# Maxime Vono

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## Research interests

My current research interests lie in computational statistics, federated learning, generative modeling and Bayesian neural networks.
My Ph.D. works focused on deriving a broad approximate statistical framework and associated Monte Carlo sampling approaches by taking inspiration from the variable splitting method in optimisation, e.g., used by quadratic penalty approaches and the alternating direction method of multipliers (ADMM).
Currently, I am working on distributed Bayesian learning, Bayesian federated learning and Bayesian deep learning.

**Keywords:** Bayesian inference, computational statistics, federated learning, optimisation, Monte Carlo methods, signal and image processing, statistical machine learning.

## Education

2017-2020 **Ph.D. in Statistics**, ***University of Toulouse***, Toulouse.
Asymptotically exact data augmentation - Models and Monte Carlo sampling with applications to Bayesian inference, under the supervision of Nicolas Dobigeon and Pierre Chainais.

**Defended on October 7, 2020**. Ph.D. committee: Pierre Chainais (advisor), Emilie Chouzenoux (examiner), Nicolas Dobigeon (advisor), Jalal Fadili (referee), Florence Forbes (referee), Jean-Michel Marin (examiner) and Eric Moulines (president). Do not hesitate to contact Jalal Fadili and Florence Forbes if you need their reports.

I was awarded a competitive scholarship from CIMI Excellence Laboratory. *Rank: 1/50+*.

In spring 2019, I was a visiting research scholar at the **University of Oxford** in Arnaud Doucet's research group.

I was also a member of the ORION-B project which brings together observatorial astronomers, theoretical astrophysicists, data scientists and statisticians in order to analyse galactic and extra-galactic molecular line observations.

2016-2017 **M.Sc. in Applied Mathematics**, ***University of Lille***, Lille.
Major in **Probability & Statistics**: Itô calculus, statistics, stochastic processes. *Honours*.

*Clearance pricing policy optimisation with an application to Leroy Merlin France pricing strategy*, under the supervision of Azzouz Dermoune.

2013-2017 **M.Sc. in Engineering**, ***École Centrale de Lille***, Lille.
Major in **Data Analysis & Decision making (DAD):** optimisation, statistical estimation and learning. *Rank: 1/24. Top 2% (250 students)*.

## Work experience

nov. 2020 - current **Research Associate**, *Lagrange Mathematics and Computing Research Center, Huawei*, Paris.
I am working with Alain Durmus (ENS Paris-Saclay) and Eric Moulines (Polytechnique, member of the French Academy of Sciences).
Research topics: distributed/federated Bayesian methods with applications to large-scale machine learning problems.
I am mentoring 1 Ph.D. student and 2 M.Sc. interns.

apr. 2017 - sep. 2017 **Data Scientist intern**, *Vekia*, Lille.
Machine learning techniques (random forests, sparse representations, time series, ...) applied to sales forecasting issues and supply chain management.
Led 4 major projects in different sectors: clothing, home improvement, food and health/beauty.

mar. 2016 - sep. 2016 **Data Scientist intern**, *Leroy Merlin France*, Lille.
Daily revenue forecasting (time series). The derived revenue forecasting algorithm is currently used to anticipate potential losses with respect to initial objectives.

sep. 2015 - feb. 2016 **Financial Auditor intern**, *EY*, Paris.
Financial statements analyses.

## Industrial partnerships

2018 - 2019 **Intermarché**, *Strategy, Commercial Performance and Data direction*, Paris.
Consultancy missions in data strategy and sales/revenue forecasting (32 days).

2016 - 2017 **Leroy Merlin France**, *Pricing direction*, Lille.
Dynamic pricing in clearance and promotional events (stochastic processes, robust control, Itô calculus). The derived pricing strategy was tested on real sales transactions and has been proposed to some French brick-and-mortar stores.

## Supervision

2021 **Elie Louis (M.Sc. intern)**, *Mines ParisTech*, co-advised with Eric Moulines.
Variational inference for black-box inverse problems with applications to astrophysics.

2021 **Ayoub Tajja (M.Sc. intern)**, *ENSTA ParisTech*, co-advised with Eric Moulines.
Variational inference for non-linear inverse problems.

2020 - current **Vincent Plassier (Ph.D. student)**, *Ecole Polytechnique*, co-advised with Alain Durmus and Eric Moulines.
Distributed Monte Carlo methods with applications to large-scale Bayesian inference.

