

## PERSONAL DETAILS

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<i>Birth</i>	May 02, 1986 in Strasbourg, France (French nationality)
<i>Currently</i>	Assistant Professor, Institut de Recherche en Informatique de Toulouse, Université Paul Sabatier, 31400, Toulouse, France.
<i>Web</i>	edouard.pauwels@irit.fr, <a href="http://www.irit.fr/~edouard.pauwels">http://www.irit.fr/~edouard.pauwels</a>

## APPOINTMENTS

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<b>Assistant Professor</b> <i>IRIT, Toulouse, France</i>	Start - Sept. 2015
Member of ADRIA team at IRIT and AOC joint project team between IRIT and IMT.	
<b>Post-doc in Applied Mathematics</b> <i>Technion, Haifa, Israel</i>	Oct. 2014 - Jul. 2015
Supervisor: Shoham Sabach. Large scale convex optimization.	
<b>Post-doc in Applied Mathematics</b> <i>LAAS-CNRS, University of Toulouse, France</i>	Jan. 2014 - Sep. 2014
Supervisors: Didier Henrion and Jean-Bernard Lasserre. Polynomial optimization for inverse control.	

## EDUCATION

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<b>French Habilitation in Applied Mathematics</b> <i>Université Toulouse 3 Paul Sabatier</i>	Dec. 2020
Contributions to optimization and applications to machine learning.	
<b>Ph.D. in Applied Mathematics</b> <i>Center for Computational Biology, Mines ParisTech, Curie Institute, INSERM U900, France</i>	Sept. 2010 - Dec. 2013
Supervisor: Véronique Stoven. Machine learning in computational biology.	
<b>Engineering degree (M.Sc.)</b> <i>Mines ParisTech, France</i>	Sept. 2006 - Jul. 2010
Computer science, optimization, statistics. Majoring in Geostatistics.	

## DISTINCTIONS

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

## PROJECTS

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<b>American Air Force</b>	<i>USAF</i>	2019-2022
American Air Force Grant (co-PI) FA9550-19-1-7026 (2 postocs, PI, J. Bolte)		
<b>MasDol</b>	<i>ANR</i>	2019-2022
Mathematics of stochastic and deterministic optimization for deep learning		

<b>ANITI</b>	<i>ANR</i>	2019-2022
Junior member of the chair on “Large scale optimization for AI”		
<b>ALAPAGE (PI)</b>	<i>CNRS-MASTODONS, CIMI Labex</i>	2017-2020
Algebra and approximation for machine learning		
<b>Approximate structured learning (Co PI)</b>	<i>CIMI Labex</i>	2017-2020
Approximation processes in structured learning with applications in discourse processing.		

## ACADEMIC ACTIVITIES

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### SCIENTIFIC EVENTS

<b>POP-23</b>	<i>Toulouse</i>	October 2023
Member of the organization committee, international workshop on future trends in polynomial optimization.		
<b>Mois de l’optimisation</b>	<i>Toulouse</i>	November 2022
Member of the organization committee, four public conferences to popularise mathematical optimization.		
<b>Mobilit.AI</b>	<i>Québec, Canada</i>	May 2022
Member of the scientific committee, transport industry forum.		
<b>CIMI thematic semester</b>	<i>Toulouse</i>	2019
Member of the organization committee of the CIMI thematic semester on statistics with geometry and topology. Responsible for the organisation of one workshop.		
<b>French-Chilean days</b>	<i>Toulouse</i>	July 2017
President of the organizing committee of the 8-th French Chilean days on Optimization in Toulouse (60 registered attendees).		
<b>AOC</b>	<i>Toulouse</i>	Since 2016
Member of the organizing committee of weekly meetings and working groups.		

### SCIENTIFIC AND ACADEMIC RESPONSIBILITIES

<b>Associate Editor</b>		since 2021
Journal of optimization theory and applications (url)		
<b>GDR MOA</b>		Since 2021
Mathematics Optimisation and Applications. National board member.		
<b>AOC team</b>	<i>Co responsible with Laurent Risser</i>	since 2020
Scientific animation, team activity reporting		
<b>IMA Master program</b>	<i>Co responsible with Thomas Pellegrini</i>	since 2021
Administrative organisation and pedagogic conception		
<b>Stat-Eco Master program</b>	<i>Co responsible with Anne Ruiz-Gazen</i>	2018-2021
Administrative organisation and pedagogic conception		
<b>SPOT</b>	<i>Toulouse</i>	Since 2016
Member of the organizing committee of the Toulouse Seminar on Optimization.		

