

GSI'13

Geometric Science of Information

Ecole des Mines ParisTech

28th – 30th August 2013

<http://www.gsi2013.org>



THALES

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WELCOME TO GSI'13 CONFERENCE

On behalf of both organizing and scientific committees, it is a great pleasure to welcome all delegates, representatives and participants from around the world to the first International SEE conference on “Geometric Science of Information”, GSI'13, hosted by Ecole des Mines de Paris, from 28th to 30th of August 2013.

GSI'13 benefits from scientific sponsor of SMF (Société Mathématique de France: <http://smf.emath.fr/>), and financial sponsor by THALES (www.thalesgroup.com), INRIA (<http://www.inria.fr/en/>), GDR CNRS MIA (<https://fadili.users.greyc.fr/mia/>) and GDR CNRS Maths & Entreprises (<http://www.maths-entreprises.fr/>). The conference is also organized in the frame of the relations set up between SEE (<http://www.see.asso.fr/>) and scientific institutions or academic labs: Ecole des Mines de Paris, Supélec, Université Paris-Sud, Institut Mathématique de Bordeaux, SONY Research.

Let me express all my thanks to the Mathematical Department of Ecole des Mines de Paris for hosting this first scientific event at the interface between Geometry, Probability and Information Geometry.

GSI'13 event has been motivated in the continuity of first initiatives launched by Leon Brillouin seminar (<http://repmus.ircam.fr/brillouin/home>) since 2009 on “Geometric Sciences of Information” by THALES, IRCAM and Ecole Polytechnique: among others, the French-Indian Workshop organized at Ecole Polytechnique and Thales Research & Technology in 2011 on “Matrix Information Geometry” with proceedings published by SPRINGER (<http://www.springer.com/engineering/signals/book/978-3-642-30231-2>) and GDR CNRS MIA Symposium at Institut Henri Poincaré on “Optimal Transport and Information Geometry” (<https://www.ceremade.dauphine.fr/~peyre/mspc/mspc-thales-12>).

The technical program covers all the main topics and highlights in the domain of “Geometric Science of Information” including Information Geometry Manifolds of structured data/information and their advanced applications. GSI'13 addresses inter-relations between different mathematical domains like shape spaces (geometric statistics on manifolds and Lie groups, deformations in shape space,...), probability/optimization & algorithms on manifolds (structured matrix manifold, structured data/Information, ...), relational and discrete metric spaces (graph metrics, distance geometry, relational analysis,...), computational and hessian information geometry, algebraic/infinite dimensionnal/Banach information manifolds, divergence geometry, tensor-valued morphology, optimal transport theory, manifold & topology learning, ... and applications like geometries of audio-processing, inverse problems and signal processing.

Papers are presented in keynote and plenary oral sessions in the morning, parallel oral sessions in the afternoon, with one poster session the first day. 100 publications will be presented and testify the world wide interest for topics covered by GSI'13. Three international experts have been scheduled with a keynote presentation each day: Yann Ollivier on “Information-geometric optimization” (Université Paris-Sud, France), Hirohiko Shima on “Geometry of Hessian Structures” (Yamaguchi University, Japan) and Giovanni Pistone on “Nonparametric Information Geometry” (Collegio Carlo Alberto, Italy). Talk of Professor Shima will be dedicated to Professor Jean-Louis

Koszul work on flat manifold and at the origin of the notion of Hessian structures. As guest speaker, we have the great honor to welcome Professor Shun-ichi Amari (RIKEN Brain Science Institute, Japan) for a tutorial on “Information Geometry and Its Applications: Survey”.

I would like to acknowledge all the Organizing and Scientific Committee members for their hard work, in evaluating submissions. I also give my thanks to authors and co-authors, for their tremendous effort and scientific contribution.



THALES

Frédéric BARBARESCO

SEE/SMF GSI'13 General Chair

President of SEE SI²D Club (Signal, Image, Information & Decision)

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GSI'13 CONFERENCE

The objective of this SEE international Conference hosted by MINES ParisTech, is to bring together pure/applied mathematicians and engineers, with common interest for Geometric tools and their applications for Information analysis, with active participation of young researchers for deliberating emerging areas of collaborative research on “Information Geometry Manifolds and Their Advanced Applications”.

Current and ongoing uses of Information Geometry Manifolds in applied mathematics are the following: Advanced Signal/Image/Video Processing, Complex Data Modeling and Analysis, Information Ranking and Retrieval, Coding, Cognitive Systems, Optimal Control, Statistics on Manifolds, Machine Learning, Speech/sound recognition, natural language treatment, etc., which are also substantially relevant for the industry.

This international conference will be an interdisciplinary event and will federate skills from Geometry, Probability and Information Theory to address the following topics among others:

- Geometric Statistics on manifolds and Lie groups
- Deformations in Shape Spaces
- Relational Metric and Discrete Metric Spaces
- Computational/Hessian Information Geometry
- Optimization on Matrix Manifolds
- Optimal Transport Theory
- Probability on Manifolds
- Divergence Geometry & Ancillarity
- Tensor-Valued Mathematical Morphology
- Machine/Manifold/Topology Learning
- Algebraic/Infinite dimensionnal/Banach Information Manifolds
- ...

Invited talks are scheduled with 3 Keynote and 1 Guest speakers in plenary sessions:

- Yann OLLIVIER (Paris-Sud Univ.):
 - “Information-geometric optimization: The interest of information theory for discrete and continuous optimization”
- Hirohiko SHIMA (Yamaguchi Univ.):

- “Geometry of Hessian Structures” dedicated to Prof. J.L. KOSZUL
- Giovanni PISTONE (Collegio Carlo Alberto):
 - “Nonparametric Information Geometry”
- Shun-ichi AMARI (Riken):
 - “Information Geometry and Its Applications: Survey”

GS'I'13 ORGANIZATION

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Frédéric Barbaresco THALES AIR SYSTEMS, France

Silvère Bonnabel Mines-Paristech, France

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Alain Trouvé ENS Cachan, France

