December 2011

MADALGO seminars by Lap Kei Lee, Aarhus University

Edit Distance to Monotonicity in Sliding Windows

Abstract:
Given a stream of items each associated with a numerical value, its edit distance to monotonicity is the minimum number of items to remove so that the remaining items are non-decreasing with respect to the numerical value. The space complexity of estimating the edit distance to monotonicity of a data stream is becoming well-understood over the past few years.

Motivated by applications on network quality monitoring, we extend the study to estimating the edit distance to monotonicity of a sliding window covering the w most recent items in the stream for any $w \geq 1$. We give a deterministic algorithm which can return an estimate within a factor of (4+ε) using $O\left(\frac{1}{\varepsilon^2}\log^2(\varepsilon\omega)\right)$ space. We also extend the study to consider an out-of-order stream. In an out-of-order stream, each item is associated with a creation time and a numerical value, and items may be out of order with respect to their creation times. The goal is to estimate the edit distance to monotonicity with respect to the numerical value of items arranged in the order of creation times. We show that any randomized constant-approximate algorithm requires linear space.

Joint work with Ho-Leung Chan, Tak-Wah Lam, Jiangwei Pan, Hing-Fung Ting, and Qin Zhang