Multivariate Permutation Tests

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Abstract: The Union-Itersection (UI) principle for multivariate testing has quite a long story since S.N. Roy (1953). This approach assumes that the hypotheses H_0 and H_1 can be equivalently written as

$$H_0 \equiv \bigcap_{k=1}^{K} H_{0k} \quad \text{and} \quad H_1 \equiv \bigcup_{k=1}^{K} H_{1k},$$

and that the global testing can be obtained by considering a suitable list of K partial tests T_k, each specific for the sub-null H_{0k} versus $H_{1k}, k = 1, \ldots, K$. Thus, the solution of the related testing problem is found by a suitable combination of the K partial tests that are generally dependent in a way that is often extremely difficult, or even impossible, to work out by usual regression techniques. Such a global solution is obtained within the nonparametric combination (NPC) of dependent tests methodology.

Guided by two real multivariate and quite intriguing problems from the literature, their related solutions within the permutation theory and the NPC of the K partial dependent tests, into which have been broken-down, are discussed.

The purpose of this talk is discussing on main properties of the UI-NPC methodology and presenting some few of its multivariate applications.

Some references:

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[3] Pesarin, F,. Salmaso, L., Carrozzo, E. and Arboretti, R. Union-Intersection Permutation Solution for Two-Sample Equivalence Testing. *Statistics & Computing.* DOI: 10.1007/s1222-015-9552-y, 2015.

[4] Roy S.N. On a heuristic method of test construction and its use in multivariate analysis. *The Annals of Mathematical Statistics*, 24, 220-238, 1953.

[5] Sen P.K. Union–intersection principle and constrained statistical inference. *Statistical Planning and Inference.* 137, 3741–3752, 2007.