GSI'13 PROGRAM & AGENDA

	Wednesday 28th of August			Thursday 29th of August			Friday 30th of August		
08h30-09h00	Welcome /Registration			Welcome			Welcome		
09h00-10h00	Amphi V107 Keynote Speaker 1: Yann OLLIVIER Information-Geometric Optimization: the interest of Information Theory for Discrete and Continuous Optimization			Amphi V107 Keynote Speaker 2: Hitoshi SHIMA Geometry of Hessian Structures (dedicated to Prof. J.L. KOSZUL)			Amphi V107 Keynote Speaker 3: Giovanni PISTONE Nonparametric Information Geometry		
10h00-10h30	Coffee Break			Coffee Break			Coffee Break		
10h30-12h35	Plenary session: Probability on Manifolds (Chairman: Marc Arnaudon)			Plenary session: Hessian Information Geometry I (Chairman: Michel Boyom)			Plenary session: Deformations in Shape Space (Chairman: Alain Trounev)		
12h35-13h30	Lunch Break at Ecole des Mines + Poster session (Chairman: Frédéric Barbaresco)			Lunch Break at Ecole des Mines			SCLAB "GSI" TOOLBOX Initiative (Amphi V107)	Lunch Break at Ecole des Mines	
13h30-15h35	Relational Metric (chairman: Jean-François Marcotorchino)	Algebraic/Infinite dimensional/Banach Information Manifolds (Chairman: Giovanni Pistone)	Computational Information Geometry (chairman: Frank Nielsen)	Hessian Information Geometry II (Chairman: Frédéric Barbaresco)	Tensor-Valued Mathematical Morphology (Chairman: Jesus Angulo)	Geometry of Inverse Problems (Chairman: Ali Mohammad-Djafari)	Geometric Statistics on manifolds and Lie groups (Chairman: Xavier Pennec)	Machine/Manifold/Topology Learning (Chairmen: Michael Aupetit & Frédéric Chazal)	Differential Geometry in Signal Processing (Chairman: Michel Berthier)
15h35-16h05	Coffee Break / Poster session			Coffee Break			Coffee Break		
	Amphi V107	Amphi V106A	Amphi V106B	Amphi V107	Amphi V106A	Amphi V106B	Amphi V107	Amphi V106A	Amphi V106B
16h05-18h10	Discrete Metric Spaces (chairmen: Michel Deza & Michel Petitjean)	Optimal Transport Theory (Chairmen: Gabriel Peyré & Bertrand Maury)	Geometry of Audio Processing (Chairmen: Arshia Cont & Arnaud Dessein)	Optimization on Matrix Manifolds (Chairman: Silvere Bonnabel)	Divergence Geometry & Ancillarity (Chairman: Michel Broniatowski)	Information Geometry Manifolds (Chairman: Hichem Snoussi)	Entropic Geometry (Chairman: Roger Balian)	Algorithms on Manifolds (Chairman: Olivier Schwander)	Computational Aspects of Inform. Geometry in Statistics (Chairman: Frank Critchley)
18h10-18h30	Ecole des Mines, Terrasse of Hôtel de Vendôme Break			Amphi V107 Break			Amphi V107 Closing session of GSI'13 Workshop		
18h30-19h30	Cocktail at Ecole des Mines			Guest Speaker: Shun-ichi AMARI Information Geometry and its Applications: Survey			Geometry in Mineralogy Mineralogy Museum Visit at Ecole des Mines		
	IRCAM			Eiffel Tower (1st Floor)			End of GSI'13		
20h30-22h30	Concert at IRCAM			GSI 2013 GALA DINNER RESTAURANT 58 TOUR EIFFEL, 1st FLOOR					

GS1'13 KEYNOTE & GUEST SPEAKERS

Invited talks are scheduled with 3 Keynote speakers and 1 Guest Speaker for plenary sessions:

KEYNOTE SPEAKERS

- **Yann OLLIVIER** (Paris-Sud Univ.): “Information-geometric optimization: The interest of information theory for discrete and continuous optimization”
- **Hirohiko SHIMA** (Yamaguchi Univ.): “Geometry of Hessian Structures” dedicated to Prof. J.L. KOSZUL
- **Giovanni PISTONE** (Collegio Carlo Alberto): “Nonparametric Information Geometry”

GUEST SPEAKER

- **Shun-ichi Amari** (RIKEN Brain Science Institute): « Information Geometry and Its Applications: Survey”



Abstract

Yann Ollivier, Paris-Sud University, France

Information-geometric optimization: The interest of information theory for discrete and continuous optimization

Black box optimization is the problem of searching for the minimum of a function on a given space (discrete or continuous), without any prior knowledge about the function. Information geometry provides a systematic method, IGO (information-geometric optimization) to easily build optimization algorithms having nice properties; in particular it minimizes the influence of arbitrary choices such as how the space of solutions is represented. In some situations IGO recovers known and widely used algorithms, thus providing theoretical justification for them.

Specific properties of information geometry and the Kullback-Leibler divergence guarantee, at each step, minimal diversity loss in the exploration of possible solutions; this suggests IGO algorithms automatically tune the simultaneous exploration of different regions.

References

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Biography

Yann's research generally focuses on the introduction of probabilistic models on structured objects, and more particularly addresses the interplay between probability and differential geometry.

He is currently Research scientist at the CNRS, currently in the Computer Science department at Paris-Sud Orsay University, previously in the Mathematics department at the École Normale Supérieure in Lyon (2004–2010).

He graduated to his PhD in Mathematics, under the supervision of M. Gromov and P. Pansu in 2003 and is accredited to supervise research since 2009

<http://www.yann-ollivier.org/rech/index>



Hirohiko Shima, Yamaguchi University, Japan

Geometry of Hessian Structures

Abstract

A Riemannian metric g on a flat manifold M with flat connection D is called a *Hessian metric* if it is locally expressed by the Hessian of local functions ϕ with respect to the affine coordinate systems, that is, $g = Dd\phi$. Such pair (D, g) , g , and M are called a *Hessian structure*, a *Hessian metric*, and a *Hessian manifold*, respectively [S7]. Typical examples of these manifolds include homogeneous regular convex cones [V] (e.g. the space of all positive definite real symmetric matrices). J.L. Koszul studied a flat manifold endowed with a closed 1-form α such that $D\alpha$ is positive definite [K1][K2]. Then $g = D\alpha$ is exactly a Hessian metric. Hence this is the ultimate origin of the notion of Hessian structures. On the other hand, a Riemannian metric on a complex manifold is said to be a *Kählerian metric* if it is locally expressed by the complex Hessian of functions with respect to holomorphic coordinate systems. For this reason S.Y. Cheng and S.T. Yau called Hessian metrics *affine Kähler metrics* [CY]. These two types of metrics are not only formally similar, but also intimately related. In fact, the tangent bundle of a Hessian manifold is a Kählerian manifold. Hessian geometry (the geometry of Hessian structures) is thus a very close relative of Kählerian geometry, and may be

placed among, and finds connection with important pure mathematical fields such as affine differential geometry, homogeneous spaces, cohomology, non-associative algebras (e.g. left symmetric algebras, Jordan algebras) and others. Moreover, Hessian geometry, as well as being connected with these pure mathematical areas, also, perhaps surprisingly, finds deep connections with information geometry. The notion of flat dual connections, which plays an important role in information geometry, appears in precisely the same way for our Hessian structures [A][AN]. Thus Hessian geometry offers both an interesting and fruitful area of research.

