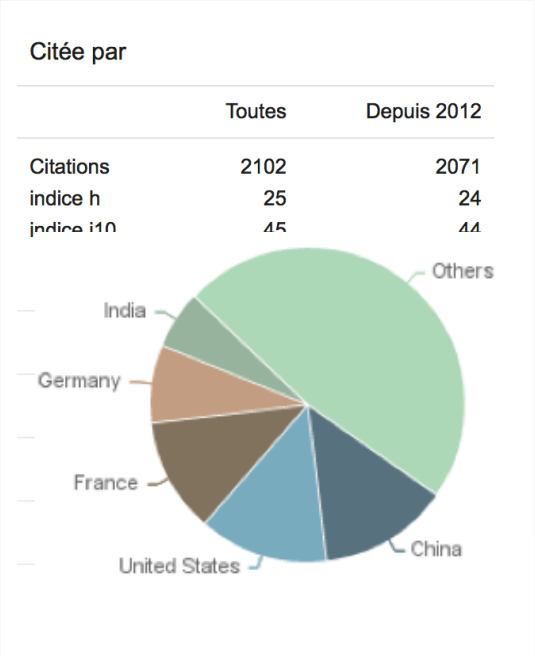

LSD: a Line Segment Detector

article | demo | archive

Please cite the reference article if you publish results obtained with this online demo.

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pages: << < > >> - 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30 31 32 33 34 35 36 37 38 39 40 41 42 43 44 45 46 47 48 49 50 51 52 53 54 55 56 57 58 59 60 61 62 63 64 65 66 67 68 69 70 71 72 73 74 75 76 77 78 79 80 81 82 83 84 85 86 87 88 89 90 91 92 93 94 95 96 97 98 99 100 101 102 103 104 105 106 107 108 109 110 111 112 113 114 115 116 117 118 119 120 121 122 123 124 125 126 127 128 129 130 131 132 133 134 135 136 137 138 139 140 141 142 143 144 145 146 147 148 149 150 151 152 153 154 155 156 157 158 159 160 161 162 163 164 165 166 167 168 169 170 171 172 173 174 175 176 177 178 179 180 181 182 183 184 185 186 187 188 189 190 191 192 193 194 195 196 197 198 199 200 201 202 203 204 205 206 207 208 209 210 211 212 213 214 215 216 217 218 219 220 221 222 223 224 225 226 227 228 229 230 231 232 233 234 235 236 237 238 239 240 241 242 243 244 245 246 247 248 249 250 251 252 253 254 255 256 257 258 259 260 261 262 263 264 265 266 267 268 269 270 271 272 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key	DAA025671FAC936C63E55BE7404E1A57
date	2017/10/16 05:41
lsd version	Version 1.6 of November 11, 2011, compiled Nov 21 2015 19:42:14
run time (s)	0.704778194427
files	output.txt output.eps output.svg

images

key	97ABD6B990E6ADEFE6BC19131320B124
date	2017/10/16 05:43
lsd	Version 1.6 of November 11, 2011, compiled Nov 21 2015

images

Gb in the archives.

3. Impact of the journal

Impact of the online demos

- **Test immediately** without having to install anything, in any machine
- Encourages **comparing** the methods
- **Verify** the results claimed in the paper
- Quickly **assess** the performance and limitations of the algorithm/code with respect to a certain problem

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Impact of workshop demos

- Using the **online demos** as a **supplementary material** for a **3rd party publication**
- An online demo might **convince reviewers** about the method since they can **test by themselves** with **their own data**

4. Evolution of the journal

New mode workshop demos (since Spring 2014)

- Simple idea: creation of demos without associating them to an article
- **Objective**: **testing** and **dissemination**. **Not publications!**
- **Other uses**: using the demos as supplementary material or to show results in conferences

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- Sim
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- **Oth**

