



**The Hong Kong University of Science and Technology**

**Department of Mathematics**

**PhD THESIS EXAMINATION**

**Controlling the False Discovery Rate in Transformations**

*By*

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**ABSTRACT**

Controlling the False Discovery Rate (FDR) in a variable selection procedure is critical for reproducible discoveries, which receives an extensive study in sparse linear models. However, it remains largely open in the scenarios where the sparsity constraint is not directly imposed on the parameters, but on linear transformations of the parameters to be estimated. Examples include change point detection, total variations, trend filtering, and pairwise comparisons, etc. In this thesis, the author presents a data adaptive approach for FDR control in transformations called the Split Knockoff method. This proposed scheme leverages both variable splitting and data splitting. By relaxing the linear transformation constraint to its Euclidean neighbourhood, an orthogonal design that benefits both FDR control and selection power is obtained. The effectiveness of the proposed scheme is validated through simulations and applications in biomedical image analysis for Alzheimer's Disease and statistical ranking with pairwise comparisons.

**Date : 20 July 2024, Saturday**

**Time : 10:00 am**

**Venue : Room 4472 (Lifts 25-26)**

**Thesis Examination Committee:**

**Chairman : Prof. Chu ZHANG, FINA/HKUST**

**Thesis Supervisor : Prof. Yuan YAO, MATH/HKUST**

**Member : Prof. Zhigang BAO, MATH/HKUST**

**Member : Prof. Dong XIA, MATH/HKUST**

**Member : Prof. Xinghua ZHENG, ISOM /HKUST**

**External Examiner : Prof. Weijie SU, University of Pennsylvania**

*(Open to all faculty and students)*

The student's thesis is now being displayed on the reception counter in the General Administration Office (Room 3461).