### ADVISOR, PHD STUDENTS

<b>Ryan Boustany</b>	<i>With Jérôme Bolte</i>	2021-
Computational aspects of algorithmic differentiation		
<b>Tam Le</b>	<i>With Jérôme Bolte</i>	2020-
Conservative fields in machine learning		
<b>Tong Chen</b>	<i>With Victor Magron and Jean-Bernard Lasserre</i>	2019-2022
Polynomial optimization for robustness certification (manuscript url)		
<b>Camille Castera</b>	<i>With Jérôme Bolte and Cédric Févotte</i>	2018-2021
Optimization for deep learning (manuscript url)		

## ADVISOR, POSTDOCTORAL FELLOWS

<b>Cyrille Combettes</b>	<i>With Jérôme Bolte</i>	2021-2022
Convergence of Franck-Wolfe algorithm		
<b>Antony Silvetti-Falls</b>	<i>With Jérôme Bolte</i>	2021-2022
Nonsmooth implicit differentiation		
<b>Rodolfo Rios-Zeruche</b>	<i>With Jérôme Bolte</i>	2020-2022
Convergence of the subgradient algorithm		
<b>Lilian Glaudin</b>	<i>With Jérôme Bolte</i>	2020-2021
Optimization for min-max structured problems		
<b>Zheng Chen</b>	<i>With Jérôme Bolte</i>	2016-2017
Composite algorithms for convex optimization		
<b>Antoine Hochart</b>	<i>With Jérôme Bolte</i>	2016-2017
Perturbed sets and constraints qualification		

## ADVISOR, MS STUDENTS

<b>Cheik Traore</b>		2020
Convergence of adaptive algorithms in Optimization		
<b>Petr petr Zamolodtchikov</b>	<i>With Jean-Michel Loubes</i>	2019
Distributional robustness for empirical risk minimization.		
<b>Trang May Vu</b>	<i>With François Bachoc</i>	2018
Statistical bounds for empirical Christoffel function		
<b>Yousouf Emin</b>	<i>With Jean-Bernard Lasserre</i>	2017
Christoffel function for singular measures		
<b>Benoit Tran</b>	<i>With Jean-Bernard Lasserre</i>	2017
Optimization for evaluation of the Christoffel function		
<b>Frank Buijs</b>	<i>With Stergos Afantagos and Mathieu Serrurier</i>	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

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All preprints are available from my webpage:

<https://www.irit.fr/~Edouard.Pauwels/publications.html>

## JOURNAL ARTICLES

1. 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
2. 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)
3. MARX, S., AND PAUWELS, E. Path differentiability of ode flows. *Journal of Differential Equations* 338 (2022), 321–351
4. 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
5. 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
6. 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
7. 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
8. TRAORÉ, C., AND PAUWELS, E. Sequential convergence of adagrad algorithm for smooth convex optimization. *Operations Research Letters* 49, 4 (2021), 452–458
9. BOLTE, J., AND PAUWELS, E. Curiosities and counterexamples in smooth convex optimization. *Mathematical Programming* (2021), 1–51
10. PAUWELS, E. Incremental without replacement sampling in nonconvex optimization. *Journal of Optimization Theory and Applications* (2021). In press
11. CASTERA, C., BOLTE, J., FÉVOTTE, C., AND PAUWELS, E. An inertial newton algorithm for deep learning. *Journal of Machine learning research* (2021)
12. MARX, S., PAUWELS, E., WEISSER, T., AND DIDIER HENRION, J.-B. L. Semi-algebraic approximation using christoffel-darboux kernel. *Constructive approximation* (2020)
13. BOLTE, J., AND PAUWELS, E. Conservative set valued fields, automatic differentiation, stochastic gradient methods and deep learning. *Mathematical Programming* 188, 1 (2021), 19–51
14. PAUWELS, E., PUTINAR, M., AND LASSERRE, J.-B. Data analysis from empirical moments and the christoffel function. *Foundations of Computational Mathematics* (2020), 1–31
15. LASSERRE, J. B., AND PAUWELS, E. The empirical christoffel function with applications in data analysis. *Advances in Computational Mathematics* 45, 3 (2019), 1439–1468

