December 20, 2023

Edouard Pauwels

PERSONAL DETAILS

Birth	May 02, 1986 in Strasbourg, France (French nationality)
Currently	Professor, Toulouse School of Economics 1 Esplanade de l'université , 31080 Toulouse Cedex 06.
Contact	edouard.pauwels@tse-fr.eu +33561128510 edouardpauwels.fr

APPOINTMENTS

Professor Start - Sept. 2023
Toulouse School of Economics, Toulouse, France

Assistant Professor Sept. 2015 - Aug. 2023
IRIT, Toulouse, France
ADRIA team.

Post-doc in Applied Mathematics Oct. 2014 - Jul. 2015
Technion, Haifa, Israel
Supervisor: Shoham Sabach. Large scale convex optimization.

Post-doc in Applied Mathematics Jan. 2014 - Sep. 2014
LAAS-CNRS, University of Toulouse, France
Supervisors: Didier Henrion and Jean-Bernard Lasserre. Polynomial optimization for inverse control.

EDUCATION

French Habilitation in Applied Mathematics Dec. 2020
Université Toulouse 3 Paul Sabatier
Contributions to optimization and applications to machine learning.

Ph.D. in Applied Mathematics Sept. 2010 - Dec. 2013
Center for Computational Biology, Mines ParisTech, Curie Institute, INSERM U900, France
Supervisor: Véronique Stoven. Machine learning in computational biology.

Engineering degree (M.Sc.) Sept. 2006 - Jul. 2010
Mines ParisTech, France
Computer science, optimization, statistics. Majoring in Geostatistics.

DISTINCTIONS

Math. Prog.	*Meritorious Service Award, exceptional diligence in reviewing*	2023
IUF	*Junior member, Institut Universitaire de France*	2022
CNRS bronze Medal	*INSII, section 7*	2020
PEDR	*CNU, reward for doctoral supervision and research*	2019-2023
Best reviewer award	*Neural information processing systems (url, url)*	2015 and 2017

PROJECTS

American Air Force *USAF* 2019-2022
American Air Force Grant (co-PI) FA9550-19-1-7026 (2 postocs, PI, J. Bolte)

MasDol *ANR* 2019-2022
Mathematics of stochastic and deterministic optimization for deep learning

ANITI *ANR* 2019-2022
Junior member of the chair on "Large scale optimization for AI"

ALAPAGE (PI) *CNRS-MASTODONS, CIMI Labex* 2017-2020
Algebra and approximation for machine learning

Approximate structured learning (Co PI) *CIMI Labex* 2017-2020
Approximation processes in structured learning with applications in discourse processing.

ACADEMIC ACTIVITIES

SCIENTIFIC EVENTS

POP-23 *Toulouse* October 2023
Member of the organization comittee, international workshop on future trends in polynomial optimization.

ANITI-PRAIRIE *Toulouse* June 2023
Member of the organization comittee, organised between AI institutes from Paris and Toulouse.

Mois de l'optimisation *Toulouse* November 2022
Member of the organization comittee, four public conferences to popularise mathematical optimization.

Mobilit.AI *Québec, Canada* May 2022
Member of the scientific committe, transport industry forum.

CIMI thematic semester *Toulouse* 2019
Member of the organization comittee of the CIMI thematic semester on statistics with geometry and topology. Responsible for the organisation of one workshop.

French-Chilean days *Toulouse* July 2017
President of the organizing comitee of the 8-th French Chilean days on Optimization in Toulouse (60 registered attendees).

AOC *Toulouse* Since 2016
Member of the organizing comittee of weekly meetings and working groups.

SCIENTIFIC AND ACADEMIC RESPONSIBILITIES

Associate Editor since 2021
Journal of optimization theory and applications (url)

GDR MOA Since 2021
Mathematics Optimisation and Applications. National board member.

AOC team *Co responsible with Laurent Risser* since 2020
Scientific animation, team activity reporting

IMA Master program *Co responsible with Thomas Pellegrini* since 2021
Administrative organisation and pedagogic conception

Stat-Eco Master program *Co responsible with Anne Ruiz-Gazen* 2018-2021
Administrative organisation and pedagogic conception

SPOT *Toulouse* Since 2016
Member of the organizing comittee of the Toulouse Seminar on Optimization.

