

Magali Champion

Assistant professor in Statistics

Laboratoire de Mathématiques Appliquées (MAP5)
IUT de Paris - Rives de Seine, Université Paris Cité, France

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Summary of activities

Research interests

- Statistical learning : network inference, graphical models, clustering, high dimension, penalized linear regressions, sparsity
- Computational biology : cancer, multi-omics data integration, gene regulatory networks, non-invasive prenatal diagnosis

Scientific production

- Publications : 7 international journal papers, 1 proceedings conference paper, 1 preprint
- Software : 4 publicly-available R packages
- Oral presentations : 19 accepted abstracts at conferences with peer-review, more than 30 invited talks to seminars and workgroups

Supervision

- 1 semester thesis, 3 bachelor thesis, 6 semester projects and 1 high school student internship

Teaching

- Statistics, Machine learning, Statistical software (R, SAS, Python, Scilab), Mathematics
- Undergraduate and Master students from departments of Biology, Computer Science, Data Science, Engineering, Management and Mathematics and professionals
- IUT de Toulouse, Université Toulouse III, INSA de Toulouse, ENAC Toulouse, ETH Zürich, IUT de Paris - Rives de Seine, Université Paris Cité

Education

2014 Ph.D. in Applied Mathematics, Université Toulouse III, France

- Title : Contributions to gene regulatory networks modeling and inference
- Advisor : Prof. Dr. Sébastien Gadat ; Co-advisors : Dr. Christine Cierco-Ayrolles and Prof. Dr. Matthieu Vignes

2011 M.Sc. in Applied Mathematics (rank : 1/14), Université Toulouse III, France

2009 B.Sc. in Pure Mathematics (rank : 3/57), Université Toulouse III, France

2006 Baccalauréat (High School diploma), Lycée Théophile Gautier, Tarbes, France

Experience

- Since September 2018 Assistant professor in Statistics, laboratoire MAP5
IUT de Paris - Rives de Seine, Université Paris Cité, France
- *maternity leave from September 2022 to March 2023* -
- From January 2022 to July 2022 Academic guest, Seminar für Statistik (SfS)
ETH Zürich, Switzerland
- 2016-2018 Postdoctoral researcher, laboratoire MAP5
Université Paris Descartes, France
- 2015-2016 Postdoctoral researcher, Stanford Center for Biomedical Informatics Research
Stanford University, United States
- 2014-2015 Teaching and research assistant, Institut de Mathématiques de Toulouse
INSA de Toulouse, France
- 2011-2014 Ph.D. student
Institut de Mathématiques de Toulouse, Université Toulouse III, France
Unité Mathématiques et Informatique Appliquées, INRA Toulouse, France

Research activities

List of publications and preprints

International journal papers

- [1] M. Pacault, C. Verebi, M. Champion, L. Orhant, A. Perrier, E. Girodon, F. Leturcq, D. Vidaud, C. Férec, T. Bienvenu, R. Daveau & J. Nectoux. Non-Invasive Prenatal Diagnosis of Single Gene Disorders with enhanced Relative Haplotype Dosage Analysis for diagnosis implementation. *PLoS One*, **18**(04): 1-19 doi:10.1371/journal.pone.0280976, 2023.
- [2] M. Champion, J. Chiquet, P. Neuvial, M. Elati, F. Radvanyi & E. Birmelé. Identification of deregulation mechanisms specific to cancer subtypes. *Journal of Bioinformatics and Computational Biology*, **19**(01): 2140003 doi:10.1142/S0219720021400035, 2021.
- [3] M. Champion, K. Brennan, A. Gentles, T. Croonenborghs, N. Pochet & O. Gevaert. Module Analysis Captures Pancancer Genetically and Epigenetically Deregulated Cancer Driver Genes for Smoking and Antiviral Response. *EBioMedicine*, **27**: 156-166 doi:10.1016/j.ebiom.2017.11.028, 2018.
- [4] M. Champion, V. Picheny & M. Vignes. Inferring large graphs using ℓ_1 -penalized likelihood. *Statistics and Computing*, **28**(4): 905-921 doi:10.1007/s11222-017-9769-z, 2017.
- [5] R. Dubey, A.M. Lebensohn, Z. Bahrami-Nejad, C. Marceau, M. Champion, O. Gevaert, B.I. Sikic, J.E. Carette & R. Rohatgi. Chromatin-Remodeling Complex SWI/SNF Controls Multidrug Resistance by Transcriptionally Regulating the Drug Efflux Pump ABCB1. *Cancer Research* **76**(19): 5810-5821 doi: 10.1158/0008-5472.CAN-16-0716, 2016.
- [6] M. Champion, G. Chastaing, S. Gadat & C. Prieur. \mathbb{L}_2 -Boosting for sensitivity analysis with dependent inputs. *Statistica Sinica* **25**: 1477-1502, doi:10.5705/ss.2013.310, 2015.
- [7] M. Champion, C. Cierco-Ayrolles, S. Gadat & M. Vignes. Sparse regression and support recovery with \mathbb{L}_2 -Boosting algorithms. *Journal of Statistical Planning and Inference*, **155**(C): 18-40, doi:10.1016/j.jspi.2014.07.006, 2014.

