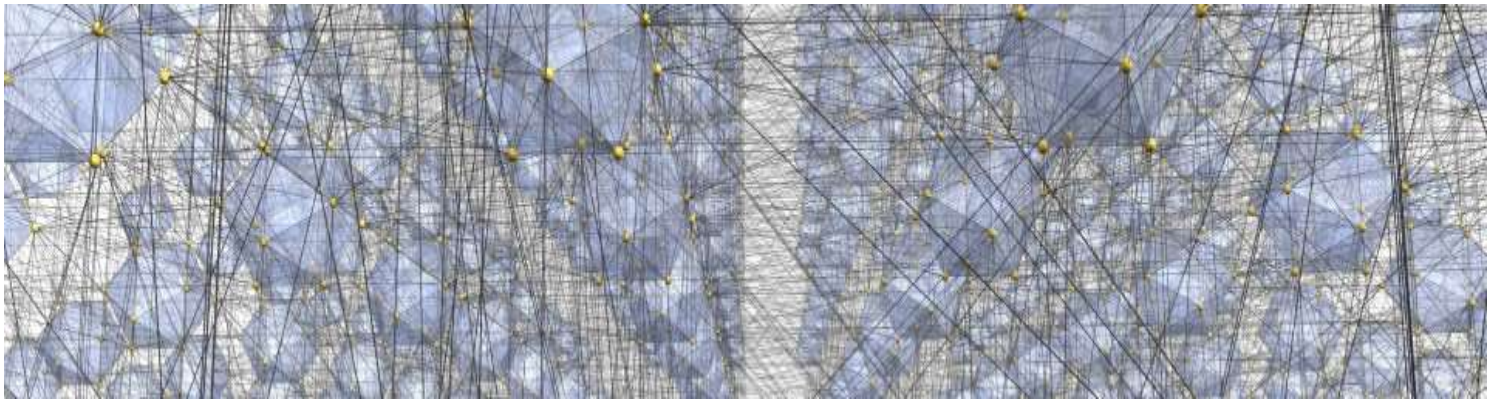

(https://team.inria.fr/geometrica)

Winter School 2016

Computational Geometry and Topology for Data Analysis

Jean-Daniel Boissonnat, Frédéric Chazal, Kunal Dutta, Alfredo Hubard

January 11-15, 2016 – INRIA Sophia Antipolis

This course is an introduction to the emerging field of Geometric and Topological Data Analysis. Fundamental questions to be addressed are:

– How can we represent complex shapes in high-dimensional spaces ?

– How can we infer properties of shapes from samples even in the presence of noise ?

Module 1: "*Algorithmic Geometry of Triangulations" – Course Notes*

(https://team.inria.fr/geometrica/files/2016/01/main-1.pdf)

Jean-Daniel Boissonnat (http://www-sop.inria.fr/members/Jean-Daniel.Boissonnat/)

- Simplicial complexes in metric spaces (https://team.inria.fr/geometrica/files/2015/11/1-simplicial-complexes.pdf)

- Delaunay complexes, Voronoi diagrams and convex hulls (https://team.inria.fr/geometrica/files/2016/01/2-delaunay-1.pdf), Union of balls and a-complexes (https://team.inria.fr/geometrica/files/2015/11/3-weightedDT.pdf)
- Witness Complexes (https://team.inria.fr/geometrica/files/2016/01/4-witness-complex.pdf)

Module 2: ***"An Introduction to Topological Data Analysis Through Persistent Homology"***

Frédéric Chazal (http://geometrica.saclay.inria.fr/team/Fred.Chazal/) – Slides 1 (http://geometrica.saclay.inria.fr/team/Fred.Chazal/slides/Introduction.pdf) – Slides 2 (http://geometrica.saclay.inria.fr/team/Fred.Chazal/slides/HomologyInference.pdf)

- Homology: introduction and inference from point cloud data.
- Persistent homology for functions and point clouds.
- Applications in TDA: clustering and multiscale topological signatures.

Module 3: ***"Computational Convexity and Isoperimetry"***

Alfredo Hubard

- Combinatorial convexity and big data.
- Volumes in convex bodies.
- Separators in graphs and expander graphs

Module 4: ***""***

Kunal Dutta

- Introduction to VC-dimension, -Nets, and -Samples
- Introduction to Combinatorial Discrepancy
- Haussler's Packing Lemma
- Primal and Dual Shatter Dimensions, and -Nets for Geomtric Set Systems
- Shallow Packing, Weighted -Nets, and Quasi-random Sampling

Program:

	Monday	Tuesday	Wednesday	Thursday	Friday
09:00 - 10:30	Simplicial Complexes	Delaunay Triangulation, Voronoi and Power Diagrams	Haussler's Packing Lemma	Shallow Packings, Weighted -Nets, and Quasi-Random Sampling	Separators in Graphs and Expander Graphs
10:30 - 11:00	Pause	Pause	Pause	Pause	Pause
11:00 - 12:30	Introduction to VC-dimension, -nets, and -samples	Homology and Inference from Point Cloud Data	Persistent Homology for Functions and Point Clouds	Persistent Homology for Functions and Point Clouds	Clustering and Multiscale Topological Signatures
12:30 - 14:00	Déjeuner	Déjeuner	Déjeuner	Déjeuner	Déjeuner
14:00 - 15:30	Combinatorial Convexity	Combinatorial Convexity	Primal and Dual Shatter Dimensions, and -Nets for Geometric Set Sytems	Volumes in Convex Bodies	Exam
15:30 - 16:00	Pause	Pause	Pause	Pause	
16:00 - 17:30	Introduction to Combinatorial Discrepancy	Homology and Inference from Point Cloud Data	Volumes in Convex Bodies	Clustering and Multiscale Topological Signatures	

Frédéric Chazal
Kunal Dutta
Alfredo Hubard

(https://team.inria.fr/geometrica/files/2015/11/PROG.jpg)

Registration:

For organisational reasons, if you wish to attend the winter school, please send a mail to florence.barbara@inria.fr (mailto:florence.barbara@inria.fr) **before January 4th.** This will also allow us to warn you about changes in the organisation if necessary.

Practical information:

Place:

Inria Sophia Antipolis

Building Kahn – Room K2-K3

2004 Route des Lucioles

06902 Sophia Antipolis

How to reach Inria Sophia (http://www.inria.fr/centre/sophia/presentation/les-implantations-du-centre-sur-le-bassin-mediterraneen)

Accommodation:

INRIA offers to accommodate Master's students at CIV Valbonne (http://www.civfrance.com/centre/hebergement) (from January 10th to 15th). The number of places being limited, we recommend that you complete the accommodation form (https://team.inria.fr/geometrica/files/2015/12/accommodation_form.pdf) as soon as possible.

Lunch:

Students will have the possibility to have lunch at the university canteen on presentation of their student card.

Meta

- Log in (https://team.inria.fr/geometrica/wp-login.php)
- Entries RSS (Really Simple Syndication) (https://team.inria.fr/geometrica/feed/)
- Comments RSS (Really Simple Syndication) (https://team.inria.fr/geometrica/comments/feed/)
- WordPress.org (https://wordpress.org/)

Blogroll

- HAL tools (http://haltools.inria.fr)
- Inria (http://www.inria.fr)

(http://www.inria.fr/en)

Team Web Sites Generator / SEISM / DSI / INRIA

Made with ♥ by Graphene Themes (https://www.graphene-theme.com/).