Otto-von-Guericke-Universität Magdeburg
Fakultät für Mathematik

Auf Einladung des Institutes für Mathematische Stochastik spricht

Herr **Prof. Dr. Pierre Bellec**

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über das Thema

Degrees-of-freedom in high-dimensional statistics

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Zu diesem Vortrag sind alle Interessierten herzlich eingeladen.

Abstract:
In classical statistics, degrees-of-freedom adjustments arise naturally in the construction of unbiased estimators; for instance in linear regression with p parameters and p<<<n, the residual sum of squares divided by (n-p) estimates the noise level without bias. I will present in this talk two examples of degrees-of-freedom adjustments in high dimensions (i.e., when n>>>p), and explain the mathematics that justify applying these degrees-of-freedom adjustments for estimators commonly used to analyze high-dimensional data.

A well-understood degrees-of-freedom adjustment appears in Stein's Unbiased Risk Estimate (SURE) to construct an unbiased estimate of the mean square risk of almost any estimator μ̃; here the divergence of μ̃ plays the role of degrees-of-freedom or the estimator. Thanks to Stein's formula, not only unbiased estimates can be constructed for the risk of μ̃, but also for the risk of SURE itself (SURE for SURE): a simple unbiased estimate provides information about the squared distance between SURE and the squared estimation error of μ̃, again involving degrees-of-freedom adjustments.

A second area where degrees-of-freedom appear is the construction of confidence intervals. A novel analysis reveals that degrees-of-freedom adjustments play a major role in de-biasing methodologies to construct confidence intervals in high-dimension. We will see that in sparse linear regression for the Lasso for Gaussian designs, existing de-biasing schemes need to be modified with an adjustment that accounts for the degrees-of-freedom of the Lasso. This degrees-of-freedom adjustment is necessary for statistical efficiency in the regime s>>>n^{2/3}. Here, the necessity of degrees-of-freedom adjustment is explained using the interpolation path between Gaussian vectors typically used to derive Slepian's lemma.