ADVISOR, PHD STUDENTS

Ryan Boustany *With Jérôme Bolte* 2021-
Computational aspects of algorithmic differentiation

Tam Le *With Jérôme Bolte* 2020-

Conservative fields in machine learning

Tong Chen *With Victor Magron and Jean-Bernard Lasserre* 2019-2022
Polynomial optimization for robustness certification (manuscipt url)

Camille Castera *With Jérôme Bolte and Cédric Févotte* 2018-2021
Optimization for deep learning (manuscript url)

ADVISOR, POSTDOCTORAL FELLOWS

Cyrille Combettes *With Jérôme Bolte* 2021-2022
Convergence of Franck-Wolfe algorithm

Antony Silvetti-Falls *With Jérôme Bolte* 2021-2022
Nonsmooth implicit differentiation

Rodolfo Rios-Zeruche *With Jérôme Bolte* 2020-2022
Convergence of the subgradient algorithm

Lilian Glaudin *With Jérôme Bolte* 2020-2021
Optimization for min-max structured problems

Zheng Chen *With Jérôme Bolte* 2016-2017
Composite algorithms for convex optimization

Antoine Hochart *With Jérôme Bolte* 2016-2017
Perturbed sets and constraints qualification

ADVISOR, MS STUDENTS

Cheik Traore 2020
Convergence of adaptive algorithms in Optimization

Petr petr Zamolodtchikov *With Jean-Michel Loubes* 2019
Distributional robustness for empirical risk minimization.

Trang May Vu *With Franҫis Bachoc* 2018
Statistical bounds for empirical Chirstoffel function

Yousouf Emin *With Jean-Bernard Lasserre* 2017
Christoffel function for singular measures

Benoit Tran *With Jean-Bernard Lasserre* 2017
Optimization for evaluation of the Christoffel function

Frank Buijs *With Stergos Afantagos and Mathieu Serrurier* 2016
Structured output learning for discourse processing

REVIEWER

Bioinformatics
Computational and Applied Mathematics
Conference on Learning Theory (COLT)
Constructive approximation
International Conference on Machine Learning (ICML)
International Conference on Learning Representations (ICLR)
IEEE International Conference on Decision and Control (CDC)
IEEE Transactions on Automatic Control
IEEE Transactions on Computational Biology
IEEE Transactions on Signal Processing.
Journal of Approximation Theory
Journal of Global Optimization
Journal of Machine Learning Research.
Journal of Mathematical Analysis and Applications
Journal of Optimization Theory and Applications
Journal of the Society for the Foundations of Computational Mathematics
Machine Learning

Mathematical Control and Related Fields
Mathematics of Operation research
Mathematical Programming
Neural Information Processing Systems (best reviewer award, 2015, 2017)
Molecular BioSystems
Optimization
Optimization Letters
Plos One
Séminaire et Congrès de la SMF.
Set-Valued Analysis and Variational Analysis
SIAM Journal on Optimization
SIAM Journal on Control and Optimization

COMMUNICATIONS

All preprints are available from my webpage:
`https://www.irit.fr/~Edouard.Pauwels/publications.html`

JOURNAL ARTICLES

1. Bolte, J., Combettes, C. W., and Pauwels, E. The iterates of the frank-wolfe algorithm may not converge. *arXiv preprint arXiv:2202.08711* (2022)

2. Bolte, J., Pauwels, E., and Silveti-Falls, A. J. Differentiating nonsmooth solutions to parametric monotone inclusion problems. *arXiv preprint arXiv:2212.07844* (2023). Accepted for publication in SIAM journal on Optimization

3. Bolte, J., Le, T., and Pauwels, E. Subgradient sampling for nonsmooth nonconvex minimization. *arXiv preprint arXiv:2202.13744* (2023). Accepted for publication in SIAM journal on optimization

4. Pauwels, E. Conservative parametric optimality and the ridge method for tame min-max problems. *Set-Valued and Variational Analysis 31*, 3 (2023), 1–24

5. Bolte, J., Glaudin, L., Pauwels, E., and Serrurier, M. A Hölderian backtracking method for min-max and min-min problems. Tech. rep., 2020. Accepted for publication in Open journal of Optimization

6. Pauwels, E., and Vaiter, S. The derivatives of sinkhorn-knopp converge. *arXiv preprint arXiv:2207.12717* (2023). Accepted for publication in SIAM journal on optimization

7. Bolte, J., Pauwels, E., and Rios-Zertuche, R. Long term dynamics of the subgradient method for lipschitz path differentiable functions. *Journal of the European Mathematical Society* (2022)

8. Marx, S., and Pauwels, E. Path differentiability of ode flows. *Journal of Differential Equations 338* (2022), 321–351

