

An Application of Fluctuation Moments of Random Matrices to Statistical Data Analysis

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This doctoral dissertation discusses the explicit formulae of fluctuation moments of some random matrices applying free probability theory, as well as the application of random matrix theory to statistical data analysis. Especially, an explicit formula of fluctuation moments of general Wigner matrices is derived by using the second order free cumulants with a combinatorial interpretation.

Furthermore, by regarding the kernel matrices derived from given noisy data as Wishart matrices with the Marchenko-Pastur law, the methods to separate the noise components and to estimate the optimal kernel parameter and the number of clusters are proposed. This approach suggests new possibilities for applying random matrix theory to data analysis.