Master School on Data Science and Geometry

INSTITUT DE MATHEMATIQUES DE TOULOUSE

2-26 july 2019

First week PROGRAM 2-5 july

	Monday	Tuesday	Wednesday	Thursday	Friday
9h00-10h15 room		Welcome 9h30-12h00	**Geometry** Amphi Schwartz	**Geometry** MIP	**Geometry** MIP
10h30-12h30 room		Welcome 9h30-12h00	**Prob/Stat** Amphi Schwartz	**Geometry** MIP	**Prob/Stat** MIP
14h00-16h00 room		**Prob/Stat** MIP 1R3	**Prob/Stat** Amphi Schwartz	**Prob/Stat** 129 1R2	**Geometry** MIP 14h-15h30
16h30-17h45 room			**Geometry** Amphi Schwartz		**Geometry** MIP 16h-17h30

Lectures of the week

GEOMETRY (10h) : An Introduction to Riemannian Geometry

Paulo Carrillo Rouse

Lecture 1 Differentiable manifolds, tangent spaces, vector fields.

Lecture 2 Riemannian metrics and Riemannian connections.

Lecture 3 Geodesics; convex neighbourhoods.

Lecture 4 Curvature. Ricci and scalar curvature. Tensors on Riemannian manifolds.

Lecture 5 Jacobi fields. Morse Index theorem.

References:

1. Manfredo do CARMO. Riemannian geometry. Birkhauser Boston, Inc., Boston, MA, 1992. xiv+300 pp.
2. S. Gallot, D. Hulin and J. Lafontaine. Riemannian geometry. Third edition. Universitext. Springer-Verlag, Berlin, 2004. xvi+322 pp.

PROB/STAT (10h) : Probability background for statistical learning

Clément Pellegrini

Lecture 1 Convergence of random variables, SLLN, CLT Delta method and Slutsky lemma , Gaussian vectors, Classical concentration inequalities I.

Lecture 2 Convergence of random variables, SLLN, CLT Delta method and Slutsky lemma , Gaussian vectors, Classical concentration inequalities II.

Lecture 3 Conditional expectation.

Lecture 4 Parameter estimation in statistics. Moments methods and maximum likelihood estimation. Confidence sets.

Lecture 5 Basic methods in statistical learning. PCA, Regression, k-nearest neighbours algorithm, theoretical study of the rate of convergence of the k-nearest neighbours algorithm.