



THE HONG KONG UNIVERSITY OF SCIENCE & TECHNOLOGY

Department of Mathematics

JOINT PURE AND APPLIED MATH SEMINAR

**Information Geometry and Statistical
Mirror Symmetry**

By

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Abstract

A parametric statistical model is a family of probability density functions over a given sample space, whereby each function is indexed by a parameter taking value in some subset of \mathbb{R}^n . Treating such parameterization as a local coordinate chart, the family forms a manifold M equipped with a Riemannian metric g given by the Fisher-information (the well-known Fisher-Rao metric). The classical theory of information geometry prescribes a family of dualistic, torsion-free conjugate connections constructed from Amari-Chensov tensor as deformation from the Levi-Civita connection associated with g . Here we prescribe an alternative geometric framework of the manifold M by i) treating the parameter as an affine parameter of a flat connection on M and then ii) prescribing its g -conjugate connection as a curvature-free but torsion-carrying one. This new framework enables the construction of a pair of distinct objects on the tangent bundle TM using data from the base manifold M . The pair consists of a Hermitian structure and an almost Kahler structure simultaneously constructed that are in "mirror correspondence." To the extent this complex-to-symplectic correspondence can be constructed from any parametric statistical model, we call this "statistical mirror-symmetry" and speculate its meaning in the context of statistical inference. (Joint work with Gabriel Khan of Iowa State University).

Biosketch

Jun Zhang is a Full Professor at the University of Michigan, Ann Arbor, where he has worked since 1992 as a tenure-track and then tenured faculty in the Department of Psychology, with adjunct appointments in the Department of Mathematics, Department of Statistics, and Michigan Institute of Data Sciences. He has held various visiting positions at the University of Melbourne (Australia), CNRS (France), University of Waterloo (Canada), RIKEN Brain Science Institute (Japan), CMSA at Harvard, and a number of positions in China including a recent appointment at the newly established Shanghai Institute of Mathematics and Interdisciplinary Sciences (SIMIS), China. Professor Jun Zhang works in the interdisciplinary field of mathematical psychology, computation neuroscience, computation cognitive science, machine learning, and geometric science of information (information geometry). He is an elected fellow of Association for Psychological Sciences (APS) and Psychonomic Society, and co-Editor of the Springer journal Information Geometry.

Date : 28 November 2024 (Thursday)

Time : 3:00p.m. – 4:00p.m.

Venue : Room 2463 (near Lifts 25/26)

All are Welcome!