9. Vu, M. T., Bachoc, F., and Pauwels, E. Rate of convergence for geometric inference based on the empirical christoffel function. *ESAIM: Probability and Statistics 26* (2022), 171–207

10. Fabian, M., Hiriart-Urruty, J.-B., and Pauwels, E. On the generalized jacobian of the inverse of a lipschitzian mapping. *Set-Valued and Variational Analysis* (2022), 1–9

11. Chen, T., Lasserre, J.-B., Magron, V., and Pauwels, E. A sublevel moment-sos hierarchy for polynomial optimization. *Computational Optimization and Applications 81*, 1 (2022), 31–66

12. Castera, C., Bolte, J., Févotte, C., and Pauwels, E. Second-order step-size tuning of sgd for non-convex optimization. *Neural Processing Letters 54*, 3 (2022), 1727–1752

13. Traoré, C., and Pauwels, E. Sequential convergence of adagrad algorithm for smooth convex optimization. *Operations Research Letters 49*, 4 (2021), 452–458

14. Bolte, J., and Pauwels, E. Curiosities and counterexamples in smooth convex optimization. *Mathematical Programming* (2021), 1–51

15. Pauwels, E. Incremental without replacement sampling in nonconvex optimization. *Journal of Optimization Theory and Applications* (2021). In press

16. Castera, C., Bolte, J., Févotte, C., and Pauwels, E. An inertial newton algorithm for deep learning. *Journal of Machine learning research* (2021)

17. Marx, S., Pauwels, E., Weisser, T., and Didier Henrion, J.-B. L. Semi-algebraic approximation using christoffel-darboux kernel. *Constructive approximation* (2020)

18. Bolte, J., and Pauwels, E. Conservative set valued fields, automatic differentiation, stochastic gradient methods and deep learning. *Mathematical Programming 188*, 1 (2021), 19–51

19. Pauwels, E., Putinar, M., and Lasserre, J.-B. Data analysis from empirical moments and the christoffel function. *Foundations of Computational Mathematics* (2020), 1–31

20. Lasserre, J. B., and Pauwels, E. The empirical christoffel function with applications in data analysis. *Advances in Computational Mathematics 45*, 3 (2019), 1439–1468

21. Sagnol, G., and Pauwels, E. An unexpected connection between bayes a-optimal designs and the group lasso. *Statistical Papers 60*, 2 (2019), 215–234. Presented in conference MODA 2019

22. Bolte, J., Chen, Z., and Pauwels, E. The multiproximal linearization method for convex composite problems. *Mathematical Programming* (2018), 1–36

23. Bolte, J., Hochart, A., and Pauwels, E. Qualification conditions in semi-algebraic programming. *SIAM journal on Optimization 28*, 2 (2018), 1867–1891

24. Pauwels, E., Beck, A., Eldar, Y., and Sabach, S. On Fienup methods for sparse phase retrieval. *IEEE transactions on Signal Processing 66*, 4 (2018), 982–991

25. Nguyen, T. P., Pauwels, E., Richard, E., and Suter, B. W. Extragradient method in optimization: Convergence and complexity. *Journal of Optimization Theory and Applications 176*, 1 (2017), 137–162

26. Beck, A., Pauwels, E., and Sabach, S. Primal and dual predicted decrease approximation methods. *Mathematical Programming* (2017), 1–37

27. Pauwels, E. The value function approach to convergence analysis in composite optimization. *Operations Research Letters 44*, 6 (2016), 790–795

28. Bolte, J., and Pauwels, E. Majorization-minimization procedures and convergence of sqp methods for semi-algebraic and tame programs. *Mathematics of Operations Research 41*, 2 (2016), 442–465

29. Pauwels, E., Henrion, D., and Lasserre, J.-B. Linear conic optimization for inverse optimal control. *SIAM Journal on Control and Optimization 54*, 3 (2016), 1798–1825

30. Beck, A., Pauwels, E., and Sabach, S. The cyclic block conditional gradient method for convex optimization problems. *SIAM Journal on Optimization 25*, 4 (2015), 2024–2049

31. Pauwels, E., Lajaunie, C., and Vert, J.-P. A bayesian active learning strategy for sequential experimental design in systems biology. *BMC Systems Biology 8*, 1 (2014), 102

32. Mizutani, S., Pauwels, E., Stoven, V., Goto, S., and Yamanishi, Y. Relating drug–protein interaction network with drug side effects. *Bioinformatics 28*, 18 (2012), i522–i528