## Editorial activities

### Refereeing for conferences

IEEE ICASSP Conferences, IEEE MLSP Workshops, ICML Conferences, NeurIPS Conferences.

### Refereeing for journals

Digital Signal Processing, Journal of Machine Learning Research.

## Seminars and invited talks

2021/08 **Invited talk**, *Journées MAS 2020*, online.
"Asymptotically exact data augmentation : models, algorithms and theory"

2021/06 **Invited talk**, *Workshop on large scale simulation and high-dimensional sampling, Huawei Hong-Kong*, Online.
"DG-LMC: A turn-key and scalable synchronous distributed MCMC algorithm via Langevin Monte Carlo within Gibbs"

2020/12 **Seminar**, *$S^3$ Seminar - The Paris-Saclay Signal Seminar*, CentraleSupelec.
"Efficient MCMC sampling via asymptotically exact data augmentation"

2020/11 **Invited talk**, *Workshop on large scale simulation and high-dimensional sampling, Huawei Hong-Kong*, Online.
"Asymptotically exact data augmentation (AXDA): An approximate statistical framework for Bayesian inference" and "Efficient sampling in high-dimensional and large-scale problems based on AXDA"

2020/09 **Seminar**, *Laplace's Demon Seminar*, Online.
"Efficient MCMC sampling using ADMM-type splitting"

2020/02 **Seminar**, *Actuarial Mathematics & Statistics Seminar*, School of Mathematics of Heriot Watt University, Edinburgh, United Kingdom.
"Asymptotically exact data augmentation: models, properties and algorithms"

2019/12 **Invited talk**, *Toulouse Inderdisciplinary group on Deep Learning*, Quai des Savoirs, Toulouse, France.
"Asymptotically exact data augmentation: models, properties and algorithms"

2019/12 **Invited talk**, *Workshop on optimization, probability and simulation*, Shenzhen Institute of Artificial Intelligence and Robotics for Society, University of Hong-Kong, Shenzhen, China.
"Asymptotically exact data augmentation: models, properties and algorithms"

2019/04 **Invited talk**, *Mews Digital Day*, Mews Partners, Toulouse, France.
"On artificial intelligence dedicated to supply chain and business strategy"

2019/03 **Seminar**, *OxCSML Seminar*, Department of Statistics, University of Oxford, Oxford, United Kingdom.
"Asymptotically exact data augmentation: models, properties and algorithms"

2018/05 **Seminar**, *CRIStAL Seminar*, Ecole Centrale de Lille, Lille, France.
"Split-and-augmented Gibbs sampler - A divide & conquer approach to solve large-scale inference problems"

## Computer skills

| | |
|---|---|
| Programming | MATLAB, Python, R |
| Documents | LaTeX, Microsoft Office |

## Languages

| | |
|---|---|
| French | Mother tongue |
| English | Fluent |
| Spanish | Fluent |

## Publications

**Synthetic summary of the scientific production** (submitted as gray subscripts)

| | total | | 2021 | 2020 | 2019 | 2018 |
|---|---|---|---|---|---|---|
| international journal | $6^{+1}$ | = | 5 | | 1 | |
| international conference | $5^{+1}$ | = | 1 | | 3 | 1 |
| national conference | 2 | = | | | 2 | |

**Bibliometric indicators** (source: Google Scholar, August 2021)

Citations : 90

H-index : 6

**Full list of publications**

### Submitted papers

[S2] **M. Vono**, V. Plassier, A. Durmus, A. Dieuleveut and E. Moulines, *QLSD: Quantised Langevin stochastic dynamics for Bayesian federated learning*. arXiv: 2106.00797. Submitted to NeurIPS 2021.

[S1] **M. Vono***, D. Paulin*, and A. Doucet, *Efficient MCMC sampling with dimension-free convergence rate using ADMM-type splitting*. arXiv: 1905.11937. In revision in Journal of Machine Learning Research.

### International journal papers

[JI6] **M. Vono**, N. Dobigeon, and P. Chainais (2021), *High-dimensional Gaussian sampling: A review and a unifying approach based on a stochastic proximal point algorithm*, SIAM Review, to appear.

[JI5] **M. Vono**, N. Dobigeon, and P. Chainais (2021), *Asymptotically exact data augmentation: models, properties and algorithms*, Journal of Computational and Graphical Statistics, vol. 30, no. 2, pp. 335-348.