con

lts in

2017: 46

Main imp

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- Use
- Pos

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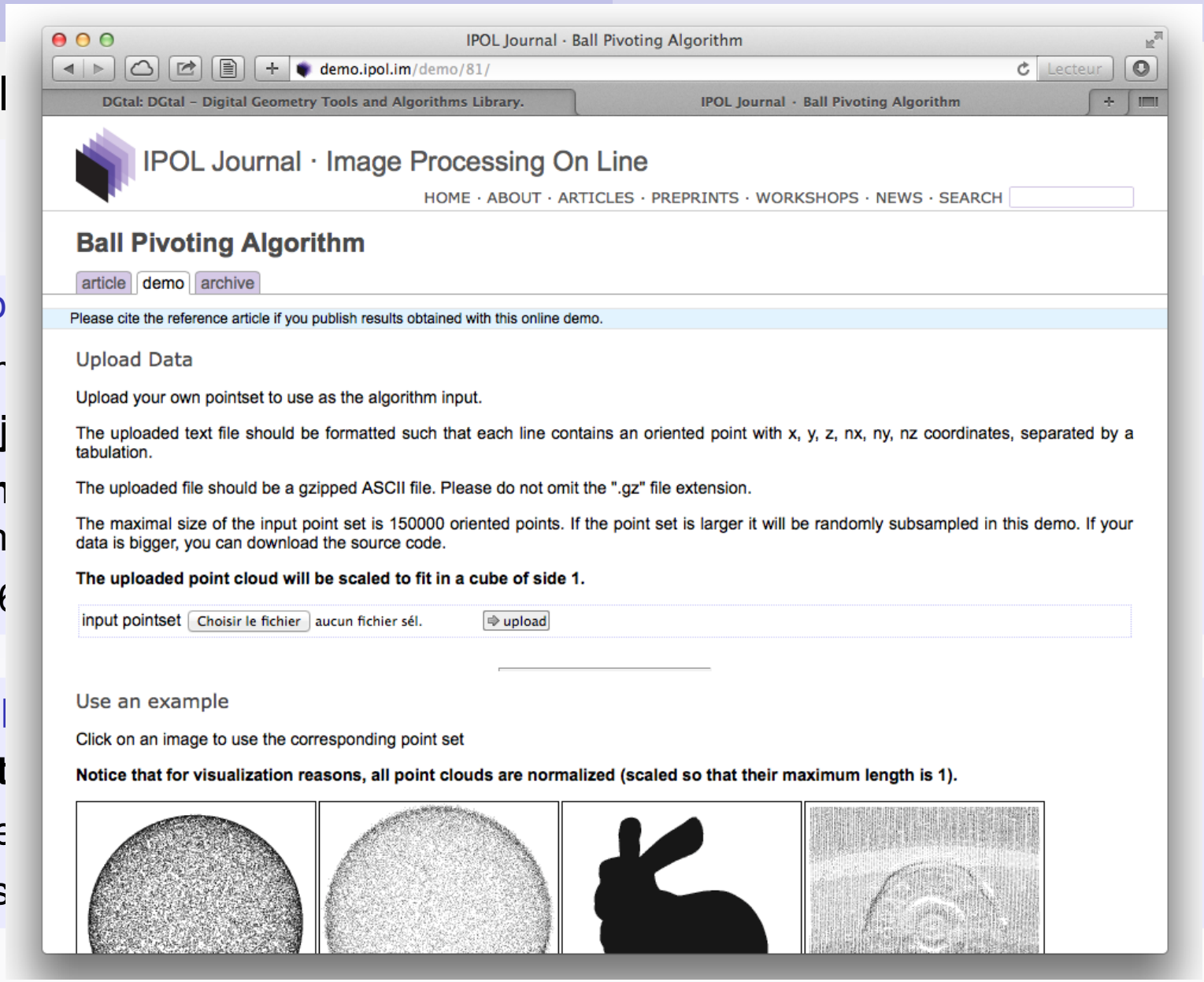