33. Tabei, Y., Pauwels, E., Stoven, V., Takemoto, K., and Yamanishi, Y. Identification of chemogenomic features from drug–target interaction networks using interpretable classifiers. *Bioinformatics 28*, 18 (2012), i487–i494

34. Yamanishi, Y., Pauwels, E., and Kotera, M. Drug side-effect prediction based on the integration of chemical and biological spaces. *Journal of chemical information and modeling 52*, 12 (2012), 3284–3292

35. Pauwels, E., Surdez, D., Stoll, G., Lescure, A., Del Nery, E., Delattre, O., and Stoven, V. A probabilistic model for cell population phenotyping using hcs data. *PLoS ONE 7*, 8 (08 2012), e42715

36. Pauwels, E., Stoven, V., and Yamanishi, Y. Predicting drug side-effect profiles: a chemical fragment-based approach. *BMC bioinformatics 12*, 1 (2011), 169

37. Yamanishi, Y., Pauwels, E., Saigo, H., and Stoven, V. Extracting sets of chemical substructures and protein domains governing drug-target interactions. *Journal of chemical information and modeling 51*, 5 (2011), 1183–1194

INTERNATIONAL CONFERENCE PROCEEDINGS

1. Bolte, J., Pauwels, E., and Vaiter, S. One-step differentiation of iterative algorithms. *arXiv preprint arXiv:2305.13768* (2023)

2. Bolte, J., Boustany, R., Pauwels, E., and Pesquet-Popescu, B. Nonsmooth automatic differentiation: a cheap gradient principle and other complexity results. In *International Conference on Learning Representations* (2023). Spotlight presentation (top 25% accepted papers)

3. Bolte, J., Pauwels, E., and Vaiter, S. Automatic differentiation of nonsmooth iterative algorithms. In *Advances in Neural Information Processing Systems* (2022)

4. Bertoin, D., Bolte, J., Gerchinovitz, S., and Edouard, P. Numerical influence of relu'(0) on backpropagation. In *Advances in Neural Information Processing Systems* (2021)

5. Bolte, J., Le, T., Pauwels, E., and Silveti-Falls, A. Nonsmooth implicit differentiation for machine learning and optimization. In *Advances in Neural Information Processing Systems* (2021)

6. Chen, T., Lasserre, J.-B., Magron, V., and Pauwels, E. Semialgebraic representation of monotone deep equilibrium models and applications to certification. In *Advances in Neural Information Processing Systems* (2021)

7. Chen, T., Lasserre, J.-B., Magron, V., and Pauwels, E. Semialgebraic optimization for lipschitz constants of relu networks. In *Advances in Neural Information Processing Systems* (2020)

8. Bolte, J., and Pauwels, E. A mathematical model for automatic differentiation in machine learning. In *Advances in Neural Information Processing Systems* (2020). Spotlight presentation (top 25% accepted papers)

9. Pauwels, E., Bach, F., and Vert, J.-P. Relating leverage scores and density using regularized christoffel functions. In *Advances in Neural Information Processing Systems* (2018)

10. Pauwels, E., and Lasserre, J. B. Sorting out typicality with the inverse moment matrix sos polynomial. In *Advances in Neural Information Processing Systems* (2016), pp. 190–198

11. Pauwels, E., Henrion, D., and Lasserre, J.-B. Inverse optimal control with polynomial optimization. In *Annual Conference on Decision and Control (CDC)* (2014), IEEE, pp. 5581–5586

BOOKS

1. Jean-Bernard Lasserre, Edouard Pauwels, M. P. *The Christoffel-Darboux Kernel for Data Analysis*. Cambridge University Press, 2021

BOOK CHAPTERS

1. Pauwels, E. Introduction to optimization for machine learning. Tech. rep., 2023. Textbook chapter, in preparation

2. Pauwels, E., Henrion, D., and Lasserre, J.-B. Positivity certificates in optimal control. In *Geometric and Numerical Foundations of Movements*, J.-P. Laumond, N. Mansard, and J.-B. Lasserre, Eds. SPRINGER, 2017

3. Henrion, D., and Pauwels, E. Linear conic optimization for nonlinear optimal control. In *Advances and Trends in Optimization with Engineering Applications*, T. Terlaky, M. Anjos, and S. Ahmed, Eds. SIAM, 2017

