

中央研究院統計科學研究所

學術演講

講題：Robust inference for scatter matrices and functionals

演講人：Dr. Gaspard Bernard

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時間：2025-02-17 (Mon.) 10:30-12:00

地點：Auditorium, B1F, Institute of Statistical Science ; The tea reception will be held at 10:10.

備註：Online live streaming through Cisco Webex will be available.

Abstract

In this talk, we will address several distinct topics that fall - to varying degrees - under the umbrella term of robust inference. The aim of this presentation is to present published results, current projects and research prospects.

We will first explore robust methods in multivariate analysis by examining two classical testing problems on scatter matrices related to PCA. More specifically, we will examine the null hypothesis of equality of the q smallest eigenvalues of a scatter matrix parameter in an elliptical model - with q strictly less than the dimension of the observations - and the null hypothesis of equality of all the eigenvalues. We will propose new tests based on the elliptical signs and ranks of the observations for these two problems as well as (pseudo-)Gaussian tests. We will study the robustness properties of these tests, their local asymptotic powers and their potential local asymptotic optimality using Le Cam's asymptotic theory of experiments. We will show that these procedures can be made asymptotically valid under heavy tails, that they can be improved to reach arbitrarily large power in non-standard - but highly relevant in practice - triangular array scenarios where the LRT displays a problematic lack of power, and that they can even be robust to certain deviations from the i.i.d. assumption. We will then present the next objectives, projects and challenges in this field, the overall objective being to propose a robust toolbox for tackling testing problems relevant in dimension reduction.

In the second part of this presentation, we will discuss the robust estimation of a functional. We will focus on the semiparametric causal inference problem

consisting of estimating the expectation of a Bernoulli random variable Y under the hypothesis that we observe only i.i.d. copies of RY , a masked version of it. Here, R is a Bernoulli random variable, potentially not independent of Y . This problem is important in clinical trials, where Y could be the outcome of a treatment, for instance. We will show that the classical root- n consistent estimators proposed in the literature are not robust. Indeed, they rely on fairly strict assumptions about the underlying distribution and they can behave extremely badly under contamination – even if only a very small proportion of the observations does not satisfy the aforementioned assumptions. Using the theory of rho-estimation, we will propose new robust estimators and study their potential root- n consistency. We will then present the open questions that still need to be addressed in this new field of robust estimation of functionals.



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