SAMUEL HURAULT

Postdoctoral Researcher at Ecole Normale Superieure, Paris

Inverse Problems, Optimization, Machine Learning

@ huraultsamuel@ens.fr scholar https://scholar.google.fr/citations?user=f_rtYCAAAAAJ&hl=fr

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Education

PhD Student

Institut de Mathématiques de Bordeaux

2020-2023 Bordeaux, France

Supervisors : Prof. Nicolas Papadakis, Dr. Arthur Leclaire https://theses.hal.science/tel-04401431

Convergent plug-and-play methods for image inverse problems with explicit and nonconvex deep regularization.

Master "Mathematiques, Vision, Appentissage" (MVA)

Ecole Normale Superieure Paris-Saclay

2018 – 2019 Paris, France

Bachelor in Mathematics

Ecole Normale Superieure Paris-Saclay

2016 – 2018 Cachan, France

Professional Experiences

Postdoctoral researcher

CNRS - Ecole Normale Superieure

April 2024 – Paris, France

Supervisor : Prof. Gabriel Peyré

Research visit

Geometric Data Processing Group, CSAIL, Massachusetts Institute of Technology (MIT).

September 2022 – December 2022 Cambridge, USA

Supervisor : Prof. Justin Solomon

Developed a discretization-free framework for solving a large PDEs on probability measures with neural networks [1].

Research internship in Video Processing

Image Processing Group, University Pompeu Fabra (UPF)

November 2019 – July 2020 Barcelona, Spain

Supervisors : Prof. Coloma Ballester, Prof. Gloria Haro

Developed a performant soccer player detection and tracking method using self-supervision and domain adaptation [6].

Research internship in Deep Learning

Ministère des Armées

April – September 2019 Paris, France

Detailed review and performance comparison of acceleration and compression methods for deep neural networks.

Research internship in 3D Vision

Computer Science Department, Otago University

May – September 2018 Dunedin, New-Zealand

Supervisor : Prof. Steven Mills

Developed a Microsoft Hololens mixed reality system to assist pool players.

Research internship in Image Processing

Centre Borelli, ENS Paris-Saclay

January – July 2017 Cachan, France

Supervisors : Prof. Jean-Michel Morel, Prof. Pablo Arias, Dr. Thibaud Ehret

Analysis, optimization, and extensions of the EPLL image denoising algorithm [9].

Publications

Conference Proceedings

[1] Convergent Bregman Plug-and-Play Image Restoration for Poisson Inverse Problems.
S Hurault, U Kamilov, A Leclaire, N Papadakis
Neural Information Processing Systems (Neurips) (2023)

[2] Self-Consistent Velocity Matching of Probability Flows.
Lingxiao Li, Samuel Hurault, Justin Solomon
Neural Information Processing Systems (Neurips) (2023)

[3] A Relaxed Proximal Gradient Descent Algorithm for Convergent Plug-and-Play with Proximal Denoiser
S Hurault, A Chambolle, A Leclaire, N Papadakis
Scale Space and Variational Methods in Computer Vision (SSVM) (2023)

[4] Proximal Denoiser for Convergent Plug-and-Play Optimization with Nonconvex Regularization
S Hurault, A Leclaire, N Papadakis
International Conference on Machine Learning (ICML) (2022)

[5] Gradient Step Denoiser for convergent Plug-and-Play
S Hurault, A Leclaire, N Papadakis
International Conference on Learning Representations (ICLR) (2022)

[6] Self-Supervised Small Soccer Player Detection and Tracking
S Hurault, C Ballester, G Haro
3rd International Workshop on Multimedia Content Analysis in Sports, 9-18 (2020)

Book Chapters

[7] An Analysis of Generative Methods for Multiple Image Inpainting
Coloma Ballester, Aurelie Bugeau, Samuel Hurault, Simone Parisotto, Patricia Vitoria
Handbook of Mathematical Models and Algorithms in Computer Vision and Imaging, Springer (2022).

Journal Articles

[8] Convergent plug-and-play with proximal denoiser and unconstrained regularization parameter
S Hurault, A Chambolle, A Leclaire, N Papadakis
Journal of Mathematical Imaging and Vision (2024)
[9] EPLL: an image denoising method using a Gaussian mixture model learned on a large set of patches
S Hurault, T Ehret, P Arias
Image Processing On Line 8, 465-489 (2018)

Grants, Awards

Best PhD Award from GRETSI, Club EEA, and GdR IASIS
Best PhD Thesis Award for 2024 in Signal, Image, and Vision

Best Student Paper Award SSVM (2023)
For the paper [3] **A Relaxed Proximal Gradient Descent Algorithm for Convergent Plug-and-Play with Proximal Denoiser** S Hurault, A Chambolle, A Leclaire, N Papadakis

Grant UBGRS International Mobility
University of Bordeaux Grant for a research stay at Massachusetts Institute of Technology.

CDSN **PhD Grant**
Doctoral grant for Ecole Normale students.

Software Productions

Co-created and developed the python library **Deep Inverse**
An open-source Pytorch library for solving imaging inverse problems using deep learning
`https://deepinv.github.io`
In collaboration with Julian Tachella, Matthieu Terris, Dongdong Chen

Open-source **codes** for Plug-and-Play image restoration
Python libraries implementing methods from my research papers on Plug-and-Play inverse problems
PyTorch implementations based on PyTorch Lightning
`https://github.com/samuro95`

Organization of scientific events

Organization of an **international workshop**

Mathematical Models for Plug-and-play Image Restoration

`https://gdr-mia.math.cnrs.fr/events/pnpworkshop/`

2022 — Paris, France

Organization of a **coding hackathon**

For the DeepInverse Library

`https://conferences.cirm-math.fr/3396.html`

2024 — CIRM, Marseille, France

Talks and presentations

CIROQUO scientific days at CEA *invited speaker*

November 2024 — Paris, France

Paris-Saclay Signal Seminar *invited speaker*

October 2024 — Saclay, France

Grenoble DATA seminar *invited speaker*

September 2024 — Grenoble, France

DIPOpt Workshop *Presentation of the DeepInverse library*

December 2023 — Lyon, France

Inria Saclay MIND team seminar *invited speaker*

November 2023 — Virtual

Applied Inverse Problems Conference (AIP) 2023 *contributed talk*

September 2023 — Gôttingen, Germany

ENS Lyon "Machine Learning & Signal Processing" seminar *invited speaker*

June 2023 — Lyon, France

Interfacing Bayesian Stat., ML, Applied Analysis, and Blind and Semi-Blind Imaging Inv. Prob. *invited speaker*

January 2023 — Edinburgh, Scotland

Workshop on Mathematical Models for Plug-and-play Image Restoration *tutorial presentation*

December 2022 — Paris, France

Workshop Analytic and Geometric Approaches to Machine Learning *invited speaker*

July 2022 — Bath, UK

3rd IMA Conference on Inverse Problems from Theory to Application *contributed talk*

May 2022 — Edinburgh, Scotland

SIAM Conference on Imaging Science 2022 *contributed talk*

March 2022 — Virtual

Supervision

Internship supervision of Marcelo Domingues (M1, ENS Rennes)

IPOL Journal extension of the conference paper [5]

Co-supervised by Prof. N Papadakis & Dr. Arthur Leclaire

Teaching

Assistant Professor, Numerical Methods for Mathematics (3rd year of Bachelor)

University of Bordeaux

2021/2022 (64h) — Bordeaux, France