A Hessian structure is characterized by the *Codazzi equation*; $(D_X g)(Y, Z) = (D_Y g)(X, Z)$. Using this equation the notion of Hessian structure is easily generalized as follows. A pair (D, g) of a torsion free connection D and a Riemannian metric g on M is called a *Codazzi structure* if it satisfies the *Codazzi equation*; $(D_X g)(Y, Z) = (D_Y g)(X, Z)$ [Del]. For a Codazzi structure (D, g) we can define a new torsion-free connection D' by $Xg(Y, Z) = g(D_X Y, Z) + g(Y, D'_X Z)$. Then we have $D' = 2\mathcal{V} - D$ where \mathcal{V} is the Levi-Civita connection of g . The pair (D', g) is also a Codazzi structure. The connection D' and the pair (D', g) are called the *dual connection* of D and the *dual Codazzi structure* of (D, g) , respectively.

Historically, the notion of dual connections was obtained by quite distinct approaches. In affine differential geometry the notion of dual connections was naturally obtained by considering a pair of a non-degenerate affine hypersurface immersion and its conormal immersion [NS]. In contrast, S. Amari and H. Nagaoka found that smooth families of probability distributions admit dual connections as their natural geometric structures. Information geometry aims to study information theory from the viewpoint of the dual connections [A][AN].

References

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Biography

Emeritus Professor of Yamaguchi University Degree of PhD (Osaka University 1970)
Osaka University (1966-1970) Yamaguchi University (from 1970 to the present)

<http://www.worldscientific.com/worldscibooks/10.1142/6241>



Giovanni Pistone, Collegio Carlo Alberto, Italy

Nonparametric Information Geometry

Abstract

The differential-geometric structure of the set of positive densities on a given measure space has raised the interest of many mathematicians after the discovery by CR Rao of the geometric meaning of the Fisher information. Most of the research is focused on parametric statistical models. In series of papers [1-5] a particular version of the nonparametric case has been discussed. This minimalistic structure is modeled according the theory of exponential families: given a reference density other densities are represented by the centered log likelihood which is an element of an Orlicz space. This mappings give a system of charts of a Banach manifold. It has been observed that, while the construction is natural, the practical applicability is limited by the technical difficulty to deal with such a class of Banach spaces. It has been suggested recently [7-

8] to replace the exponential function with other functions with similar behavior but polynomial growth at infinity in order to obtain more tractable Banach spaces, e.g. Hilbert spaces. The aim of the talk is to present a state of the art of this issue and to discuss its connection with other approaches [9-10].

References

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Biography

Giovanni Pistone has been professor of Probability of the Politecnico di Torino to the year 2009 when he retired. Previously he was professor at the Università di Genova, where he served as Head of the Department of Mathematics. He obtained his Master degree from the Università di Torino in 1969, and the degree "docteur de 3me cycle" from the Université de Rennes (France) in 1975. Contributions to Probability and Mathematical Statistics cover various topics, e.g. Stochastic Partial Differential Equations, Industrial Statistics, Information Geometry, Algebraic Statistics. Currently he is affiliate of the de Castro Statistics Initiative of the Collegio Carlo Alberto, Moncalieri, Italy.



Shun-ichi Amari, RIKEN Brain Science Institute, Japan

Information Geometry and Its Applications: Survey

Abstract

Information geometry emerged from the study of the geometrical structure of a manifold of probability distributions under the criterion of invariance. It defines a Riemannian metric uniquely, which is the Fisher information metric. Moreover, a family of dually coupled affine connections are introduced. Mathematically, this is a study of a triple $\{M, g, T\}$, where M is a manifold, g is a Riemannian metric, and T is a third-order symmetric tensor. Information geometry has been applied not only to statistical inferences but also to various fields of information sciences where probability plays an important role.

Many important families of probability distributions are dually flat Riemannian manifolds. A dually flat manifold possesses a beautiful structure: It has two mutually coupled flat affine connections and two convex functions connected by the Legendre transformation. It has a canonical divergence, from which all the geometrical structure is derived. The KL-divergence in probability distributions is automatically derived from the invariant flat nature. Moreover, the generalized Pythagorean and geodesic projection theorems hold.

Conversely, we can define a dually flat Riemannian structure from a convex function. This is derived through the Legendre transformation and Bregman divergence connected with a convex function. Therefore, information geometry is applicable to convex analysis, even when it is not connected with probability distributions. This widens the applicability of information geometry to convex analysis, machine learning, computer vision, Tsallis entropy, economics, and game theory.

The present talk summarizes theoretical constituents of information geometry and surveys a wide range of its applications.

References

- S. Amari and H. Nagaoka, *Methods of Information Geometry*, American Mathematical Society and Oxford University Press, 2000
- S. Amari, *Information geometry and its applications: Convex function and dually flat manifold*. *Emerging Trends in Visual Computing*, edited by F. Nielsen,

Biography

Shun-ichi Amari received Dr. Eng. degree from the University of Tokyo in 1963. He had worked as a professor at the University of Tokyo and is now Professor-Emeritus. He served as Director of RIKEN Brain Science Institute for five years, and is now its senior advisor. He is a foreign member of the Polish Academy of Science. He has been engaged in research in wide areas of mathematical engineering, in particular, mathematical foundations of neural networks, including statistical neurodynamics, dynamical theory of neural fields, associative memory, self-organization, and general learning theory. Another main subject of his research is information geometry initiated, which provides a new powerful method to information sciences. Dr. Amari served as President of International Neural Networks Society and President of Institute of Electronics, Information and Communication Engineers, Japan. He received Emanuel A. Piore Award and Neural Networks Pioneer Award from IEEE, the Japan Academy Award, Order of Cultural Merit of Japan, Gabor Award, Caianiello Award, Bosom Friend Award from Chinese Neural Networks Council, and C&C award, among many others.

