IPOL: un journal en ligne pour la recherche reproductible

Pascal Monasse <pascal.monasse@enpc.fr>
LIGM, École des Ponts, Univ. Gustave Eiffel, Marne-la-Vallée, France

Sous la co-tutelle de :
CNRS
ÉCOLE DES PONTS PARISTECH
UNIVERSITÉ GUSTAVE EIFFEL

Les Plans de Gestion des Logiciels de la Recherche, UGE, 23-24 mai 2024

Some definitions

Repeatability and replicability

Capacity to perform the same experiment as many times as needed.

→ **Repeatability**: Same team, same experimental setup

→ **Replicability**: Different team, same experimental setup

Example: is distilled water electrically conductive? Is salt water conductive?

We can perform the experiment many times and get results

(`https://www.dailymotion.com/video/x2lcg6a`).

Some definitions

Repeatability and replicability

Capacity to perform the same experiment as many times as needed.

→ **Repeatability**: Same team, same experimental setup

→ **Replicability**: Different team, same experimental setup

Example: is distilled water electrically conductive? Is salt water conductive? We can perform the experiment many times and get results (`https://www.dailymotion.com/video/x2lcg6a`).

Reproducibility

Capacity to obtain the same results when repeating an experiment by following a detailed procedure

→ Different team, different experimental setup

In computational sciences (deterministic code, digital data): results obtained by following a detailed and correct pseudo-code description must coincide if the same input data is provided.

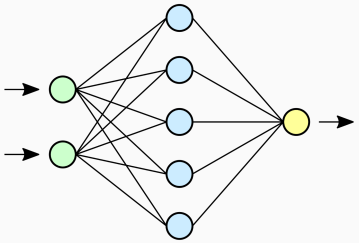
Repeatability Examples

Repeatable

Obtaining the classification results with a neural network.

We can repeat the experiment as many times as we want.

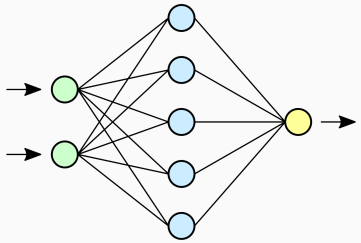
We just need the weights of the network and the input data.



Repeatability Examples

Repeatable

Obtaining the classification results with a neural network. We can repeat the experiment as many times as we want. We just need the weights of the network and the input data.



Not repeatable:

Detection of the merger of two black holes from gravitational waves. We can't repeat the experiment as needed.

Reproducibility Examples

Reproducible:

Given:

- a detailed pseudo-code (or the source code itself),
- any associated learning or initialization data,
- the input data,

we should obtain exactly the same results each time we run the algorithm.

$\Rightarrow$ Exactly the same denoised image, classification results, etc.

Reproducibility Examples

Reproducible:

Given:

- a detailed pseudo-code (or the source code itself),
- any associated learning or initialization data,
- the input data,

we should obtain exactly the same results each time we run the algorithm.
⇒ Exactly the same denoised image, classification results, etc.

Not reproducible

In a paper that shows

- a pseudo-code without all the details, or its initialization,
- the source code is not available,
- neither the learning data,

other researchers can't compare with the proposed method.
⇒ We can't be sure about anything on the method, nor test it with our own data.

Implementation of Reproducible Research

- Non-exact sciences (biology, medicine, . . .): difficult (but *desirable*). Hard to have exactly the same conditions along experiments.
- Computational sciences: no excuse!

Why are we not all doing reproducible research?

Implementation of Reproducible Research

- Non-exact sciences (biology, medicine, . . .): difficult (but *desirable*). Hard to have exactly the same conditions along experiments.
- Computational sciences: no excuse!

Why are we not all doing reproducible research?

Several reasons in general:

- Some researchers don't want to make public working code
  - doesn't correspond to any version of the pseudo-codes,
  - low software quality,
  - quality software takes more time to produce: testing, documentation, objective quality metrics.
- Results of the method do not generalize
- . . . (For the discussion later!)

Implementation of Reproducible Research

- Non-exact sciences (biology, medicine, . . .): difficult (but *desirable*). Hard to have exactly the same conditions along experiments.
- Computational sciences: no excuse!

Why are we not all doing reproducible research?

Several reasons in general:

- Some researchers don't want to make public working code
  - doesn't correspond to any version of the pseudo-codes,
  - low software quality,
  - quality software takes more time to produce: testing, documentation, objective quality metrics.
- Results of the method do not generalize
- . . . (For the discussion later!)