WORKING PAPERS

1. Pauwels, E. On the nature of bregman functions. *HAL preprint hal-03974132* (2023)

2. Serrurier, M., Loubes, J.-M., and Pauwels, E. Fairness with wasserstein adversarial networks. Tech. rep., 2019. Working paper

ORAL COMMUNICATIONS: CONFERENCES, WORKSHOPS AND SEMINARS

1. CCOA workshop, September 2023, Tel-Aviv University, Tel-Aviv, Israel.

2. Colloquium, February 2023, IMAG, Montpellier, France.

3. PMNL workshop (GdR RO), October 2022, LIRMM, Montpellier, France.

4. GdR MOA workshop, October 2022, Université Côte d'Azur, Nice, France.

5. Learning and Optimization in Luminy, October 2022, CIRM, Luminy, France (video).

6. French-Chilean days on optimisation, June 2022, Promes, Perpignan, France.

7. MaLGa Seminar, May 2022, Genoa, Italy.

8. Workshop on The Christoffel-Darboux Kernel & Applications, Newcastle, England.

9. Seminaire MBI-MCS, Paris 13, January 2022, France (online).

10. CIMI-ANITI school on optimization, September 2021, Toulouse, France.

11. One world optimization seminar (OWOS), September 2021, Austria (online).

12. Statistics Seminar, Paris 6 - Paris 7 Universities, June 2021, France (online).

13. Mobilit.AI forum, May 2021, France-Quebec (online).

14. Colloquium CIMI, International Centre for Mathematics and Computer Science in Toulouse, May 2021, France (online).

15. Télécom Paris Seminar, May 2021, Paris, France (online).

16. Séminaire d'Automatique du plateau de Saclay, Laboratory of signals and systems, February 2021, Paris Saclay, France (online).

17. Tutorial on GANs at Games, Approachability and Learning Workshop the, January 2021, Paris France (online).
18. CAS seminar, November 2020, Mines ParisTech, Paris, France (online).
19. Madstat seminar, September 2020, Toulouse School of Economics.
20. Séminaire Français d'optimisation, July 2020, online.
21. POEMA H2020 Innovative Training Networks online learning weeks, June 2020, three session course, online.
22. Workshop on Optimization for machine learning, March 2020, CIRM, Luminy, France.
23. Workshop on Optimization and Statistical Learning, March 2019. Les Houches, France.
24. Network and Optimization Seminar, October 2018. Amsterdam, Netherlands.
25. Journées TSE-IMT, Setpember 2018, IMT, Toulouse.
26. International Conference on Mathematical Programming, July 2018. Bordeaux, France.
27. Séminaire d'analyse non linéaire et d'optimisation, May 2018, Avignon, France.
28. Zalando Research Seminar, April 2018, Berlin, Germany.
29. Workshop Stat Math Appli, Septembre 2017. Fréjus, France.
30. Conference on Neural Information Processing Systems, December 2016. Barcelona, Spain.
31. Continuous Optimization: Challenges and Applications, an international workshop celebrating Ronny Ben-Tal's 70 birthday, September 2016. Technion, Haifa, Israel.
32. International Conference on Continuous Optimization, August 2016, Tokyo, Japan.
33. Wokshop on Geometric and Numerical Foundations of Movements, November 20 2015. LAAS-CNRS, Toulouse, France.
34. International Symposium on Optimization, July 2015, Pittsburgh USA.
35. MIA-T seminar, Sep. 23 2016, INRA Toulouse, France.
36. Mini-workshop on optimization. LAAS CNRS, June 2016, Toulouse, France.
37. Séminaire Parisien d'Optimisation, June 2016, IHP, Paris, France.
38. Journées SMAI-MODE, Mars 2016, ENSEEIHT, Toulouse, France.
39. SPOT seminar, September 2015, Toulouse France
40. Nonlinear Analysis and Optimization seminar, Jan. 18 2015, Mathematics Faculty, Technion, Haifa, Israël.
41. MIA-T seminar, February 14 2014, INRA Toulouse, France.
42. Identification of chemogenomic features from drug-target interaction networks using interpretable classifiers. ECCB 2012, Basel, Switzerland.
43. Modeling cell populations in high content screening using copulas. Poster, NIPS 2011 Workshop on Copulas in Machine Learning, Grenada, Spain.
44. Mixture models for cell population phenotyping. 2nd Workshop on Bioinformatics for Medical and Pharmaceutical Research, 2011, Institut Curie, France
45. Analyse statistique de liens entre les espaces moleculaires et phenotypiques. Seminaire maths et systemes, January 2011, Mines ParisTech, France