<http://www.brain.riken.jp/labs/mns/amari/home-E.html>

GSI'13 SPECIAL SESSIONS & POSTERS

	Wednesday 28th of August
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08h30-09h00	Welcome /Registration
	Amphi V107
09h00-10h00	Keynote Speaker 1: Yann OLLIVIER Information-Geometric Optimization: the Interest of Information Theory for Discrete and Continuous Optimization
10h00-10h30	Coffee Break

	Amphi V107
10h30-12h35	Plenary session: Probability on Manifolds (Chairman: Marc Arnaudon)

Group Action Induced Distances on Spaces of High-Dimensional Linear Stochastic Processes

Bijan Afsari and René Vidal

Extrinsic vs Intrinsic Means on the Circle

Thomas Hotz

Nonlinear Modeling and Processing Using Empirical Intrinsic Geometry with Application to Biomedical Imaging

Ronen Talmon, Yoel Shkolnisky, and Ronald R. Coifman

Integral Geometry of Linearly Combined Gaussian and Student-t, and Skew Student's t Random Fields

Yann Gavet, Ola Suleiman Ahmad, and Jean-Charles Pinoli

12h35-13h30	Lunch Break at Ecole des Mines + Poster session (Chairman: Frédéric Barbaresco)
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	Couloir
12h35-18h05	Poster Session (Chairman : Frédéric Barbaresco)

Fast Polynomial Spline Approximation for Large Scattered Data Sets via L1 Minimization

Laurent Gajny, Eric Nyiri, and Olivier Gibaru

Target Detection of Non-stationary Radar Signal and Riemannian Geometry

Haiyan Fan, Yongmei Jiang, and Gangyao Kuang

High-Dimensional Range Profile Geometrical Visualization and Performance Estimation of Radar Target Classification via a Gaussian Mixture Model

Thomas Boulay, Ali Mohammad-Djafari, Nicolas Gac, and Julien Lagoutte

Visual Point Set Processing with Lattice Structures: Application to Parsimonious Representations of Digital Histopathology Images

Nicolas Loménie

Activity Video Analysis via Operator-Based Local Embedding

Xiao Bian and Hamid Krim

Multivariate Texture Discrimination Based on Geodesics to Class Centroids on a Generalized Gaussian Manifold

A. Shabbir, G. Verdoolaege, and G. Van Oost

Robust Estimation of Natural Gradient in Optimization by Regularized Linear Regression

Luigi Malago and Matteo Matteucci

To the Homogeneous Symplectic Manifold toward the Geometry of Information

F. Mouna, T.B. Bouetou, and M.B. Nguiffo

	Amphi V107
13h30-15h35	Relational Metric (chairman: Jean-François Marcotorchino)

Optimal Transport and Minimal Trade Problem, Impacts on Relational Metrics and Applications to Large Graphs and Networks Modularity

F. Marcotorchino and P. Conde Céspedes

Comparing Different Modularization Criteria Using Relational

P. Conde Céspedes and J.F. Marcotorchino

A General Framework for Comparing Heterogeneous Binary Relations

Julien Ah-Pine

On Prime-Valent Symmetric Bicirculants and Cayley Snarks

Ademir Hujdurovic, Klavdija Kutnar, and Dragan Marusi

	Amphi V106A
13h30-15h35	Algebraic/Infinite dimensionnal/Banach Information Manifolds (Chairman: Giovanni Pistone)

Asymptotically Efficient Estimators for Algebraic Statistical Manifolds

Kei Kobayashi and Henry P. Wynn

Infinite-Dimensional Manifolds of Finite-Entropy Probability Measures

Nigel J. Newton

Invariant geometric structures on statistical models

Hông Vân Lê

The Δ_2 -Condition and ϕ -Families of Probability Distributions

Rui F. Vigelis and Charles C. Cavalcante

A Riemannian Geometry in the q-Exponential Banach Manifold Induced by q-Divergences

G. Loaiza and H.R. Quiceno

	Amphi V106B
13h30-15h35	Computational Information Geometry (chairman: Frank Nielsen)

Hypothesis Testing, Information Divergence and Computational Geometry

Frank Nielsen

A New Implementation of k-MLE for Mixture Modeling of Wishart Distributions

Christophe Saint-Jean and Frank Nielsen

Variational Problem in Euclidean Space with Density

Lakehal Belarbi and Mohamed Belkhefja

The Exponential Family in Abstract Information Theory

Jan Naudts and Ben Anthonis

15h35-16h05	Coffee Break / Poster session
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	Amphi V107
16h05-18h10	Discrete Metric Spaces (chairmen: Michel Deza & Michel Petitjean)

Discrete Metric Spaces Studying New Classes of Graph Metrics

Pavel Chebotarev

Tessellabilities, Reversibilities, and Decomposabilities of Polytopes (A Survey)

Jin Akiyama, Ikuro Sato, and Hyunwoo Seong

Counting the Number of Solutions of k DMDGP Instances

Carlile Larvor, Leo Liberti, Jorge Alencar, and Germano Abud

On the Identification of Discretization Orders for Distance Geometry with Intervals

Antonio Mucherino

	Amphi V106A
16h05-18h10	Optimal Transport Theory (Chairmen: Gabiel Peyré & Bertrand Maury)

A Comparison of Two Dual Methods for Discrete Optimal Transport

Quentin Mérigot

The Tangent Earth Mover's Distance

Ofir Pele and Ben Taskar

A Geometric Study of Wasserstein Spaces: An Addendum on the Boundary

Jérôme Bertrand and Benoît R. Kloeckner

A Primal-Dual Approach for a Total Variation Wasserstein Flow

Martin Benning, Luca Calatroni, Bertram Düring, and Carola-Bibiane Schönlieb

	Amphi V106B
16h05-18h10	Geometry of Audio Processing (Chairmen: Arshia Cont & Arnaud Dessein)

Online Change Detection in Exponential Families with Unknown Parameters

Arnaud Dessein and Arshia Cont

Differential Geometry Applied to Acoustics: Non Linear Propagation in Reissner Beams

Joel Bensoam

Predictive Information in Gaussian Processes with Application to Music Analysis

Samer Abdallah and Mark Plumbley

Characterizing Time Series Variability and Predictability from Information Geometry Dynamics

Shlomo Dubnov

	Ecole des Mines, Terrasse of Hôtel de Vendôme
18h10-18h30	Break
18h30-19h30	Cocktail at Ecole des Mines
	IRCAM
20h30-22h30	Concert at IRCAM

	Thursday 29th of August
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08h30-09h00	Welcome
	Amphi V107
09h00-10h00	Keynote Speaker 2: Hirohiko SHIMA Geometry of Hessian Structures (dedicated to Prof. J.L. KOSZUL)
10h00-10h30	Coffee Break

	Amphi V107
10h30-12h35	Plenary session: Hessian Information Geometry I (Chairman: Michel Boyom)

Hessian Structures on Deformed Exponential Families

Hiroshi Matsuzoe and Masayuki Henmi

Foliations on Affinely Flat Manifolds: Information Geometry

Michel Nguiffo Boyom and Robert Wolak

Hypersurfaces with Isometric Reeb Flow in Hermitian Symmetric Spaces of Rank

Young Jin Suh

Complexification of information geometry in view of quantum estimation theory

Hiroshi Nagaoka

Fisher information geometry of the barycenter of probability measures

Mitsuhiro Itoh

12h35-13h30	Lunch Break at Ecole des Mines
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	Amphi V107
13h30-15h35	Hessian Information Geometry II (Chairman: Frédéric Barbaresco)