Not really considered for career advance

- Classic metrics: "number of high impact-factor classic publications"
- Software is considered as a 2nd class citizen

Reproducible Research Platforms

Different types of platforms

- Online execution platforms.
- Dissemination platforms.
- Peer-reviewed journals.

- **Galaxy** - `https://galaxyproject.org`
- **IPython** - `https://ipython.org`
- **Jupyter** - `http://jupyter.org`
- **RunMyCode** - `http://www.runmycode.org`
- **Code Ocean** - `https://codeocean.com`
- **DAE** - `http://dae.cse.lehigh.edu/DAE`
- **IPOL** - `https://www.ipol.im`
- **Research Compendia** - `ResearchCompendia.org`
- **MLOSS** - `https://mloss.org/software`
- **DataHub** - `https://datahub.io/`
- **PaperWithCode** - `https://paperswithcode.com`

- **ReScience Journal** - `http://rescience.github.io`
- **JOSS Journal** - `https://joss.theoj.org`
- **Insight J Journal** - `https://insight-journal.org`

Reproducible Research Platforms

Different types of platforms

- Online execution platforms.
- Dissemination platforms.
- Peer-reviewed journals.

- **Galaxy** - `https://galaxyproject.org`
- **IPython** - `https://ipython.org`
- **Jupyter** - `http://jupyter.org`
- **RunMyCode** - `http://www.runmycode.org`
- **Code Ocean** - `https://codeocean.com`
- **DAE** - `http://dae.cse.lehigh.edu/DAE`
- **IPOL** - `https://www.ipol.im`
- **Research Compendia** - `ResearchCompendia.org`
- **MLOSS** - `https://mloss.org/software`
- **DataHub** - `https://datahub.io/`
- **PaperWithCode** - `https://paperswithcode.com`

- **ReScience Journal** - `http://rescience.github.io`
- **JOSS Journal** - `https://joss.theoj.org`
- **Insight J Journal** - `https://insight-journal.org`

Reproducible Research Platforms

Different types of platforms

- Online execution platforms.
- Dissemination platforms.
- Peer-reviewed journals.

- **Galaxy** - `https://galaxyproject.org`
- **IPython** - `https://ipython.org`
- **Jupyter** - `http://jupyter.org`
- **RunMyCode** - `http://www.runmycode.org`
- **Code Ocean** - `https://codeocean.com`
- **DAE** - `http://dae.cse.lehigh.edu/DAE`
- **IPOL** - `https://www.ipol.im`
- **Research Compendia** - `ResearchCompendia.org`
- **MLOSS** - `https://mloss.org/software`
- **DataHub** - `https://datahub.io/`
- **PaperWithCode** - `https://paperswithcode.com`

- **ReScience Journal** - `http://rescience.github.io`
- **JOSS Journal** - `https://joss.theoj.org`
- **Insight J Journal** - `https://insight-journal.org`

The IPOL Journal

- Started in 2009 under the initiative of Nicolas Limare and Jean-Michel Morel (ENS Paris Saclay).
- A journal initially targeting image processing (Image Processing On Line)
- Some other data types were added: video, audio, 3D data...
- Even some articles on SARS-CoV-2 evolution!
  "A Daily Measure of the SARS-CoV-2 Effective Reproduction Number for all Countries" `http://www.ipol.im/pub/art/2020/304/`
- Today it it a general journal on reproducible algorithms
  → Information Processing On Line

IPOL Publications

Peer-reviewed

- Both the article (PDF) and the source code.
- Reproducibility: the reviewers check carefully that the source code matches the pseudo-code.

IPOL Publications

Peer-reviewed

- Both the article (PDF) and the source code.
- Reproducibility: the reviewers check carefully that the source code matches the pseudo-code.

Each publication:

- A text describing the method in detail, including pseudo-codes.
- The source code, under an open-source software license.
- An online demo which allows users to test the method with their own data.
- An archive of experiments.

IPOL Publications

Peer-reviewed

- Both the article (PDF) and the source code.
- Reproducibility: the reviewers check carefully that the source code matches the pseudo-code.

Each publication:

- A text describing the method in detail, including pseudo-codes.
- The source code, under an open-source software license.
- An online demo which allows users to test the method with their own data.
- An archive of experiments.

- No need to be an original work. We're interested in the math details, reproducibility, and understanding.
- ISSN, DOI, indexed by SCOPUS. Not yet an "Impact Factor".