Conference proceedings papers

[8] M. Champion, J. Chiquet, P. Neuvial, M. Elati, F. Radvanyi & E. Birmelé. Identification of Deregulated Transcription Factors Involved in Specific Bladder Cancer Subtypes. *Proceedings of the 12th International Conference on Bioinformatics and Computational Biology*, **70**: 1-10 doi:10.29007/v7qj, 2020.

Preprints

[9] C. Champion, M. Champion, M. Blazère, R. Burcelin & J.M. Loubes. ℓ_1 -spectral clustering algorithm : a spectral clustering method using ℓ_1 -regularization. *Submitted*, hal-03095805, 2022.

R-Packages

- ℓ_1 spectral: An ℓ_1 -Version of the Spectral Clustering (C. Champion & M. Champion). Available on CRAN.
- LIONS: Identification of deregulation mechanisms specific to cancer subtypes (M. Champion, J. Chiquet, P. Neuvial, M. Elati & E. Birmelé). Available on GitHub.
- PancancerAMARETTO: Multi-omics data fusion for cancer module discovery (M. Champion, K. Planey & O. Gevaert). Available on Bitbucket.
- GADAG: A Genetic Algorithm for Learning Directed Acyclic Graphs (M. Champion, V. Picheny & M. Vignes). Available on CRAN.

Scientific talks

Contributions to international conferences

- M. Pacault, C. Verebi, M. Champion, L. Orhant, A. Perrier, C. Férec, T. Bienvenu, R. Daveau & J. Nectoux. Non-invasive prenatal diagnosis of monogenic diseases by enhanced relative haplotype dosage analysis. European Human Genetics Conference (ESHG), Vienna, Austria (2022).
- M. Champion, J. Chiquet, P. Neuvial, M. Elati, F. Radvanyi & E. Birmelé. Identification of deregulated transcription factors in specific bladder cancer subtypes. 12th International Conference on Bioinformatics and Computational Biology (BICOB), San Francisco, United States (2020). *Canceled due to Coronavirus.*
- M. Champion, K. Brennan, T. Croonenborghs, A. Gentles, N. Pochet & O. Gevaert. Module Analysis Captures Pancancer Genetically and Epigenetically Deregulated Cancer Driver Genes for Smoking and Antiviral Response. Intelligent Systems for Molecular Biology (ISMB), Boston, United States (2018).
- M. Champion, J. Chiquet, P. Neuvial, M. Elati & E. Birmelé. Identification of deregulated transcription factors in specific subtypes of cancer. 16th International Conference on Bioinformatics (InCoB), Shenzhen, China (2017).
- M. Champion & O. Gevaert. Pancancer module analysis captures major oncogenic pathways and identifies master regulator of immune response. Keystone symposia on Molecular and Cellular Biology: The Cancer Genome, Banff, Canada (2016).
- M. Champion & O. Gevaert. Multi-omics data fusion for cancer data. 14th Annual International Conference on Critical Assessment of Massive Data Analysis (CAMDA), Dublin, Ireland (2015).
- M. Champion, G. Chastaing, S. Gadat & C. Prieur. \mathbb{L}_2 -Boosting on Generalized Hoeffding Decomposition for Dependent Variables. SIAM Conference on Uncertainty Quantification, Savannah, United States (2014).

- M. Champion, J. Vandel, C. Cierco-Ayrolles, S. Gadat & M. Vignes. An L_2 -Boosting algorithm for sparse multivariate regression : application to gene network recovery. NIPS Machine Learning for Computational Biology Workshop, Sierra Nevada, Spain (2011).