16. 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
17. BOLTE, J., CHEN, Z., AND PAUWELS, E. The multiproximal linearization method for convex composite problems. *Mathematical Programming* (2018), 1–36
18. BOLTE, J., HOCHART, A., AND PAUWELS, E. Qualification conditions in semi-algebraic programming. *SIAM journal on Optimization* 28, 2 (2018), 1867–1891
19. PAUWELS, E., BECK, A., ELДАР, Y., AND SABACH, S. On Fienup methods for sparse phase retrieval. *IEEE transactions on Signal Processing* 66, 4 (2018), 982–991
20. 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
21. BECK, A., PAUWELS, E., AND SABACH, S. Primal and dual predicted decrease approximation methods. *Mathematical Programming* (2017), 1–37
22. PAUWELS, E. The value function approach to convergence analysis in composite optimization. *Operations Research Letters* 44, 6 (2016), 790–795
23. 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
24. 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
25. 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
26. 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
27. 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
28. TABELI, 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
29. 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
30. 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
31. PAUWELS, E., STOVEN, V., AND YAMANISHI, Y. Predicting drug side-effect profiles: a chemical fragment-based approach. *BMC bioinformatics* 12, 1 (2011), 169
32. 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., 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)
2. BOLTE, J., PAUWELS, E., AND VAITER, S. Automatic differentiation of nonsmooth iterative algorithms. In *Advances in Neural Information Processing Systems* (2022)
3. BERTOIN, D., BOLTE, J., GERCHINOVITZ, S., AND EDOUARD, P. Numerical influence of  $\text{relu}'(0)$  on backpropagation. In *Advances in Neural Information Processing Systems* (2021)
4. 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)
5. 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)
6. 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)
7. 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)
8. 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)
9. 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
10. 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. BOLTE, J., PAUWELS, E., AND SILVETI-FALLS, A. J. Differentiating nonsmooth solutions to parametric monotone inclusion problems. *arXiv preprint arXiv:2212.07844* (2022)
3. BOLTE, J., LE, T., AND PAUWELS, E. Subgradient sampling for nonsmooth nonconvex minimization. *arXiv preprint arXiv:2202.13744* (2022)
4. BOLTE, J., COMBETTES, C. W., AND PAUWELS, E. The iterates of the frank-wolfe algorithm may not converge. *arXiv preprint arXiv:2202.08711* (2022)
5. PAUWELS, E. The ridge method for tame min-max problems. Tech. rep., 2021
6. BOLTE, J., GLAUDIN, L., PAUWELS, E., AND SERRURIER, M. A Hölderian backtracking method for min-max and min-min problems. Tech. rep., 2020
7. 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. Colloquium, February 2023, IMAG, Montpellier, France.
2. PMNL workshop (GdR RO), October 2022, LIRMM, Montpellier, France.
3. GdR MOA workshop, October 2022, Université Côte d'Azur, Nice, France.
4. Learning and Optimization in Luminy, October 2022, CIRM, Luminy, France (video).
5. French-Chilean days on optimisation, June 2022, Promes, Perpignan, France.
6. MaLGa Seminar, May 2022, Genoa, Italy.
7. Workshop on The Christoffel-Darboux Kernel & Applications, Newcastle, England.
8. Séminaire MBI-MCS, Paris 13, January 2022, France (online).
9. CIMI-ANITI school on optimization, September 2021, Toulouse, France.
10. One world optimization seminar (OWOS), September 2021, Austria (online).
11. Statistics Seminar, Paris 6 - Paris 7 Universities, June 2021, France (online).
12. Mobilit.AI forum, May 2021, France-Quebec (online).
13. Colloquium CIMI, International Centre for Mathematics and Computer Science in Toulouse, May 2021, France (online).
14. Télécom Paris Seminar, May 2021, Paris, France (online).
15. Séminaire d'Automatique du plateau de Saclay, Laboratory of signals and systems, February 2021, Paris Saclay, France (online).
16. Tutorial on GANs at Games, Approachability and Learning Workshop the, January 2021, Paris France (online).
17. CAS seminar, November 2020, Mines ParisTech, Paris, France (online).
18. Madstat seminar, September 2020, Toulouse School of Economics.
19. Séminaire Français d'optimisation, July 2020, online.

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