Mathieu Carrière

Researcher in Machine Learning and Geometry

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French and American citizenship

Education

Now	**Post-doc in Data Science and Machine Learning**, *DataShape, Inria Saclay, Palaiseau, France.*
2017	**Ph.D. in Applied Mathematics and Informatics**, *DataShape, Inria Saclay, Palaiseau, France.* **Ph.D. Title:** On metric and statistical properties of topological descriptors for geometric data.
2014	**M.Sc. in Mathematics, Vision and Learning**, *ENS Cachan, Cachan, France.*
2014	**Engineering Degree**, *Ecole Centrale Paris, Châtenay-Malabry, France.*

Research contributions and impact

My research focuses on topological data analysis (TDA) and statistical machine learning (ML). I contributed to the analysis of topological descriptors and on the use of ML kernel methods for them with appropriate kernels, signatures and metrics. This work resulted in several scientific articles in top conference proceedings and scientific journals, and has been used in different fields, like bioinformatics and computer graphics. I also implemented part of this work in the C++ GUDHI library.

Research Articles

Machine Learning

- Stable Topological Signatures for Points on 3D Shapes. M. Carrière, S. Oudot, M. Ovsjanikov, *Proceedings of the 13th Symposium on Geometry Processing, 2015.*
  Used topological descriptors to improve accuracy in 3D point classification on the dataset of Chen et al.

- Sliced Wasserstein Kernel for Persistence Diagrams. M. Carrière, M. Cuturi, S. Oudot, *Proceedings of the 34th International Conference on Machine Learning, 2017.*
  Derived a new kernel for Persistence Diagrams improving accuracy on various datasets, such as texture images.

- Statistical Analysis and Parameter Selection for Mapper. M. Carrière, B. Michel, S. Oudot, *Submitted to Journal of Machine Learning Research, 2017.*
  Defined confidence intervals and convergence rates for the Mapper clustering algorithm.

- Two-Tiers Mapper: a user-friendly clustering method for global gene expression based on topology. R. Jeitziner, M. Carrière, J. Rougemont, S. Oudot, K. Hess, C. Brisken.
  Used the Mapper clustering algorithm for genomics.

Metrics

- Local Equivalence and Intrinsic Metrics between Reeb graphs. M. Carrière, S. Oudot, *Proceedings of the 33rd Symposium on Computational Geometry, 2017.*
  Established a local equivalence between the bottleneck and the Gromov Hausdorff distances for Reeb graphs.

- Structure and Stability of the 1-Dimensional Mapper. M. Carrière, S. Oudot, *Journal on Foundations of Computational Mathematics, 2017.*
  Defined appropriate metrics to prove the stability of the Mapper clustering algorithm.

Skills

Languages	French (native), English (professional TOEFL 627/677), Spanish (B1 level).
Code	C++ (proficient), Python, R, Matlab (prior experience).

Grants

- Funding Support from ATMCS 2016.
- Mobility Grant (1000 euros) from the DAAD exchange program.

- Mobility Grant (1000 euros) from the STIC doctoral school.
- Best Scientific Contribution 2017 (2nd Prize – 600 euros) from the STIC doctoral school.
- Funding Support (1800 dollars) from ICML 2017.
- Funding Support from JGA 2017.

Teaching Activities

I was a teaching assistant for the following courses.

2015–2017	*Topological Data Analysis,* Ecole Polytechnique, Palaiseau, France.
2016–2017	*Basics of Algorithmic and Progamming,* Ecole Polytechnique, Palaiseau, France.

Presentations for Workshops and Conferences

I gave presentations at the following international conferences.

Jun. 2015	*Symposium on Geometry Processing,* TU Graz, Graz, Austria.
Nov. 2015	*Journées de Géométrie Algorithmiques,* IESC, Cargèse, Corsica, *Invited.*
Dec. 2015	*Computational and Methodological Statistics,* London University, London, UK, *Invited.*
Apr. 2016	*Stochastic Geometry and its Applications,* Université de Nantes, Nantes, France, *Invited.*
Jun. 2016	*Symposium on Computational Geometry,* Tufts University, Boston, USA.
Jul. 2016	*Applied Topology: Methods, Computation and Science,* Politecnica di Torino, Torino, Italy.
Aug. 2017	*International Conference on Machine Learning,* ICC, Sydney, Australia.
Sep. 2017	*France Japan Machine Learning Workshop,* ENS Ulm, Paris, France, *Invited.*
Oct. 2017	*Amazon Graduate Research Symposium,* Amazon Meeting Center, Seattle, USA, *Invited.*

References

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