IPOL Publications

Peer-reviewed

- Both the article (PDF) and the source code.
- Reproducibility: the reviewers check carefully that the source code matches the pseudo-code.

Each publication:

- A text describing the method in detail, including pseudo-codes.
- The source code, under an open-source software license.
- An online demo which allows users to test the method with their own data.
- An archive of experiments.

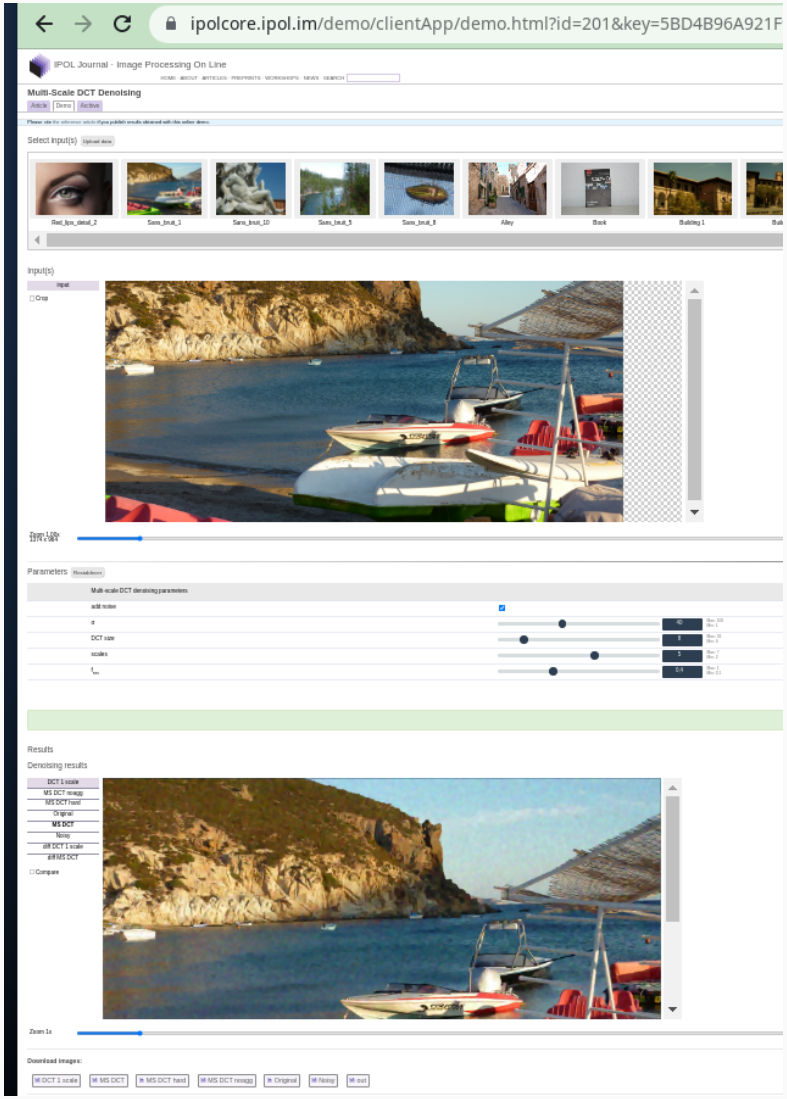
- No need to be an original work. We're interested in the math details, reproducibility, and understanding.
- ISSN, DOI, indexed by SCOPUS. Not yet an "Impact Factor".