Presentations at other conferences with peer-review

- M. Pacault, C. Verebi, M. Champion, L. Orhant, A. Perrier, C. Férec, T. Bienvenu, R. Daveau & J. Nectoux. Non-invasive prenatal diagnostic of monogenic diseases by relative haplotype dosage. 11th Meeting of Human and Medical Genetics, Rennes, France (2022).
- J. Nectoux, C. Verebi, R. Daveau, A. Launois, L. Orhant, G. Leroy, M. Champion, D. Bouvet, C. Saint-Martin, C. Ciangura, & C. Bellané-Chantelot. Non-invasive prenatal determination of the fetal genotype for pregnant women suffering from monogenic diabetes MODY-GCK : feasibility study on 24 patients. 11th Meeting of Human and Medical Genetics, Rennes, France (2022).
- M. Pacault, C. Férec & M. Champion. Non Invasive Prenatal Diagnosis of Single Gene Disorders using long read technologies. Scientific days from the Biological-Health doctoral school, Angers, France (2019).
- M. Champion, V. Picheny & M.Vignes. GADAG : an R-package for inferring Directed Acyclic Graphs by penalized maximum likelihood. 6th R meeting, Anglet, France (2017).
- M. Champion, V. Picheny & M.Vignes. Inferring Directed Acyclic Graphs by penalized maximum likelihood. 49th Statistics days of the French Statistical Society, Avignon, France (2017).
- M. Champion, J. Chiquet, P. Neuvial & E. Birmelé. Identification of deregulated transcription factors in bladder cancer. Colloquim CARTABLE for Network Learning, Toulouse, France (2016).
- M. Champion & O. Gevaert. Pancancer module analysis captures major oncogenic pathways and identifies master regulator of immune response. Stanford Cancer Institute Trainees Symposium, Stanford, United States (2016).
- M. Champion & O. Gevaert. Multi-omics data fusion for cancer data. StatMathAppli conference, Fréjus, France (2015).
- M. Vignes, M. Champion & V. Picheny. Statistical causal inference in a complex system - an hybrid convex-genetic algorithm. Joint New Zealand Statistical Association (NZSA) and Operations Research Society of New Zealand (ORSNZ) conference, Wellington, New Zealand (2014).
- M. Champion, C. Cierco-Ayrolles, S. Gadat & M. Vignes. Convex optimization for learning Gene Regulatory Network. StatMathAppli conference, Fréjus, France (2013).
- M. Champion, C. Cierco-Ayrolles, S. Gadat & M. Vignes. Results on the L_2 -Boosting algorithms for sparse regressions. 45th Statistics days of the French Statistical Society, Toulouse, France (2013).

Invited talks at seminars and workgroups

Since 2011 More than 30 presentations performed online (webtalks) or in research labs in France, the United States and Switzerland

Grants

Current grants

Since 2022 “Evaluation of the performances of non-invasive prenatal diagnosis of monogenic diseases” with Juliette Nectoux as Principal Investigator

- Funding Organization : French National Hospital Program of Clinical Research (PHRC-N)

- Amount : 700,000 €
- Role : Collaborator
- Partners : Hôpitaux de Paris, CHU de Brest, Université Paris Cité and 8 other French hospitals

Previous fundings

- 2016-2018 Postdoc funded by the French National Institute of Health and Medical Research (INSERM) and the French National Cancer Institute (INCa)
- 2015-2016 Postdoc funded by the National Institutes of Health (NIH) and the National Cancer Institute (NCI)
- 2011-2014 Ph.D. fellowship from the French Ministry of Research

Awards

- 2019-2023 Award for excellence in research (PEDR) delivered by the French Ministry of Research
- 2015 CAMDA trophy award for the best contributed analysis “Multi-omics data fusion for cancer data”

Teaching activities

Teaching experience

Since 2018 Assistant professor, IUT de Paris - Rives de Seine, Université Paris Cité (192h per year)

- Statistical learning of gene networks, from inference to clustering (Fall French school JMBS for researchers in Applied mathematics)
- Multivariate exploratory data analysis (DU¹ in Data Visualization, Université Paris Cité)
- Introduction to data mining (DU¹ in Data Science, Université Paris Cité)
- Introduction to R (DU¹ in Data Science, Université Paris Cité)
- Machine Learning in high dimension (Master students in Mathematics, Université Paris Cité)
- Regression with applications to real data (Undergraduate students in Data Science, IUT de Paris)
- Parametric Tests (Undergraduate students in Data Science, IUT de Paris)
- Linear model (Undergraduate students in Data Science, IUT de Paris)
- Statistics with R (Undergraduate students in Data Science, IUT de Paris)
- Statistical survey project (Undergraduate students in Data Science, IUT de Paris)

From January 2022 to July 2022 Guest Lecturer, ETH Zürich (24h)

- Students seminar in Statistics : Causality (Bachelor and Master students, ETH Zürich)

2016-2018 Teaching assistant, ENAC Toulouse and Université Toulouse III (40h per year)

- Random simulation technics with Python/Scilab (Master students in Applied Mathematics, Université Toulouse III)
- Statistics (Master students in Applied Mathematics, Université Toulouse III)
- Parametric statistics (Undergraduate students in Engineering, ENAC Toulouse)
- Statistics with SAS (Undergraduate students in Management, Université Toulouse III)