Geometry on Positive Definite Matrices Induced from V-Potential Function

Atsumi Ohara and Shinto Eguchi

Information/Contact Geometries and Koszul Entropy

Frédéric Barbaresco

Symplectic and Kähler Structures on Statistical Manifolds Induced from Divergence Functions

Jun Zhang and Fubo Li

Geometric Quantization of Complex Monge-Ampère Operator for Certain Diffusion Flows

Julien Keller

	Amphi V106A
13h30-15h35	Tensor-Valued Mathematical Morphology (Chairman: Jesus Angulo)

Frames for Tensor Field Morphology

Jasper J. van de Gronde and Jos B.T.M. Roerdink

Complete Lattice Structure of Poincaré Upper-Half Plane and Mathematical Morphology for Hyperbolic-Valued Images

Jesus Angulo and Santiago Velasco-Forero

Supervised Morphology for Structure Tensor-Valued Images Based on Symmetric Divergence Kernels

Santiago Velasco-Forero and Jesús Angulo

Using the Bhattacharyya Mean for the Filtering and Clustering of Positive-Definite Matrices

Malek Charfi, Zeineb Chebbi, Maher Moakher, and Baba C. Vemuri

	Amphi V106B
13h30-15h35	Geometry of Inverse Problems (Chairman: Ali Mohammad-Djafari)

Variational Bayesian Approximation for Linear Inverse Problems with a Hierarchical Prior Models

Ali Mohammad-Djafari

Learning General Gaussian Kernel Hyperparameters for SVR

F. Abdallah, Hichem Snoussi, H. Laanaya, and R. Lengellé

Stochastic Filtering by Projection: The Example of the Quadratic Sensor

John Armstrong and Damiano Brigo

A Probabilistic Solution to the $AX=XB$ Problem: Sensor Calibration without Correspondence

M. Kendal Ackerman and Gregory S. Chirikjian

Random Clouds on Matrix Lie Groups

Simone Fiori

15h35-16h05	Coffee Break
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	Amphi V107
16h05-18h10	Optimization on Matrix Manifolds (Chairman: Silvere Bonnabel)

Interpolation and Regression of Rotation Matrices

Nicolas Boumal

A Geometric Framework for Non-Unitary Joint Diagonalization of Complex Symmetric Matrices

Martin Kleinstauber and Hao Shen

An Extrinsic Look at the Riemannian Hessian

P.-A. Absil, Robert Mahony, and Jochen Trumpf

Law of Cosines and Shannon-Pythagorean Theorem for Quantum Information

Roman V. Belavkin

A Note on the Intrinsic Cramer-Rao Bound

Axel Barrau and Silvère Bonnabel

	Amphi V106A
16h05-18h10	Divergence Geometry & Ancillarity (Chairman: Michel Broniatowski)

Estimation and Tests Under L-Moment Condition Models

Alexis Decurninge

Weighted Sampling, Maximum Likelihood and Minimum Divergence Estimators

Michel Broniatowski

Some Decision Procedures Based on Scaled Bregman Distance Surfaces

Anna-Lena Kißlinger and Wolfgang Stummer

Generalized minimizers of convex integral functionals, Bregman distance, Pythagorean identities

Drantisek Matus

Some Results on a χ -divergence, an Extended Fisher Information and Generalized Cramer-Rao Inequalities

Jean-François Bercher

	Amphi V106B
16h05-18h10	Information Geometry Manifolds (Chairman: Hichem Snoussi)

Harmonic Maps Relative to α -Connections on Hessian Domains

Keiko Uohashi

A Kernel View on Manifold Sub-sampling Based on Karcher Variance Optimization

Nicolas Courty and Thomas Burger

Maximal Information Divergence from Statistical Models Defined by Neural Networks

Guido Montufar, Johannes Rauh, and Nihat Ay

Neighborhood Random Classification

Djamel A. Zighed, Diala Ezzeddine, and Fabien Rico

	Amphi V107
18h10-18h30	Break
18h30-19h30	Guest Speaker: Shun-Ichi AMARI Information Geometry and Its Applications: Survey
	Eiffel Tower (1st Floor)
20h30-22h30	GSI 2013 GALA DINNER RESTAURANT 58 TOUR EIFFEL, 1st FLOOR

	Friday 30th of August
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08h30-09h00	Welcome
	Amphi V107
09h00-10h00	Keynote Speaker 3: Giovanni PISTONE Nonparametric Information Geometry
10h00-10h30	Coffee Break

	Amphi V107
10h30-12h35	Plenary session: Deformations in Shape Space (Chairman: Alain Trouvé)

Geodesic Image Regression with a Sparse Parameterization of Diffeomorphisms

James Fishbaugh, Marcel Prastawa, Guido Gerig, and Stanley Durrleman

Template Estimation for Large Database: A Diffeomorphic Iterative Centroid Method Using Currents


Claire Cury, Joan A. Glaunès, and Olivier Colliot

On the Geometry and the Deformation of Shapes Represented by Piecewise Continuous Bézier Curves with Application to Shape Optimization

Olivier Ruatta

Random Spatial Structure of Geometric Deformations and Bayesian Nonparametrics

Christof Seiler, Xavier Pennec, and Susan Holmes

	Amphi V107
12h35-12h55	SCILAB "GSI" TOOLBOX Initiative 

Contributing to “Geometric Science of Information” development, project of **SCILAB “GSI” TOOLBOX** is initiated, inviting contributors to write external modules that extend Scilab capabilities in specific fields of GSI (Information Geometry, Geometry of Structured Matrices, Statistics/optimization on Manifolds, ...). These modules provide new features and documentation to Scilab users. A new website called “ATOMS Portal” has been released that host all external modules developed by external developers. These modules can be made available to Scilab users directly from Scilab console via a new feature named ATOMS (AuTomatic mOdules Management for Scilab), if the module author wishes it.

<http://wiki.scilab.org/ATOMS>

In parallel, external modules sources can now be managed through the new Scilab Forge.

