Deviation Tests for a High-dimensional Mean

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This paper investigates testing for deviation of a high-dimensional mean vector $\boldsymbol{\mu}$. In contrast to the standard one-sample significance test of the form: $H_0^{\mathsf{e}} : \boldsymbol{\mu} = \boldsymbol{\mu}_0$ versus $H_1^{\mathsf{e}} : \boldsymbol{\mu} \neq \boldsymbol{\mu}_0$, we focus on testing the deviation $H_0 : \|\boldsymbol{\mu} - \boldsymbol{\mu}_0\|_2 \geq d_0$ versus $H_1 : \|\boldsymbol{\mu} - \boldsymbol{\mu}_0\|_2 < d_0$ for a prespecified length $d_0 > 0$. Constructing a valid test statistic for this problem is technically nontrivial. By applying the concept of positive and negative feedback processes from control theory, we propose a test statistic based on a two-armed bandit (TAB) process. The deviation test is also extended to the two-sample setting. Simulation experiments confirm a good performance of the tests in finite samples. Finally, a real data analysis demonstrates the practical significance of the proposed deviation tests.

This is a joint work with Zengjing Chen (Shandong University) and Ruihan Liu (The University of Hong Kong).

References

1. Chen Z., Feng S. and Zhang G. (2022). Strategy-driven limit theorems associated bandit problems. *arXiv preprint* arXiv:2204.04442.

2. Chen Z., Yan, X. and Zhang, G. (2023). Strategic two-sample test via the two-armed bandit process. *Journal of the Royal Statistical Society Series B: Statistical Methodology* **85** 1271-1298.