Théo Lacombe

Postdoctoral researcher - Inria Saclay - Datashape

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Research interests

Recent progress in computational Optimal Transport has opened the door for a wide number of applications in statistics and machine learning. My research is focused on leveraging these tools and linking them with Topological Data Analysis in order to provide a theoretically consistent and numerically efficient framework to perform statistics on topological descriptors. I am now a post-doctoral researcher in the Datashape team (until March 2021). I will then join the team of Yasuaki Hiraoka (RIKEN AIP, Kyoto University).
Keywords: Statistics, Optimal Transport, Topological Data Analysis, Machine Learning.

Education

2017-2020 **Inria Saclay**, *Datashape*, Ph.D. Student.
- *Statistical tools for Topological Data Analysis via Optimal Transport*
- PhD under supervision of Steve Oudot (Inria Saclay) and Marco Cuturi (ENSAE - Google Brain)
- Grant from AMX, École polytechnique.

2016-2017 **ENS Cachan**, *MSc: Mathematics, Vision and Learning*.
- *Summa cum laude*
- Specialization on statistics, data analysis and geometry.

2013-2017 **École polytechnique**, *Engineering track*, Palaiseau, France.
Formation in applied mathematics and computer science with focus on statistics, data analysis and algebra.

Publications & Preprint

2019 **V.Divol, TL.**, (under minor revision for the JACT).
Understanding the Geometry and Topology of the Persistence Diagram Space using Optimal Transport.

2019 **M.Carriere, F.Chazal, Y.Ike, TL., M.Royer, Y.Umeda**, (AISTATS 2020).
PersLay: A Neural Network Layer for Persistence Diagrams and New Graph Topological Signatures.

2018 **TL., M.Cuturi, S.Oudot**, Advances in neural information processing systems (NIPS).
Large-scale computation of Means and Cluster for Persistence Diagrams using Optimal Transport.

Participation to workshops and Conferences

Jul. 2020 **Optimal Transport, Topological Data Analysis and Applications to Shapes and Machine Learning Workshop**, *MBI - OSU, USA*, Talk.
An optimal partial transport viewpoint on topological data analysis .

Jun. 2020 **AISTATS Conference**, *Palermo, Italy*, Talk.
PersLay: a neural network for persistence diagrams and new graph topological signatures.

Jan. 2020 **SmartData at Polito Workshop**, *Torino, Italy*, Video recording.
PersLay: Neural Networks for Persistence Diagrams and related topics.

Jui. 2019 **Saint-Flour Probability school**, *Saint-Flour, France*, Talk.
An optimal transport viewpoint on Topological Data Analysis.

May 2019 **SMAI**, *Guidel, France*, Talk, Mini-symposium *Geometrie dans les donnees*.
An introduction to Topological Data Analysis and Barycenters of Topological Descriptors.

Jan. 2019 **Workshop of Applied Topology**, *Kyoto, Japan*, Poster presentation.
Large-scale computation of Means and Cluster for Persistence Diagrams using Optimal Transport.

Dec. 2018 **NIPS Conference**, *Montreal, Canada*, Poster presentation.
Large-scale computation of Means and Cluster for Persistence Diagrams using Optimal Transport.

June 2018 **Curves and Surfaces**, *Arcachon, France*, Talk.
Invited speaker for Mini-Symposium *Topological Data Analysis and Learning* (MS9).

May 2018 **SFDS, Journées Statistiques**, *EDF Labs Paris-Saclay*, Talk.
Invited speaker for the Topological Data Analysis session.

May 2018 **Bridging Statistics and Sheaves**, *IMA - Minneapolis, USA*, Poster presentation.

Feb. 2018 **TAGS Workshop**, *Max Plank Institute, Leipzig, Germany*, Poster presentation.

Dec. 2017 **Journées de Géométrie Algorithmique**, *Aussois, France*, Talk.
Smoothed optimal transport: fast computation of matching distances and other applications.

Research internships

April 2017-Aug 2017 **ENSAE**, Paris-Saclay, CREST.
- *Wasserstein barycenters for persistence diagrams*
- Co-supervised by Marco Cuturi (Ensae, CREST) and Steve Oudot (Inria Saclay, Datashape)

March - Aug 2016 **BNP Paribas**, Paris, Quantitative Research team.
- Modeling client behavior and building recommender systems.
- Collaborative filtering, classification (SVM, Random Forest), basics of neural networks (with Python - Tensorflow).

Teaching activity

2017-2020 **École polytechnique**, *Teacher assistant*.
- CSE204 - Introduction to Machine Learning. Lecturer: Jesse Read.
- INF556 - Topological Data Analysis. Lecturer: Steve Oudot.
- INF311 - Introduction to computer science. Lecturer: François Morain.
- INF442 - Algorithms for Data analysis in C++. Lecturer: Steve Oudot.

Sept 2016 - March 2017 **Lycée Condorcet**, Paris.
Oral examination for undergraduate students in classe preparatoires MP* (colles).

Programming skills

Languages
- Advanced : Python (contribution to the `Gudhi` library).
- Notions : Java, C++, Scilab/Matlab

Languages

English C1 *IELTS 7.5/9*

Japanese Notions