

# Master School on Data Science and Geometry

INSTITUT DE MATHEMATIQUES DE TOULOUSE

2-26 july 2019

Second week PROGRAM 8-12 july

	Monday	Tuesday	Wednesday	Thursday	Friday
9h30-12h room		<b>Statistics</b> MIP	<b>Geometry</b> MIP <b>10h-12h</b>	<b>Statistics</b> MIP	<b>Statistics</b> MIP <b>10h-12h</b>
14h00-17h00 room	<b>Geometry</b> MIP	<b>Geometry</b> MIP	<b>Statistics</b> MIP		<b>Geometry</b> MIP <b>14h-16h</b>

## Lectures of the week

### GEOMETRY (10h) : Analysis on manifolds

Jerome BERTRAND

Lecture 1 Manifolds with boundary, Bishop inequality, Laplacian of the distance function.

Lecture 2 Differential operators and their formal adjoints, the Hodge-de Rham theorem. Basic spectral geometry.

Lecture 3 Some examples of Spectra, The minimax principle.

Lecture 4 Eigenvalues estimates, Bishop's theorem, Lower bounds for the first eigenvalue.

Lecture 5 Paul Levy's isoperimetric inequality

#### 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.

### STATISTICS (10h): Statistical Learning

Laurent RISSER

Lecture 1 Introduction to Python for data analysis.

Lecture 2 Unsupervised learning.

Lecture 3 Supervised learning and cross validation.

Lecture 4 Unsupervised and supervised learning.

Lecture 5 Deep learning and stochastic optimization.

#### References:

1. Hastie, Trevor and Tibshirani, Robert and Friedman, Jerome. The Elements of Statistical Learning. Springer Series in Statistics, 2001.