**Introduction**

This paper intends to get the relationships among Urban Spatio-Temporal Data Sets. However, the relationship may occur only at certain locations or time periods. So, this paper put forward a topology-based relationship. Two data sets are related only if their salient features have relationship, so the problem changes into get the salient features relationship.

First, we should know the notion of salient features, it contains points that exhibit unusual behavior with respect to its neighborhood. Now, if we have two data sets, and , has attributes ,…, ; has attributes ,…, . there may have relationships between different attributes of and , for each pair attribute() charge if they have relationship. Next, for each attribute, we represent it as a scalar function, and use merge tree to get its salient features. After getting the salient features of two data sets, use relationship score and relationship strength to measure if the salient features have relationship. Finally, this paper uses Restricted Monte Carlo Tests for Spatial Correlation to identify this relationship is meaningful or spurious.

**Problem-**About why use index

Assume there are N vertices , when get super-level set one time

|  |  |
| --- | --- |
| Use index | Time complexity |
| no | N |
| yes | 𝑁 log𝑁+𝑁𝛼(𝑁) + 𝛴 |

𝛴 is the number of super-level set

𝛼( ) : inverse Ackermann function

But this paper intends to get the relationships among many Urban Spatio-Temporal Data Sets. So an attribute of one data set needs to charge if it has relationship with more than one other attribute, the process may repeats many times, if repeat m times, then the table becomes as below:

|  |  |
| --- | --- |
| Use index | Time complexity |
| no | mN |
| yes | 𝑁 log𝑁+𝑁𝛼(𝑁) + m𝛴 |

The number of super-level set 𝛴 is small, so when m is very large, the time use index will be lower compared with not using index.