[JI4] P. Gratier, J. Pety, E. Bron, A. Roueff, J. H. Orkisz, M. Gerin, V. de Souza Magalhaes, M. Gaudel, **M. Vono**, S. Bardeau, J. Chanussot, P. Chainais, J. R. Goicoechea, V. V. Guzmán, A. Hughes, J. Kainulainen, D. Languignon, J. Le Bourlot, F. Le Petit, F. Levrier, H. Liszt, N. Peretto, E. Roueff, and A. Sievers (2021), *Quantitative inference of the $H_2$ column densities from 3 mm molecular emission: A case study towards Orion B*, Astronomy & Astrophysics, vol. 645, no. A27

[JI3] E. Bron, E. Roueff, M. Gerin, J. Pety, P. Gratier, F. Le Petit, V. Guzmán, J. H. Orkisz, V. de Souza Magalhaes, M. Gaudel, **M. Vono**, S. Bardeau, P. Chainais, J. R. Goicoechea, A. Hughes, J. Kainulainen, D. Languignon, J. Le Bourlot, F. Levrier, H. Liszt, K. Oberg, N. Peretto, A. Roueff, and A. Sievers (2020), *Tracers of the ionization fraction in dense and translucent gas. I. Automated exploitation of massive astrochemical model grids*, Astronomy & Astrophysics, vol. 645, no. A28.

[JI2] A. Roueff, M. Gerin, P. Gratier, F. Levrier, J. Pety, M. Gaudel, J. R. Goicoechea, J. H. Orkisz, V. de Souza Magalhaes, **M. Vono**, S. Bardeau, E. Bron, J. Chanussot, P. Chainais, V. V. Guzman, A. Hugues, J. Kainulainen, D. Languignon, J. Le Bourlot, F. Le Petit, H. S. Liszt, A. Marchal, M.-A. Miville-Deschenes, N. Peretto, E. Roueff, and A. Sievers (2020), *C18O, 13CO, and 12CO abundances and excitation temperatures in the Orion B molecular cloud* , Astronomy & Astrophysics, vol. 645, no. A26.

[JI1] **M. Vono**, N. Dobigeon, and P. Chainais (2019). *Split-and-augmented Gibbs sampler - Application to large-scale inference problems*, IEEE Transactions on Signal Processing, vol. 67, no. 6, pp. 1648-1661.

### International conference papers

[CI5] V. Plassier*, **M. Vono***, A. Durmus* and E. Moulines (2021), *DG-LMC: a turn-key and scalable synchronous distributed MCMC algorithm via Langevin Monte Carlo within Gibbs*, in ICML, Online

[CI4] **M. Vono**, E. Bron, P. Chainais, F. L. Petit, S. Bardeau, S. Bourguignon, J. Chanussot, M. Gaudel, M. Gerin, J. R. Goicoechea, P. Gratier, V. V. Guzmán, A. Hughes, J. Kainulainen, D. Languignon, J. L. Bourlot, F. Levrier, H. S. Listz, K. I. Oberg, J. H. Orkisz, N. Peretto, J. Pety, A. Roueff, E. Roueff, A. Sievers, V. de Souza Magalhaes, and P. Tremblin (2019), *A fully Bayesian approach for inferring physical properties with credibility intervals from noisy astronomical data*, in WHISPERS, Amsterdam, Netherlands

[CI3] **M. Vono**, N. Dobigeon, and P. Chainais (2019), *Image restoration under Poisson noise and log-concave prior*, in ICASSP, Brighton, U.K.

[CI2] **M. Vono**, N. Dobigeon, and P. Chainais (2019), *Efficient sampling through variable splitting-inspired Bayesian hierarchical models*, in ICASSP, Brighton, U.K.

[CI1] **M. Vono**, N. Dobigeon, and P. Chainais (2018), *Sparse Bayesian binary logistic regression using the split-and-augmented Gibbs sampler*. In MLSP, Aalborg, Denmark. *Finalist for the Best Student Paper Awards*.

### National conference papers

[CN2] **M. Vono**, N. Dobigeon, and P. Chainais (2019), *Modèles augmentés asymptotiquement exacts*, in GRETSI, Lille, France

[CN1] **M. Vono**, N. Dobigeon, and P. Chainais (2019), *Un modèle augmenté asymptotiquement exact pour la restauration bayésienne d'images dégradées par un bruit de Poisson*, in GRETSI, Lille, France