<http://forge.scilab.org/index.php/projects/>

12h35-13h30	Lunch Break at Ecole des Mines
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	Amphi V107
13h30-15h35	Geometric Statistics on manifolds and Lie groups (Chairman: Xavier Pennec)

Bi-invariant Means on Lie Groups with Cartan-Schouten Connections

Xavier Pennec

Parallel Transport with Pole Ladder: Application to Deformations of Time Series of Images

Marco Lorenzi and Xavier Pennec

Horizontal Dimensionality Reduction and Iterated Frame Bundle Development

Stefan Sommer

A Subspace Learning of Dynamics on a Shape Manifold: A Generative Modeling Approach

Sheng Yi and Hamid Krim

	Amphi V106A
13h30-15h35	Machine/Manifold/Topology Learning (Chairmen: Michael Aupetit & Frédéric Chazal)

Deconvolution for the Wasserstein Metric and Geometric Inference

Claire Caillerie, Frédéric Chazal, Jérôme Dedecker, and Bertrand Michel

On Directional-Search Procedures for Orbifolds: Connections with the Manifold Framework

Fabian Lim

Adaptation of Multiscale Function Extension to Inexact Matching: Application to the Mapping of Individuals to a Learnt Manifold

Nicolas Duchateau, Mathieu De Craene, Marta Sitges, and Vicent Caselles

Interleaved Filtrations: Theory and Applications in Point Cloud Data Analysis

Frédéric Chazal and Steve Y. Oudot

	Amphi V106B
13h30-15h35	Differential Geometry in Signal Processing (Chairman: Michel Berthier)

A Riemannian Fourier Transform via Spin Representations

T. Batard and M. Berthier

K-Centroids-Based Supervised Classification of Texture Images Using the SIRV Modeling

Aurélien Schutz, Lionel Bombrun, and Yannick Berthoumieu

Bayesian Atlas Estimation from High Angular Resolution Diffusion Imaging (HARDI)

Jia Du, Alvina Goh, and Anqi Qiu

Dimensionality Reduction for Classification of Stochastic Fibre Radiographs

C.T.J. Dodson and W.W. Sampson

15h35-16h05	Coffee Break / Poster session
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	Amphi V107
16h05-18h10	Entropic Geometry (Chairman: Roger Balian)

The Stochastic Flow Theorem for an Operator of Order Four

Rémi Léandre

Geometry and Shannon Capacity

Philippe Jacquet

A Metric for Quantum States Issued from von Neumann's Entropy

Roger Balian

Continuity of f-projections on Discrete Spaces

Christoph Gietl and Fabian P. Reffel

	Amphi V106A
16h05-18h10	Algorithms on Manifolds (Chairman: Olivier Schwander)

Information Geometry and Interior-Point Algorithms

Satoshi Kawahara, Atsumi Ohara, and Takashi Tsuchiya

Geometric Mean Algorithms Based on Harmonic and Arithmetic Iterations

Ben Jeuris and Raf Vandebril

Multiscale Covariance Fields, Local Scales, and Shape Transforms

Diego H. Diaz Martinez, Facundo Memoli, and Washington Mio

Deterministic Walks and Quasi-Subgradient Methods for the Karcher Mean on NPC Spaces

Miklos Palfia

	Amphi V106B
16h05-18h10	Computational Aspects of Inform. Geometry in Statistics (Chairman: Frank Critchley)

Computational information geometry in statistics: foundations

Karim Anaya-Izquierdo, Frank Critchley, Paul Marriott, and Paul Vos

Computational information geometry in statistics: mixture modeling

Karim Anaya-Izquierdo, Frank Critchley, Paul Marriott, and Paul Vos

A General Metric for Riemannian Manifold Hamiltonian Monte Carlo

Michael Betancourt

Visualizing projective shape space

John T. Kent

	Amphi V107
18h10-18h30	Closing session of GSI'13 Workshop
18h30-19h30	Geometry in Minearology Minearology Museum Visit at Ecole des Mines
	End of GSI'13

GSI'13 SOCIAL EVENTS

Wednesday 28th of August

COCKTAIL AT ECOLE DES MINES, TERRASSE OF HÔTEL DE VENDÔME

Address: Ecole des Mines ParisTech, 60 Boulevard Saint-Michel, 75006 Paris

RER/Metro: RER B Luxembourg

<http://www.mines-paristech.eu/>

18h30 – 19h30



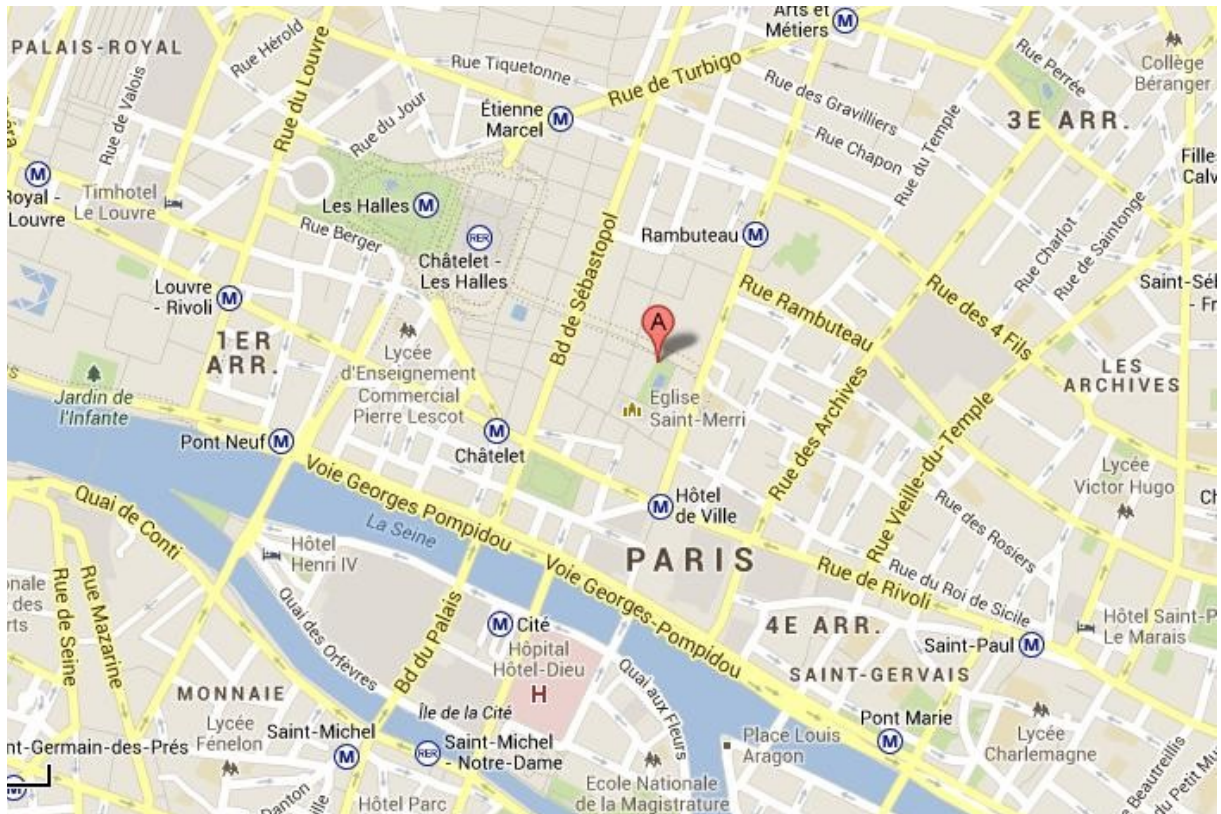
CONCERT AT IRCAM (organized by Arshia Cont)

