THE HONG KONG UNIVERSITY OF SCIENCE & TECHNOLOGY

Department of Mathematics

SEMINAR ON STATISTICS AND DATA SCIENCE

Beyond variability: a novel gene expression stability metric to unveil homeostasis and regulation

By

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Abstract

A homeostatic cell performs regular functions to maintain internal balance by continuously responding to both internal and external stimuli, a process that often involves transcriptional regulation. Most genes within such cells exhibit transcriptional stability, while a smaller subset may enter a regulatory or compensatory state in response to stimuli. Key candidates for this type of regulation include 'first responder' genes, interferons, and heat shock proteins, among others. When these responses accumulate to a certain threshold, they can lead to observable phenotypic changes and, in some cases, pathological outcomes. Therefore, identifying genes with precise regulation within homeostatic cells is crucial.

Existing statistical tools have mainly focused on cells with uniform behaviors, often overlooking the nuanced regulation of genes in specific cell subsets. In this presentation, I will discuss an unexpected journey that starts with modeling zero-inflation in single-cell data and progresses to the introduction of the Gene Homeostasis Z-index—a novel metric for gene expression stability. This index reveals genes undergoing precise regulation within specific cell subsets, offering insights into their roles in cellular adaptation. For example, we discover regulatory patterns for neuropeptides like insulin and somatostatin, which exhibit extreme values in a limited number of cells. These findings highlight the limitations of conventional mean-based approaches and demonstrate how our method provides a more refined understanding of gene expression stability.

Date   : **3 October 2024 (Thursday)**
Time   : **11:00am**
Venue : **Room 4472 (Lifts 25/26)**

All are Welcome!