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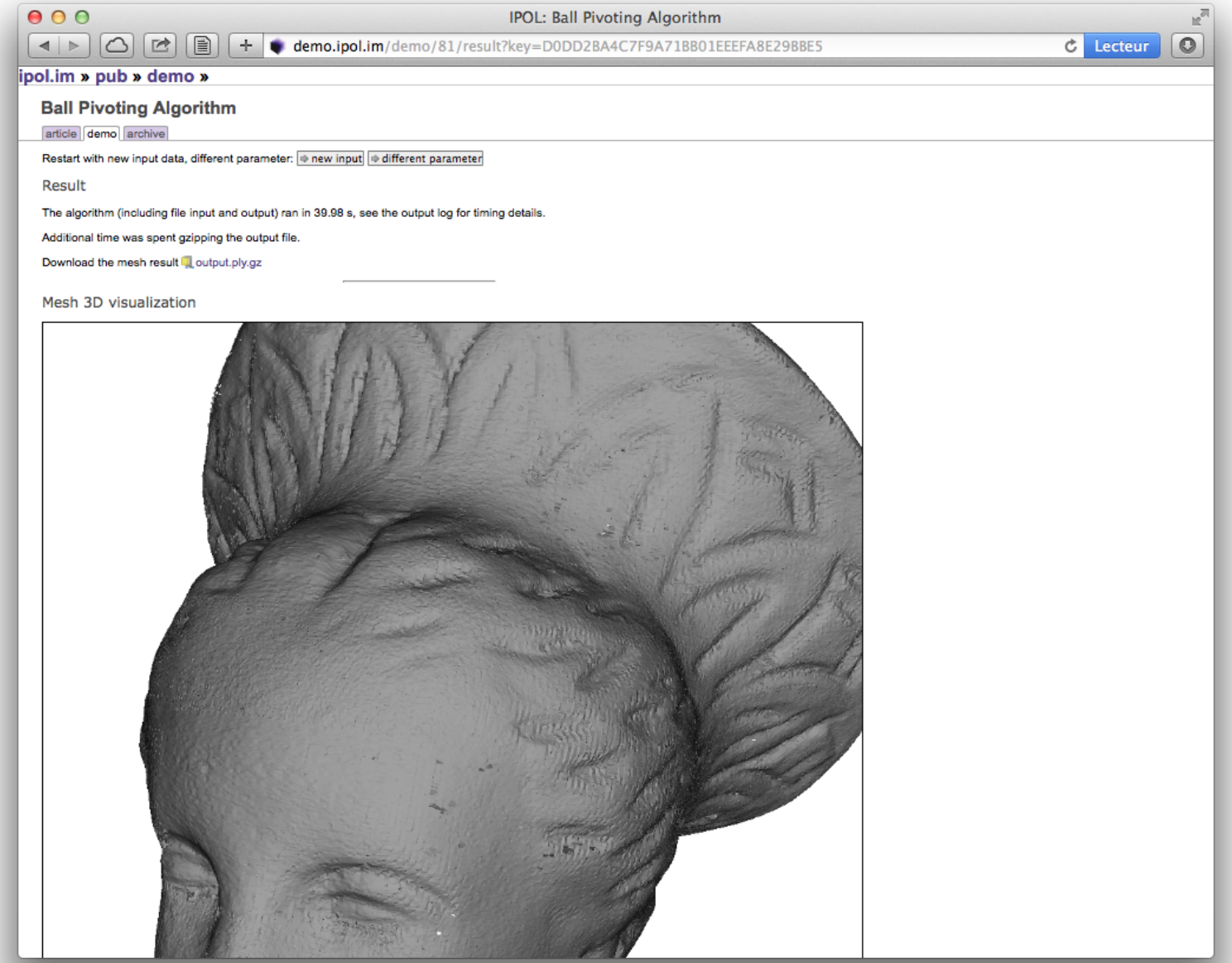

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Short Time Fourier Transform

Short Time Fourier Transform

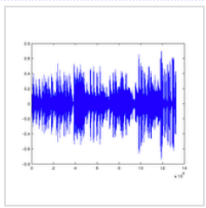
article | demo | archive

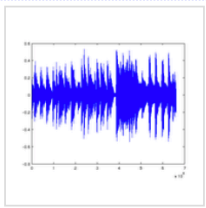
Please cite the reference article if you publish results obtained with this online demo.

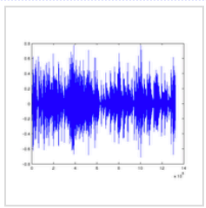
Short Time Fourier Transform

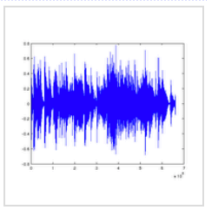
Select Data

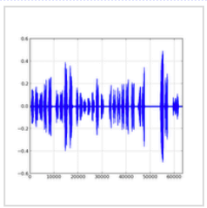
Click on an image to use the corresponding signal as input.

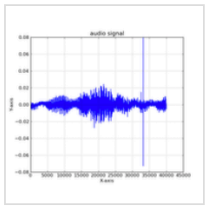

Armstrong1

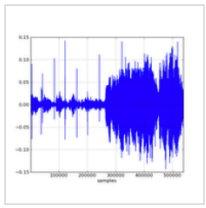

Armstrong2

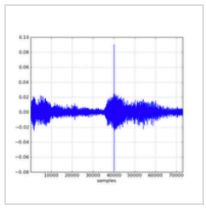

RubenGonzalez1

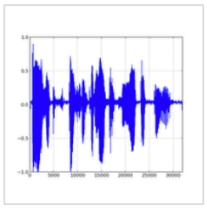

RubenGonzalez2


Bird Signal


Noise clicks


Noise clicks


Noise clicks


Speech Signal

Upload Data

Upload your own audio signals to use as the algorithm input.

input signal Choisir le fichier aucun fichier sél. upload

Upload size is limited to 30 seconds per signal file .
WAV (and other standard formats) are supported. The uploaded files may be re-used for further analysis.
Only upload suitable signals. See the copyright and legal conditions for details.

