USING CHOREMS TO CREATE VISUAL SUMMARIES OF THE RECURRING PLACES APPEARING IN HUMAN MOVEMENTS

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1. INTRODUCTION

Currently there is an increasing interest in studying human movement patterns. To understand these patterns one is not only interested in the path but also in those places which are frequently visited by an individual. Getting inside in the pattern of these recurring places can improve understanding of human behaviour. Due to the large data quantities and typical nature of movement data the traditional cartographic methods (like point density maps and flow maps) often cause over-plotting and cluttering. In this paper, we explore an alternative graphic representation method to create visual summaries of spatial structures and processes known as chorems (Brunet 1987), to visualize recurring

2. BACKGROUND

The main difference between creating traditional cartographic representations and chorems is the starting-point. The first is object oriented, where identification of the individual features is followed by symbolization according to spatial data type. The second is process oriented, where the focus is on the interaction between objects (conflict, diffusion, and separation e.g.) and symbolization is applied to express different process related aspects. The theoretical framework originates back to 1980's, when French cartographer, Roger Brunet, developed his spatial graphic toolset called _chorèmes_. Since then chorems have been infrequently used and the method only supported manual creation. Recently the interest in their automatic construction has emerged. However, researchers (Reimer 2010, Del Fatto 2009) mainly focus on creating the shape of the chorem area. Our focus is on developing automatic symbolization of chorem content.

3. APPROACH

The example dataset for developing general approach to this method consisted of one year (January 1, 2010 to December 31, 2010) active positioning data of 4 volunteers living in Tartu, Estonia. Active positioning data means that the location of the user's mobile phone was registered continuously after every 15 minutes. To automate the chorem creation process several statistical methods were applied to pre-process the data in order to identify the interactions between objects and to get the necessary attribute data for chorem content elements. The chorem content included basic shape of the research area, descriptive elements of the primal process movement (characteristics like distance, direction, origin-destination points, and time) and spatial organization likely affecting the process (road network, land cover, points of interest at the area). Data mining methods to locate key locations like home and work (Ahas _et al_. 2010) and clustering algorithms to identify other recurring places based on spatial density distribution and time spent at location were used. In chorem two spatial scale levels were separated: 1) movements inside highly populated areas (towns) and 2) movements within the whole country. Accordingly, temporal scale summarizing seasons in the country level and weekdays/weekends in town scale were used. The final construction was made by a computer driven set of pre-defined graphic placement rules (like relocate, replace, hide, emphasize) that uses the result values recorded in the database after the detection and analyze process.

4. CONCLUSION

We see a great potential in the methodology of chorems to create representations of complex spatial processes as movements. In the future, we intend to work on how this method can be adapted to much larger dataset.

5. LITERATURES

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