Compound Decision for Parallel Sequential Change Detection

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30th November 2022, 1.00pm UK time

Abstract
This talk will introduce the problem of parallel sequential change detection, which receives wide real-world applications in education, marketing, personalised medicine, and cloud computing, among many others. This problem concerns detecting change points in parallel data streams, where each stream has its own change point, at which its data has a distributional change. With sequentially observed data, a decision-maker needs to declare whether changes have already occurred to the streams at each time point. Once a stream is declared to have changed, the decision-maker will intervene, such as deactivating the stream so that its future data will no longer be collected. We argue that for many applications, it is more sensible to optimise certain compound performance metrics that aggregate over all the streams. Consequently, the decisions for different streams become dependent. We propose a general compound decision framework for parallel sequential change detection, under which different performance metrics are given. In addition, data-driven decision procedures are developed, and optimality results are established for them. Some simulation results will be given to show the power of the proposed method.

This talk is based on the following papers, and two ongoing projects (one with Chengchun Shi (LSE), Zhengke Wu (UMich) and students, and the other with Yi Yu (Warwick) and students).

1. Chen, Y., Lee, Y-H, and Li, X. (2022). Item Quality Control in Educational Testing: Change Point Model, Compound Risk, and Sequential Detection. Journal of Educational and Behavioral Statistics. 47, 322–352.

2. Chen, Y. and Li, X. (2022+). Compound Online Changepoint Detection in Parallel Data Streams. Statistica Sinica. To appear in Volume 33, No. 1, 2023.

3. Lu, Z., Chen, Y. and Li, X. (2022+). Optimal Parallel Sequential Change Detection under Generalized Performance Measures. Submitted to IEEE Transactions on Signal Processing. Minor revision.