



THE HONG KONG UNIVERSITY OF SCIENCE & TECHNOLOGY

Department of Mathematics

***MATHEMATICS COLLOQUIUM***

**Information Geometry:  
Geometric Science of Information**

By

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Abstract

Information geometry investigates parametric families of statistical model by representing probability density functions over a given sample space as points of a differentiable manifold  $M$ . Treating parameters as a local coordinate chart,  $M$  is endowed with a Riemannian metric  $g$  given by the Fisher-information (the well-known Fisher-Rao metric). However, in place of the Riemannian distance, information geometry uses a non-negative but non-symmetric “divergence function” (also called contrast function) for measuring proximity of two points, for instance Kullback-Leibler divergence,  $f$ -divergence, etc. Such divergence functions not only recovers the Fisher-Rao metric, but also a pair of “dual” connections with respect to the metric (equivalently Amari-Censov tensor). This talk will use two examples to introduce some basic ingredients of this geometric framework: the probability simplex (a case with discrete support) and the univariate normal distributions (a case with continuous support). In the former case, the application to the popular data-analytic method Compositional Data Analysis (CDA) is explained in terms of duality between exponential and mixture families. In the latter case, the construction of “statistical mirror” is briefly explained as an application of the concept of dual connections. This talk assumes some basic concepts of differentiable manifold (such as parallel transport and affine connection).

Biography

Jun Zhang is a Professor at the Shanghai Institute of Mathematics and Interdisciplinary Sciences (SIMIS) and one of its co-founders. He is currently on leave from the University of Michigan, Ann Arbor, where he has worked since 1992 as an Assistant, Associate, and Full Professor in the Department of Psychology, with adjunct appointments in the Department of Mathematics, Department of Statistics, and Michigan Institute of Data Sciences. He received his PhD in Neuroscience from the University of California, Berkeley in 1991. An elected fellow of Association for Psychological Sciences (APS) since 2012 and Psychonomic Society since 2016, Professor Jun Zhang’s scholarly contributions have been in the various fields of computation neuroscience, cognition and behavior modeling, machine learning, statistical science, complex systems, etc, and is well known in the field of mathematical psychology. In recent years, his research has focused on the interdisciplinary subject of Information Geometry.

**Date : 26 April 2024 (Friday)**

**Time : 3:00pm – 4:00pm**

**Venue : Lecture Theater F (Lifts 25/26)**

*All Are Welcome!*