4.1 New demo system architecture

Modular architecture:

- **Microservices** architecture
- Specialized **independent modules**

⇒ In production since 2016: `http://ipolcore.ipol.im/demo`

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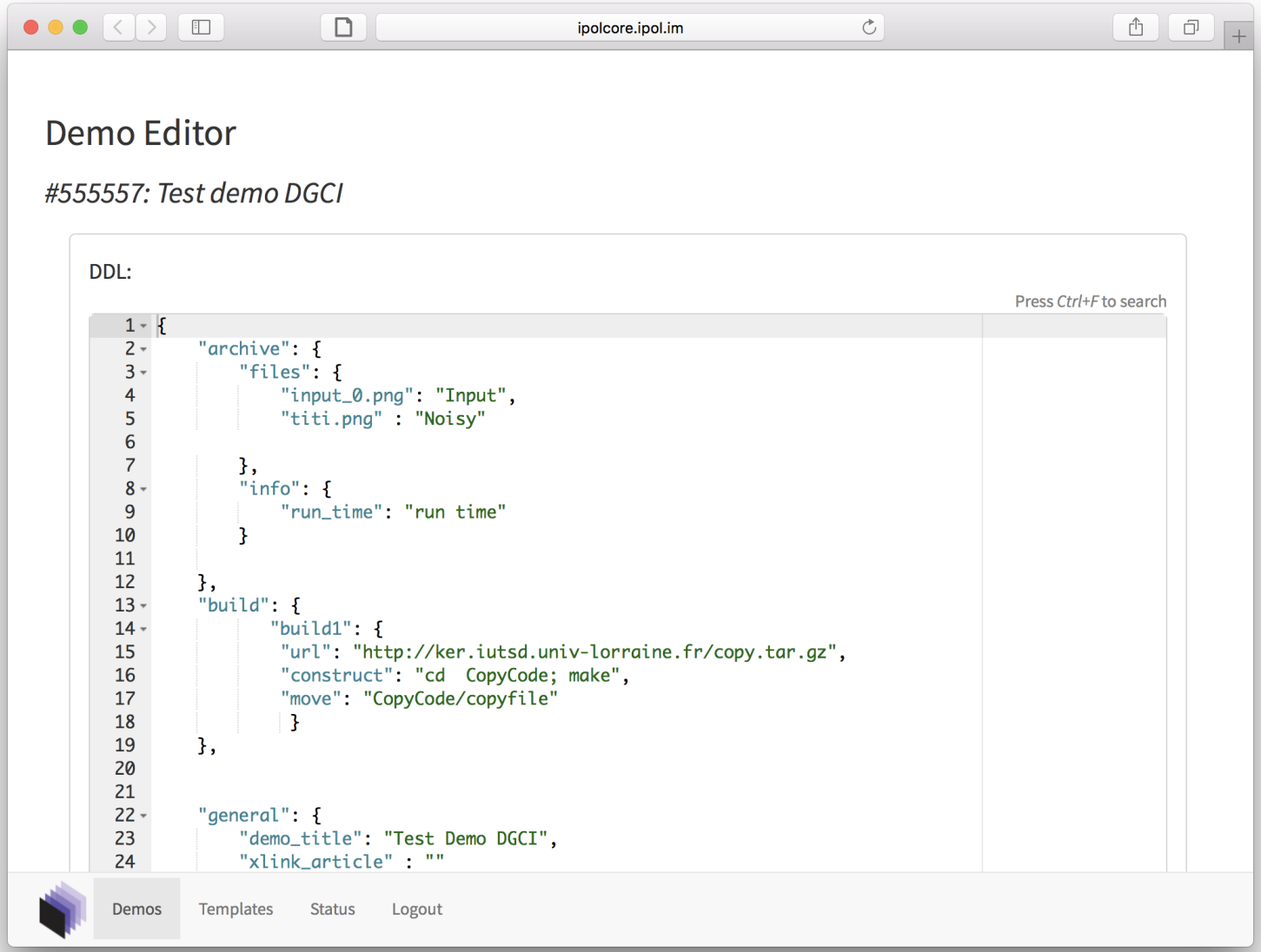
Demo generator from an structured textual description:

- A **demo** is **described** with an **text file** (title, type, parameter types and values, format of the results, . . .).
- No need to code to build an online demo

