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Discovery of Time Profiled Temporal Patterns

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ABSTRACT

Finding temporal association patterns from temporal dataset is addressed in a wider perspective in the existing literature. Discovering time profiled temporal patterns is addressed in our previous research works which includes proposing new support estimation techniques, similarity measures for computing similarity between temporal patterns. Most measures proposed in our previous research are for Gaussian space. Our previous research proposed z-space dissimilarity measures SRIHASS and KRISHNA SUDARSANA. Following these two measures, there have been no z-space measures that are proposed in literature. This paper proposes a new similarity measure for determining similarity between temporal patterns in z-space.

General Terms

Novel approach, Computational Complexity

Keywords

Z-score, support, temporal pattern, similarity computation

1. INTRODUCTION

This research extends our previous research [3, 12, 19-25] by proposing a new distance measure to find distance between patterns in z-space. The aim of this research is to propose a new distance measure for z-space similarity computation. For this, we have to map the distance value to z-space. To achieve this, we use the concept of z-score and z-score probability. Since, the measure is designed by using Gaussian membership function therefore it is required to mention the deviation value for distance computation. This research also propose a new computation expression for determining deviation value from the Lp-space threshold mentioned by user. We also propose an expression for mapping distance threshold to z-space. This distance threshold mapped for z-space is used to compare the patterns for similarity.

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2. PROPOSED MEASURE

Consider temporal items, T_p and T_q and the corresponding support time sequences denoted by $\overline{T_P}$ and $\overline{T_Q}$. Then, the support values of temporal patterns, T_p and T_q at the k^{th} timeslot are denoted by T_{p_k} and T_{q_k}. The support sequences for 'm' time slots are m-tuple denoted as $\overline{T_P} = (T_{P_1}, T_{P_1}, T_{P_3}, \ldots\ldots\ldots, T_{P_m})$ and $\overline{T_Q} = (T_{q_1}, T_{q_1}, T_{q_3}, \ldots\ldots\ldots, T_{q_m})$.

2.1 Z-score sequence of temporal pattern

The z-score of a temporal pattern, T_p w.r.t reference, R, is given by equation (1) where, σ^2 denotes the standard deviation obtained using equation (10) for a given dissimilarity measure.

$$Z(T_{P_k}) = \frac{(T_{P_k} - R_{P_k})}{\sigma^2} \quad (1)$$

The z-score value of a temporal pattern T_p at k^{th} time slot is denoted as, $Z(T_{P_k})$ and the z-score sequence considering 'm' time slots is represented as given by equation (2)

$$\overline{Z(T_P)} = \left(Z(T_{P_1}), Z(T_{P_1}), Z(T_{P_3}), \ldots\ldots\ldots Z(T_{P_m})\right) \quad (2)$$

The z-score probability of temporal pattern is written as, $P(Z(T_{P_k}))$ and the probability sequence considering 'm' time slots is represented by equation (3)

$$\overline{P\left(Z(T_P)\right)} = \left(P\left(Z(T_{P_1})\right), P\left(Z(T_{P_1})\right), P\left(Z(T_{P_3})\right), \ldots\ldots\ldots, P\left(Z(T_{P_m})\right)\right) \quad (3)$$

Also, the z-score value of reference to itself is always zero and hence the corresponding z-score sequence is a sequence consisting only zeros.