Let's have a look! $\Rightarrow$ `http://www.ipol.im/pub/art/2017/201/`

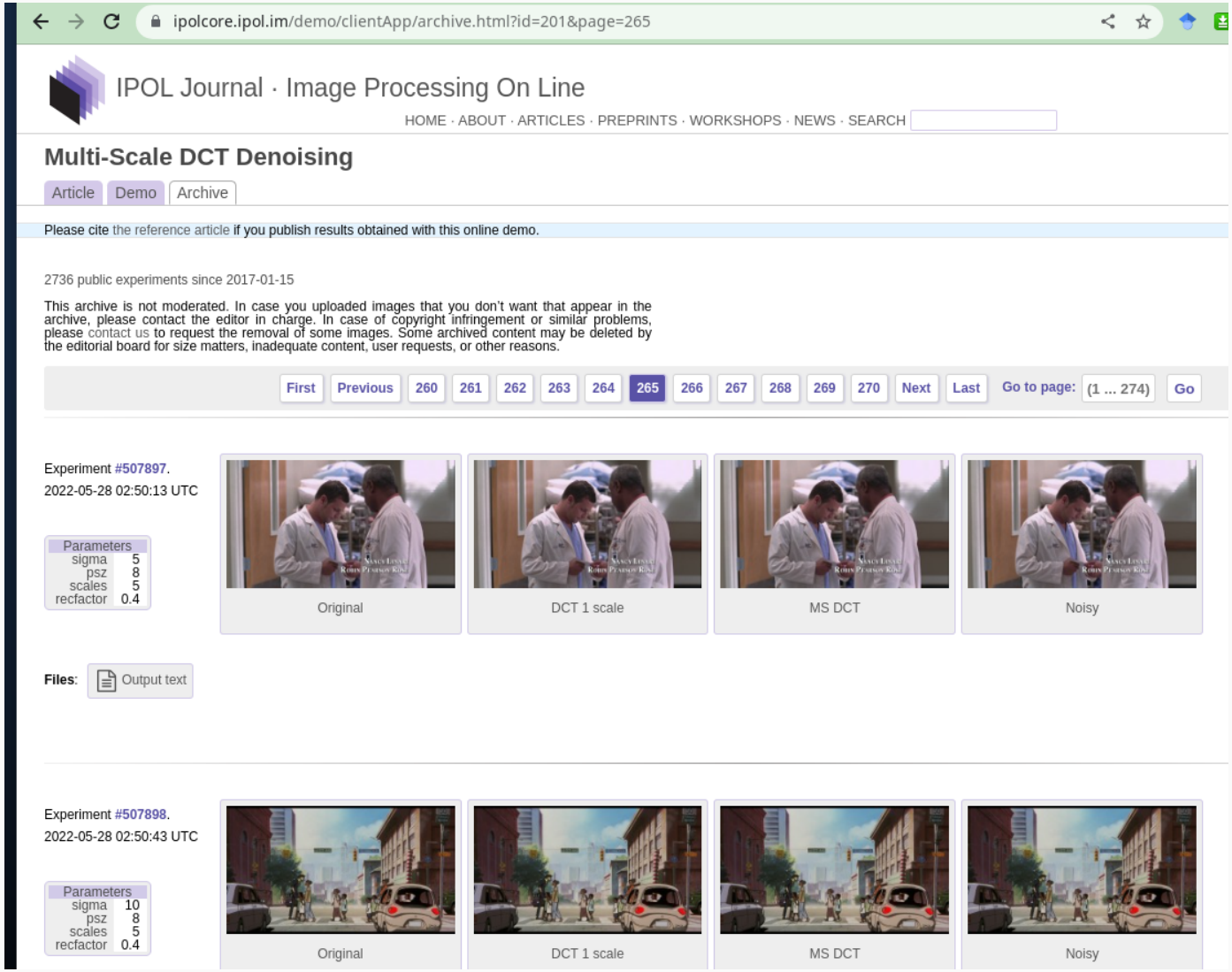
IPOL
article

IPOL

demo


ipolcore.ipol.im/demo/clientApp/demo.html?id=201&key=5BD4B96A921F
IPOL Journal - Image Processing On Line
Multi-Scale DCT Denoising
Article
Demo
Archive
Select input(s)
input(s)
Parameters
Multi-scale DCT denoising parameters
add noise
σ
DCT size
scales
Results
Denoising results
DCT 1 scale
MS DCT noisy
MS DCT hard
Original
MS DCT
Noisy
diff DCT 1 scale
diff MS DCT
Compare
Download images:

IPOL archive



Benefits of RR

If a method is worth it, the impact is large

- Users worldwide can test the algorithm with their own data.
- Increase in the number of citations: other researchers can now compare to you.

Benefits of RR

If a method is worth it, the impact is large

- Users worldwide can test the algorithm with their own data.
- Increase in the number of citations: other researchers can now compare to you.

Scientific acceleration:

$\Rightarrow$ other researchers can reuse text, source code, data

Benefits of RR

If a method is worth it, the impact is large

- Users worldwide can test the algorithm with their own data.
- Increase in the number of citations: other researchers can now compare to you.

Scientific acceleration:

$\Rightarrow$ other researchers can reuse text, source code, data

Useful to show a landscape of our scientific activity

Reviewing RR

Main attention points:

- Consider **source code** as part of the publication, not supplementary material
- Different **levels of evaluation**:
  - Lowest: **black box** (same inputs $\rightarrow$ same outputs)
  - ...
  - Highest: deep understanding of the method and checking that the source code matches the implementation faithfully.

