SAMUEL HURAULT

PhD student (3rd year)

@ samuel.hurault@math.u-bordeaux.fr scholar https://scholar.google.fr/citations?user=f_rtYCAAAAAJ&hl=fr
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Education

PhD in Image Processing

Institut de Mathématiques de Bordeaux

2020-2023 Bordeaux, France

Supervisors : Prof. Nicolas Papadakis, Dr. Arthur Leclaire

Deep denoising priors for image inverse problems: new Plug-and-Play iterative algorithms with convergence guarantees.

Master "MVA" Mathematics, Vision, Learning

Paris-Saclay University

2018 – 2019 Paris, France

Degree in Mathematics

Ecole Normale Superieure Paris-Saclay

2016 – 2018 Cachan, France

Preparatory School MPSI-PSI*

Chateaubriand high-school

2013 – 2016 Rennes, France

Research Experiences

PhD research visit

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

September 2022 – December 2022 Cambridge, USA

Supervisor : Prof. Justin Solomon

Developed a deep discretization-free scalable framework for solving a large class of mass-conserving PDEs [1].
Denoising Score Matching for 3D point clouds.

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 / Collaboration with Prof Pablo Muse and Dr. Patricia Vitoria

Improved soccer player detection and tracking performance using self-supervised learning and domain adaptation [7].
Augmentation of the VQ-VAE networks for image restoration.

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 [8].

Publications

Conference Proceedings

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

[2] Self-Consistent Velocity Matching of Probability Flows.
Lingxiao Li, Samuel Hurault, Justin Solomon
Under review (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 Chapter

[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] 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)

Talks and presentations

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

Scale Space and Variational Methods in Computer Vision (SSVM) (2023) *oral presentation*
May 2023 — Sardinia, Italy

Interfacing Bayesian Stat., ML, Applied Analysis, and Blind and Semi-Blind Imaging Inv. Prob. *poster presentation*
January 2023 — Edinburgh, Scotland

Workshop on Mathematical Models for Plug-and-play Image Restoration *tutorial presentation*
December 2022 — Paris, France

MIT Geometric Data Processing Group seminar *invited speaker*
September 2022 — Cambridge, USA

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

Grants, Awards

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

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.

Projects and Realizations

Organization of an international workshop

Mathematical Models for Plug-and-play Image Restoration
`https://gdr-mia.math.cnrs.fr/events/pnpworkshop/`

2022 Paris, France

Creation and development of the library **DeepInv**
An open-source pytorch library for solving imaging inverse problems using deep learning
`https://deepinv.github.io/deepinv/index.html`
Joint work with Julian Tachella, Matthieu Terris, Dongdong Chen