STATISTICS SEMINAR

UW-Department of Statistics www.stat.wisc.edu

TITLE:

Gaussian Process Landmarking on Manifolds

Abstract: As a means of improving analysis of biological shapes, we propose a greedy algorithm for sampling a Riemannian manifold based on the uncertainty of a Gaussian process. This is known to produce a near optimal experimental design with the manifold as the domain, and appears to outperform the use of user-placed landmarks in representing geometry of biological objects. We provide an asymptotic analysis for the decay of the maximum mean squared prediction error (MSPE), which is frequently employed as a greedy criterion for similar variance- or uncertainty-based sequential experimental design strategies; to our knowledge this is the first result of this type for experimental design. The key observation is to link the greedy algorithm with reduced basis methods in the context of model reduction for partial differential equations. We apply the proposed landmarking algorithm to geometric morphometrics, a branch of evolutionary biology focusing on the analysis and comparisons of anatomical shapes, and compare the automatically sampled landmarks with the "ground truth" landmarks manually placed by evolutionary anthropologists; the results suggest that Gaussian process landmarks perform equally well or better, in terms of both spatial coverage and downstream statistical analysis.

Speaker:

Tingran Gao
William H. Kruskal Instructor
Department of Statistics
University of Chicago

Time & Place:

Wednesday,
March 11, 2020
4**pm**,
Room 133 SMI
Cookies & Coffee @ **3:30**, Rm 1210 MSC

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