Reviewing RR

Main attention points:

- Consider **source code** as part of the publication, not supplementary material
- Different **levels of evaluation**:
  - Lowest: **black box** (same inputs → same outputs)
  - ...
  - Highest: deep understanding of the method and checking that the source code matches the implementation faithfully.

Difficulties

- **Software** is not easy to review.
- Many researchers are not software engineers!

⇒ A possible solution (IPOL): use **at least two reviewers**, one of them being an expert reading source code.

Reviewing RR

Main attention points:

- Consider **source code** as part of the publication, not supplementary material
- Different **levels of evaluation**:
  - Lowest: **black box** (same inputs → same outputs)
  - ...
  - Highest: deep understanding of the method and checking that the source code matches the implementation faithfully.

Difficulties

- **Software** is not easy to review.
- Many researchers are not software engineers!

⇒ A possible solution (IPOL): use **at least two reviewers**, one of them being an expert reading source code.

Special case of neural networks

Focus on the **architecture**, **training**, **understanding**, and **generalization**.

IPOL Submission Processing

- Four editors in chief: Luis Alvarez (Univ. Gran Canaria), PM, Jean-Michel Morel (ENS Paris Saclay), Gregory Randall (Univ. Montevideo)
- EiCs decide if the submission looks interesting.
- EiCs name an associate editor for the submission.
- The editor chooses reviewers and a demo editor.
- Reviewers may be asked to check different aspects: article, code, demo.
- After acceptation, an EiC checks the article and plays with the demo, testing with different input data and parameters

Published articles

Currently about 15–20 accepted submissions per year.

Google Scholar

CONNEXI

IPOL CITATIONS

SUIVRE

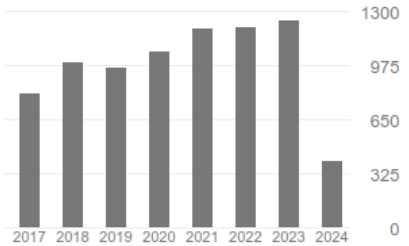
IPOL Journal Image Processing Online
Adresse e-mail validée de ctim.es - Page d'accueil
Image Processing Applied Mathematics

OBTENIR MON PROPRE PROFIL

TITRE	CITÉE PAR	ANNÉE
Non-Local Means Denoising A Buades, B Coll, JM Morel IPOL Journal : Image Processing On Line 1	949	2011
LSD: a line segment detector RG Von Gioi, J Jakubowicz, JM Morel, G Randall IPOL Journal Image Processing On Line 2, 35-55	886	2012
An Analysis of the Viola-Jones Face Detection Algorithm YQ Wang IPOL Journal : Image Processing On Line 4, 128-148	497	2014
TV-L1 Optical Flow Estimation J Sánchez, E Meinhardt-Llopis, G Facciolo IPOL Journal : Image Processing On Line. 3, 137-150	475 *	2013
Asift: An algorithm for fully affine invariant comparison G Yu, JM Morel IPOL Journal : Image Processing On Line 1	427 *	2011
An Analysis and Implementation of the BM3D Image Denoising Method M Lebrun IPOL Journal Image Processing On Line 2, 175-213	393	2012
Multiscale Retinex AB Petro, C Sbert, JM Morel IPOL Journal : Image Processing On Line 4, 71-88	353	2014
Rudin-Osher-Fatemi total variation denoising using split Bregman P Getreuer IPOL Journal : Image Processing On Line 2, 79-95	308	2012
Chan-vese segmentation P Getreuer IPOL Journal : Image Processing On Line 2, 214-224	236	2012
Self-similarity Driven Demosaicking A Buades, B Coll, JM Morel, C Sbert IPOL Journal : Image Processing On Line 1	200 *	2011

Citée par TOUT AFFICHER

	Toutes	Depuis 2019
Citations	9839	6078
indice h	44	38
indice i10	117	93



Coauteurs TOUT AFFICHER

- Jean Michel Morel — Ecole Normale Supérieure de Ca…
- rafael grompone von gioi — Centre Borelli, ENS Paris-Saclay…
- A. Buades
- Pascal Getreuer — Google Research
- C Sbert — UIB
- Gabriele Facciolo — Professor of Mathematics, Centr…
- Gregory Randall — Profesor Instituto de Ingenieria E…

Thank you for your attention