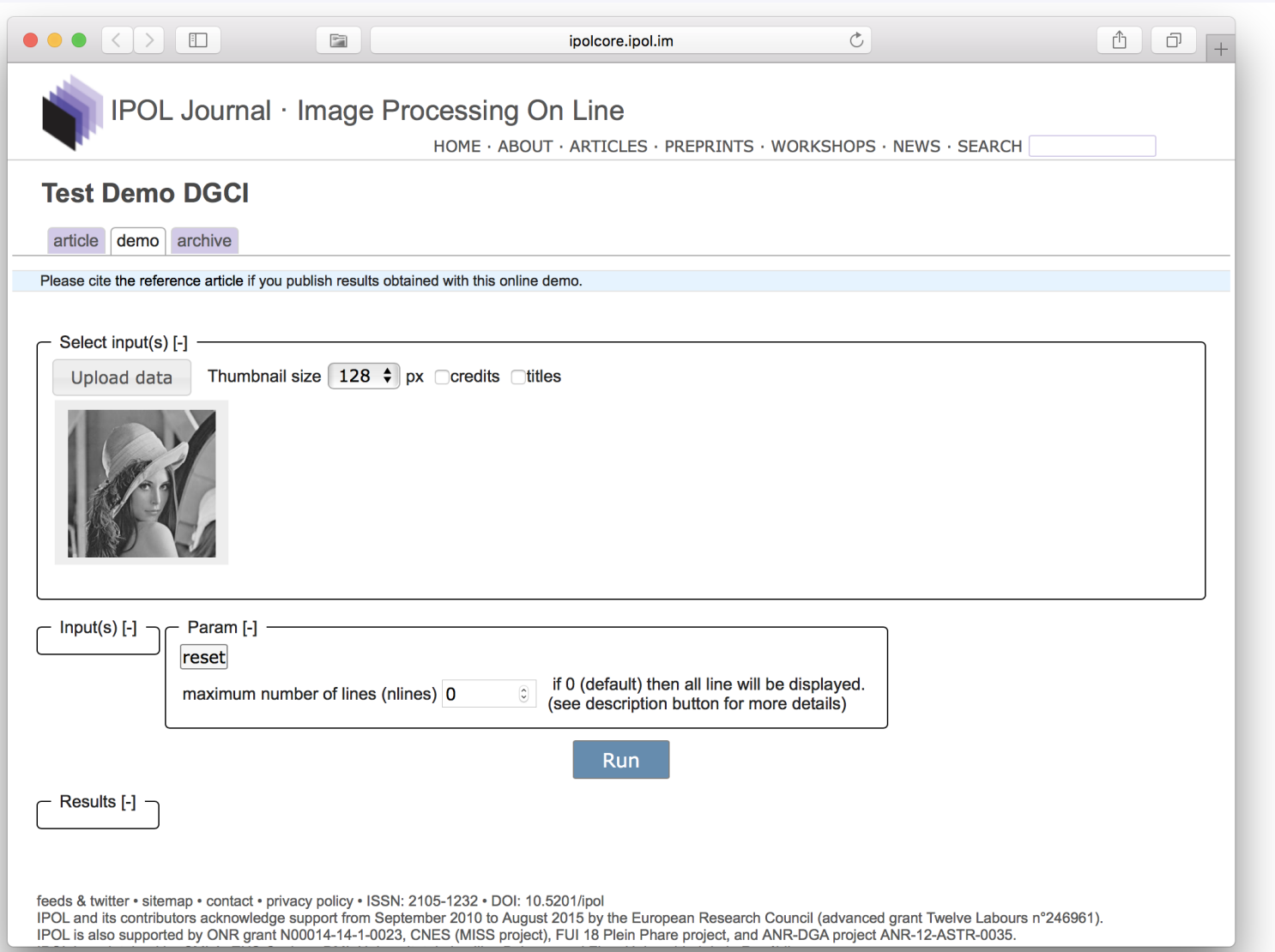
4.1 New demo system architecture (2)

Editing a demo with the **Control Panel**:



4.1 New demo system architecture (2)

The **generated demo** interface:



5. Conclusion

New ways of publishing

- An **added value** for a publication
- Requires **more effort**, but it has also a **larger impact**

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Beyond the publication

- It reveals the **real state of the art**;
- It shows the **application domains** of a certain method;
- A new tool for collaborative work and experimentation;
- The default **way of working** at **Centre Borelli**.

Thanks!

Thank you for your attention

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École normale supérieure de Cachan - ENS Cachan

(July 2013)
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