1. DU : Diplôme Universitaire (*University Diploma*), a French diploma delivered by universities to professionals.

2014-2015 Teaching assistant, INSA de Toulouse (40h)

- Analysis (Undergraduate students in Engineering, INSA Toulouse)

2011-2014 Teaching assistant, IUT de Toulouse, Université Toulouse III (64h per year)

- Mathematics (Undergraduate students in Biology, Université Toulouse III)
- Analysis (Undergraduate students in Mathematics, Université Toulouse III)
- Probability and statistics (Undergraduate students in Computer Science, IUT de Toulouse)

Supervised students

Semester thesis

2022 Julia Netzel (Master of Applied Mathematics, ETH Zürich) on “Handling gender bias in NLP models” (4 months)

Bachelor thesis

2023 Clemens Kirchner (Bachelor of Mathematics, ETH Zürich) on “Clustering algorithms of gene networks using cancer data” (ongoing)

2022 Michaël Vollenweider (Bachelor of Computational Science and Engineering, ETH Zürich) on “Benchmark of gene regulatory network inference methods” (5 months)

Riccardo Fumagalli (Bachelor of Mathematics, ETH Zürich) on “Identification of genes involved in the classification of ER+ breast cancer” (3 months)

Semester projects

2021 Gauthier Pervieux (Undergraduate student in data science, IUT de Paris) on “Breast cancer statistical study” (2 months)

2020 Marina Atangana and Michael Tsimi (Undergraduate students in Data Science, IUT de Paris) on “Statistical analysis of airbnb data” (2 months)

2016 Reyna Zhang (Master of Statistics, Stanford University) on “Data fusion for predicting cancer survival” (2 months)

Teun de Planque and Christopher Elamri (Bachelor of Computer Science and Electrical Engineering, Stanford University) on “Identifying genes with prognostic DNA methylation rates for breast cancer survival” (2 months)

High-school student internship

2015 Nabeel Mamoon (High school student, winner of the *Stanford Institutes of Medicine Summer Research* program) on “Analysis of statistical signatures in methylation-guided automated carcinoma diagnosis” (2 months)

Participation in programs to promote mathematical education

2024 DataViz challenge : organization of a data visualization challenge for undergraduate students

2019 VIRTUeL project : introduction to research for undergraduate students (proposed and rewarded in the context of a call for proposals)

2015 Stanford Institutes of Medicine Summer Research : program established by the department of medicine at Stanford University to make high-school students discover research

2014 Young Mathematics Talents: introduction to mathematics research for secondary school students

- 2013 Girls and mathematics, a bright equation: promotion of mathematics among high-school female students
Seahorse project: discovery of mathematical research for high-school students

Professional service

Seminars organization

- 2020-2022 Co-organiser of the MAP5 statistics seminar (Université Paris Cité) with J. El Methni

Editorial service

Editorial board membership

- Since 2021 Associate editor of The International Journal of Biostatistics

Manuscript reviewer

- Since 2018 Reviews for the Journal of the Royal Statistical Society, Frontiers in Public Health, Annals of Applied Statistics

Responsibilities

- 2019-2021 Director of the 2nd year program of the Data Science department at IUT de Paris - Rives de Seine
2012-2014 Elected representative of the Ph.D. students at the council of the Institut de Mathématiques de Toulouse (Université Toulouse III)
Elected representative of the Ph.D. students at the council of the Unité Mathématiques et Informatique Appliquées (INRA Toulouse)

Committee member

Panel member of Ph.D. thesis defense

- 2021 Juliana Pegoraro, Ph.D. in Applied Mathematics, Université Paris Cité, France

Hiring committee member

- 2023 Assistant professor position in Applied Statistics at Université de Lille, France
2021 Assistant professor position in Mathematical and Applied Statistics at Université de Technologie de Compiègne, France
Assistant professor position in Statistical learning at Université Paris I, France
2019 University lecturer position in English at IUT de Paris - Rives de Seine, France

Computing and language skills

Software Mathematical: R, Python, Matlab, Scilab, SAS, Maple
Others: \LaTeX , Git, Open Office, HTML

Languages French (Native tongue), English (Fluent), German (Advanced) and Spanish (Intermediate)

Extra-curricular activities

- Since 2022 International judge of Artistic Roller Skating
- Since 2020 Member of the Stanford club of Switzerland
- Since 2019 French national technical specialist of Artistic Roller Skating
- 2007-2014 Volunteer trainer of Artistic Roller Skating at Roller Artistique Hautes-Pyrénées (Laloubère, France)