Programme du 50^{e} : Nouveaux développements en probabilités libres et applications
« Atelier sur les probabilités libres : la perspective appliquée »
25 au 29 mars 2019

50th anniversary program : New Developments in Free Probability and Applications
"Workshop on Free Probability : the applied perspective"
March 25-29, 2019

Measuring the utility cost of additive privacy mechanisms via some eigenvalue gaps of sample covariance matrices

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Data privacy breaches have made evident the need of data processing techniques with mathematically provable privacy guarantees. A common family of such techniques are the so-called additive mechanisms which sanitize data by simply adding random noise to it. If the variance of the added noise is large, the additive mechanism would provide a good privacy guarantee but, at the same time, it would reduce the utility of the sanitized data. Understanding this trade-off between privacy and utility is fundamental to the deployment of privacy mechanisms in practice.

In this talk we propose a general-purpose utility measure for survey data which is based on certain eigenvalue gaps of the sample covariance matrix of the data. Here, understanding the privacy-utility trade-off of additive mechanisms requires to understand the evolution of such eigenvalue gaps as the variance of the noise increases. We answer some quantitative and qualitative questions regarding this evolution using free convolution techniques.

This talk is based on joint work with F. Alajaji (Queen's University), S. Asoodeh (Harvard University), S. Belinschi (Université Paul Sabatier), T. Linder (Queen's University), and J. Mingo (Queen's University).

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