Address: 1 Place Igor-Stravinsky, 75004 Paris

RER/Metro: RER B Châtelet-Les-Halles

<http://www.ircam.fr/?&L=1>

20h30 – 22h30



Thursday 29th of August

GSI 2013 GALA DINNER: RESTAURANT 58 TOUR EIFFEL, 1st FLOOR

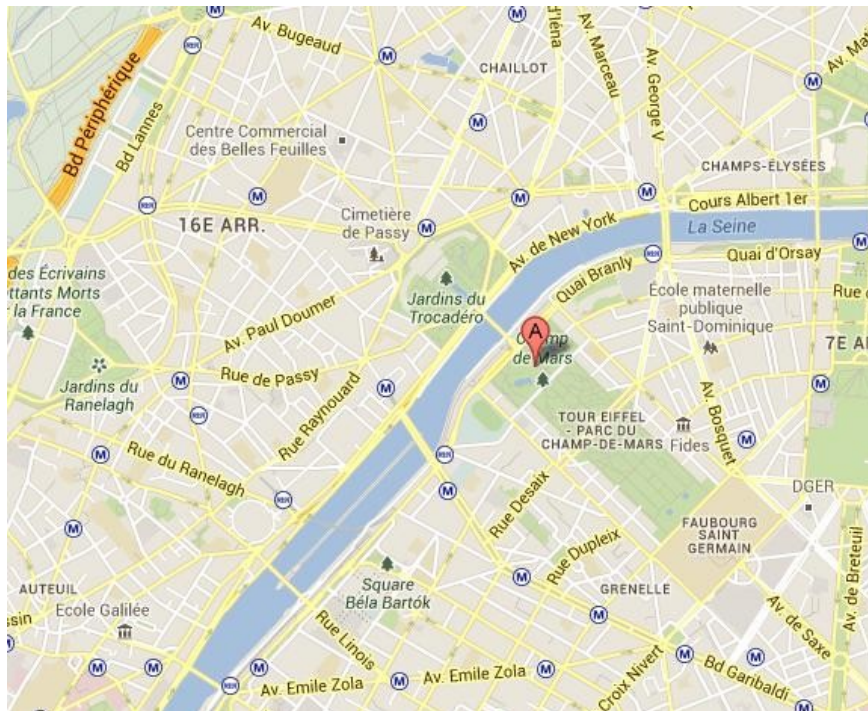
Address: Eiffel Tower, Champ de Mars, 5 Avenue Anatole France, 75007 Paris (1st Floor)

RER/Metro: RER C, Champs-de-Mars - Tour Eiffel

<http://www.restaurants-toureiffel.com/UK/EIFFEL-TOWER-RESTAURANTS/58-TOUR-EIFFEL/Lunch-Dinner-in-paris-eiffel-tower.html>

20h30 – 22h30

The most fashionable Brasserie in Paris. Dine in the heart of Parisian nightlife... When the sun goes down, 58 Tour Eiffel takes on a new dimension. Soft lights and minimalist furniture so as not to upstage the beauty of the City of Lights. Ultra-modern interior design by Patrick Jouin and menu featuring chic classical cuisine.



	Friday 0th of August
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GEOMETRY IN MINERALOGY – THE MUSEUM

Address: Ecole des Mines ParisTech, 60 Boulevard Saint-Michel, 75006 Paris

RER/Metro: RER B Luxembourg

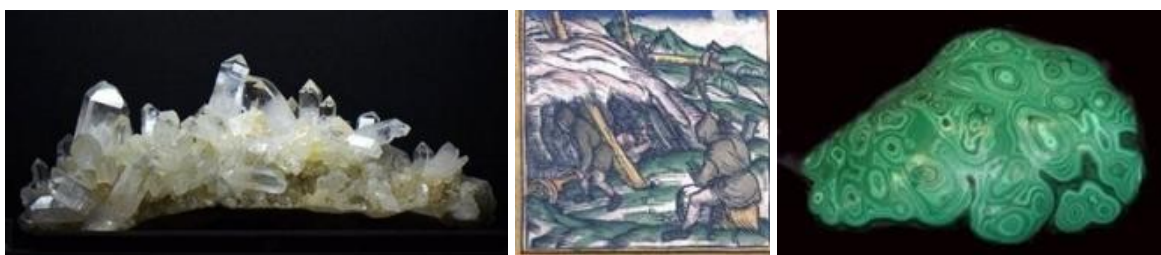
<http://www.mines-paristech.eu/About-us/Heritage/The-Museum/>

18h30 – 19h30

Geometry in Mineralogy - The Museum

The Mineralogy Museum has been located in the former Hôtel de Vendôme since 1815 and is open to the public.

All students have access to it and can make use of the geological information for free. It constitutes a unique tool not only for students but for all geological service specialists, miners and prospectors.



It ranks as the **top collection** in the world and serves as a constant reference for systematic mineralogy. Its specific activities are centred on its collections and stands as a milestone in mineralogical history.

The Mineralogy Museum hosts exhibitions on the premises of the **Hôtel de Vendôme**, as well as at provincial and foreign locations (eg. Athens, Alexandria and Casablanca, etc.).

It also welcomes school parties, amateurs and foreign museum curators and organizes meetings and workshops on themes chosen at the request of associations such as Les Amis du Louvre or the Association for the Advancement of Science, etc.

