

# Preface

The first conference of the *Geometric Sciences of Information* (GSI, website at <http://www.gsi2013.org/> includes slides and photos) took place downtown Paris (France), in August 2013. The call for papers received an enthusiastic worldwide response, resulting in about a 100 accepted submissions of an average length of eight pages, and organized into the following broad topics:

- Computational Information Geometry,
- Hessian/Symplectic Information Geometry,
- Optimization on Matrix Manifolds,
- Probability on Manifolds,
- Optimal Transport Geometry,
- Divergence Geometry and Ancillarity,
- Machine/Manifold/Topology Learning,
- Tensor-Valued Mathematical Morphology,
- Differential Geometry in Signal Processing,
- Geometry of Audio Processing,
- Geometry for Inverse Problems,
- Shape Spaces: Geometry and Statistic,
- Geometry of Shape Variability,
- Relational Metric,
- Discrete Metric Spaces,
- Etc.

The GSI proceedings has been published as a (thick!) Springer LNCS (volume number 8085, XX, 879 pages, 157 illustrations). Since we could not accommodate long papers in GSI, we decided to solicit renown researchers to contribute to a full length chapter on the latest advances in information geometry and some of its applications (like computational anatomy, image morphology, statistics, and textures, to cite a few examples). Those selected applications emphasize on algorithmic aspects when programming the *Methods of Information Geometry* [1]. The 13 chapters of this book have been organized as follows:

- *Divergence Functions and Geometric Structures They Induce on a Manifold* by Jun Zhang,
- *Geometry on Positive Definite Matrices Deformed by V-Potentials and Its Submanifold Structure* by Atsumi Ohara and Shinto Eguchi,
- *Hessian Structures and Divergence Functions on Deformed Exponential Families* by Hiroshi Matsuzoe and Masayuki Henmi,
- *Harmonic Maps Relative to  $\alpha$ -Connections* by Keiko Uohashi,
- *A Riemannian Geometry in the  $q$ -Exponential Banach Manifold Induced by  $q$ -Divergences* by Héctor R. Quiceno, Gabriel I. Loaiza and Juan C. Arango,
- *Computational Algebraic Methods in Efficient Estimation* by Kei Kobayashi and Henry P. Wynn,
- *Eidetic Reduction of Information Geometry Through Legendre Duality of Koszul Characteristic Function and Entropy: From Massieu–Duhem Potentials to Geometric Souriau Temperature and Balian Quantum Fisher Metric* by Frédéric Barbaresco,
- *Distances on Spaces of High-Dimensional Linear Stochastic Processes: A Survey*, by Bijan Afsari and René Vidal,
- *Discrete Ladders for Parallel Transport in Transformation Groups with an Affine Connection Structure* by Marco Lorenzi and Xavier Pennec,
- *A Diffeomorphic Iterative Centroid Method*, by Claire Cury, Joan A. Glaunès and Olivier Colliot,
- *Hartigan’s Method for  $k$ -MLE: Mixture Modeling with Wishart Distributions and Its Application to Motion Retrieval* by Christophe Saint-Jean and Frank Nielsen,
- *Morphological Processing of Univariate Gaussian Distribution-Valued Images Based on Poincaré Upper-Half Plane Representation* by Jesús Angulo and Santiago Velasco-Forero,
- *Dimensionality Reduction for Classification of Stochastic Texture Images* by C. T. J. Dodson and W. W. Sampson.

There is an exciting time ahead for computational information geometry in studying the fundamental concepts and relationships of Information, Geometry, and Computation!

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Frank Nielsen

## Reference

1. Amari, S., Nagaoka, H.: Method of information geometry, AMS Monograph. Oxford University Press, Oxford (2000)

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