國立中山大學應用數學系
學術演講

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講　題：Principal Component Analysis in an Asymmetric Norm

時　間：2014/03/27（星期四）14：10～15：00

地　點：理學院四樓理 SC 4011 室

茶　會：15:40 於理 SC 4010 室（系辦公室）

摘要

Principal component analysis (PCA) is a widely used dimension reduction tool in the analysis of many kind of high-dimensional data. It is used in signal processing, mechanical engineering, psychometrics, and other fields under different names. It still bears the same mathematical idea: the decomposition of variation of a high dimensional object into uncorrelated factors or components. However, in many of the above applications, one is interested in capturing the tail variables of the data rather than variation around the mean. Such applications include weather related event curves, expected shortfalls, and speeding analysis among others. These are all high dimensional tail objects which one would like to study in a PCA fashion. The tail character though requires to do the dimension reduction in an asymmetric norm rather than the classical L2-type orthogonal projection. We develop an analogue of PCA in an asymmetric norm. These norms cover both quantiles and expectiles, another tail event measure. The difficulty is that there is no natural basis, no `principal components', to the k-dimensional subspace found. We propose two definitions of principal components and provide algorithms based on iterative least squares. We prove upper bounds on their convergence times, and compare their performances in a simulation study. We apply the algorithms to a Chinese weather dataset with a view to weather derivative pricing.

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