



Joint LMU-TUM Statistics Colloquium Series

Wasserstein-Cramér-Rao Theory of Unbiased Estimation

Bodhisattva Sen

(Columbia University)

03/07/2026, 11:00 am

Department of Statistics, Ludwigstr. 33, Room 144
and online via Zoom [\[Link\]](#)
(Meeting-ID: 631 1190 7291; Password: StatsCol)

The quantity of interest in the classical Cramér–Rao theory of unbiased estimation (i.e., the Cramér–Rao lower bound, exact efficiency in exponential families, and asymptotic efficiency of maximum likelihood estimation) is the variance, which represents the instability of an estimator when its value is compared to the value for an independently sampled data set from the same distribution. In this paper, we study a different quantity that captures the instability of an estimator when its value is compared to that obtained under an infinitesimal additive perturbation of the original data set; we refer to this as the sensitivity of an estimator. The resulting theory of sensitivity is based on Wasserstein geometry in much the same way that the classical theory of variance is based on Fisher–Rao (equivalently, Hellinger) geometry. This perspective yields several results paralleling the classical case: a Wasserstein–Cramér–Rao lower bound for the sensitivity of any unbiased estimator, a characterization of models admitting unbiased estimators that attain this bound exactly, and a guarantee that Wasserstein projection estimators achieve the bound asymptotically. We illustrate the theory through a range of statistical examples, in some cases revealing new optimality properties of existing estimators and in others introducing new ones.

About the Speaker:

Bodhisattva Sen is a Professor of Statistics at Columbia University, New York. His statistical research centers around nonparametrics and large sample theory—nonparametric function estimation (with special emphasis on shape constrained estimation), likelihood and bootstrap based inference in (non-standard) parametric and nonparametric models, optimal transportation and applications in Statistics, etc. Bodhisattva is also actively involved in interdisciplinary research, especially in astronomy. He completed his Ph.D. in Statistics at the University of Michigan, Ann Arbor, in 2008.



References:

Trillos, N. G., Jaffe, A. Q., & Sen, B. (2025). Wasserstein-Cramér-Rao Theory of Unbiased Estimation. *arXiv preprint arXiv:2511.07414* [[URL](#)]