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ISBN 978-3-642-40019-3



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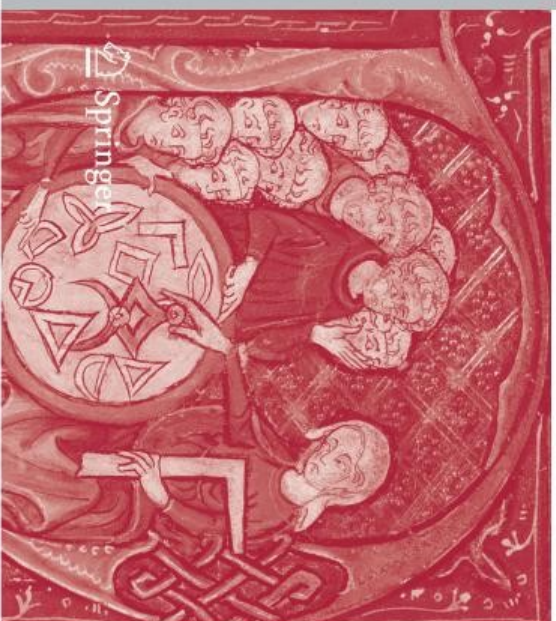
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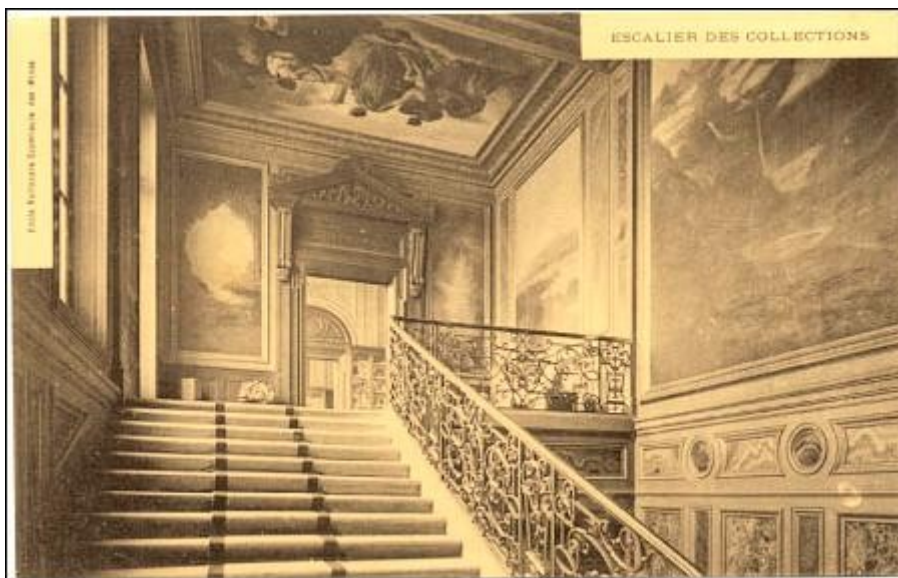
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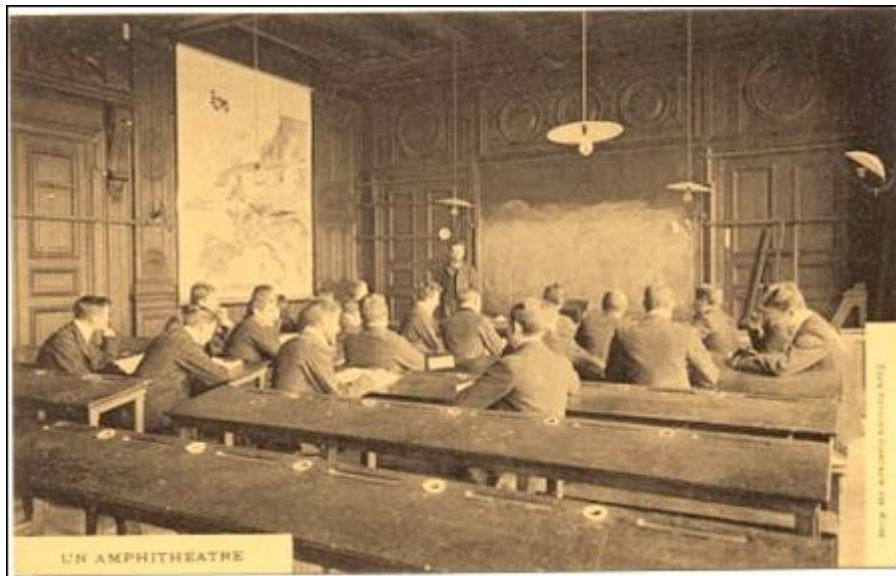


Geometric Science of Information

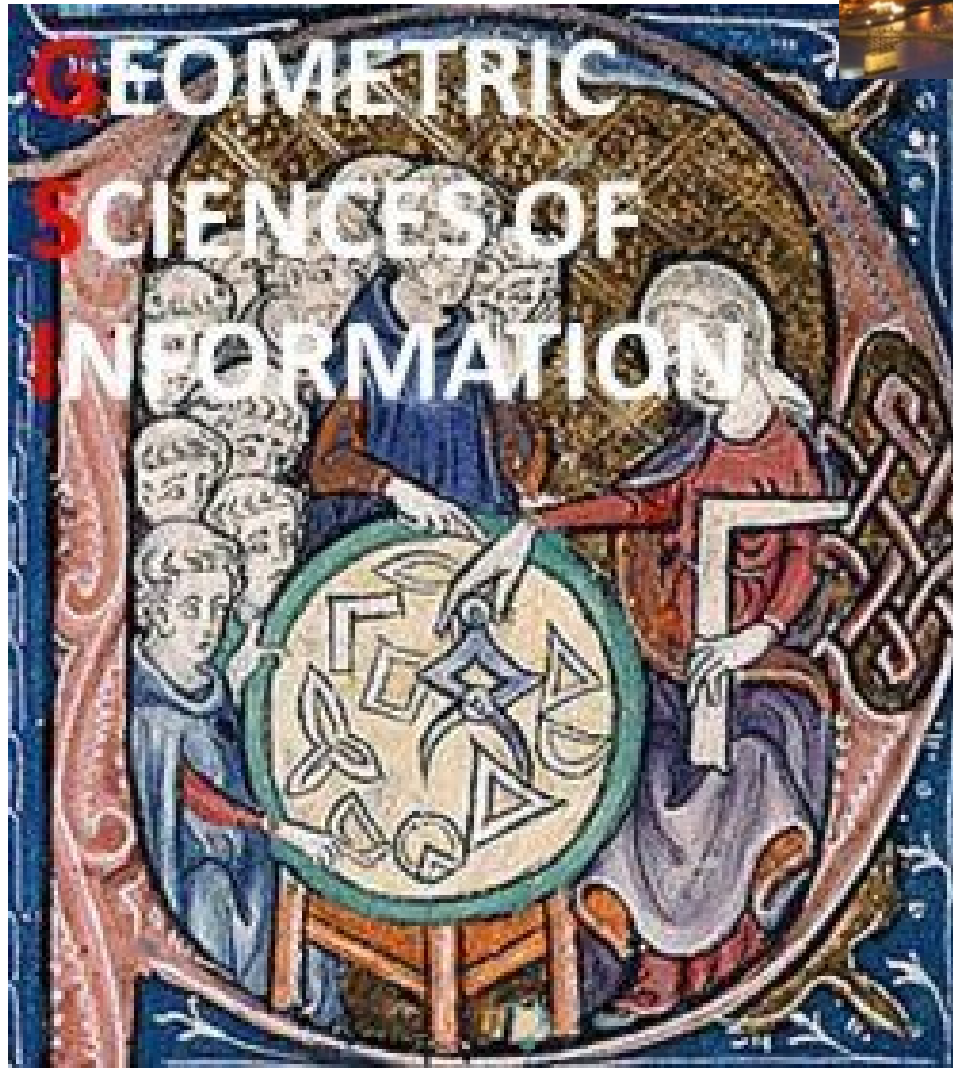
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