

國立中山大學應用數學系

學術演講

講者：林蔚安 博士候選人（國立成功大學）

講題：Emulators for the computer experiments with both qualitative and quantitative factors

時間：2025/1/21（Tuesday）11:10 ~ 12:00

地點：理 SC 4009-1 教室

茶會：10:45

Abstract

This study addresses a cooling system design problem reformulated as a black-box optimization task, where the objective function is unknown and evaluated only via a numerical simulator. The main challenge lies in building a surrogate model to approximate the objective function. Gaussian processes (GPs) are commonly used for this due to their flexibility and uncertainty quantification, but they struggle with datasets involving both qualitative and quantitative variables, especially when managing many categorical combinations. To tackle this, we propose a tree-based GP method called the category tree GP (ctGP), designed for models with qualitative factors having numerous categories. It uses a tree structure to split qualitative categories, with GP or mixed-input GP models at the leaf nodes. The splitting is guided by category cross-correlations, which improve prediction accuracy, while a cross-validation-based pruning step refines the model. Results from numerical experiments and the cooling system design case show that ctGP enhances computational efficiency, prediction accuracy, and insights into the cooling system via the tree structure. Additionally, we introduce a sequential method for black-box optimization and suggest future research directions.

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