GeoSpatial Data Management: final course project

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INTRODUCTION

Context: we have collected a set of trajectories in a museum (Trento), using an innovative real-time location system based on UWB (Ultra-Wide-Band). The position is tracked at high sampling rate (12 Hz). The spatial accuracy is on the order of a few tens of centimeters, however there can be significant noise. The exhibits in the museum are located on tables.

We present two projects both related to movement data analysis in the museum. In both cases we are concerned with stops in proximity of tables. Outside stops, the movement is not relevant and should not contribute to the analysis. Student can choose any tool and method they consider relevant to develop the project. These projects are meant to be open and inclusive. The projects will be evaluated with respect to: originality, technical quality, and presentation.

Dataset. It consists of 2 zipped layers. The coordinate system is EPSG 3003:

- 5 trajectories of visitors in a museum: CSV file
- Museum layout (tables): Esri shapefile

PROJECTS

The dataset is unique for the two projects. Students are asked to select one of the projects. The evaluation of the projects will be identical. Projects can be developed by groups of at most 2 students.

PROJECT 1

Goal: to determine the tables in the museum which are more attractive based on the stops in proximity (< 2m) and also the duration of stops. The students shall report:

1. Statistics on the dataset

2. Visit analysis: analyze the attractiveness of tables based on detected stops. A stop detection method is to be chosen/implemented, while feel free to define one or more measures of attractiveness. For example, a simple measure is the number of stops or the number of users per table.

Expected outcome:

- A set of symbolic trajectories, one per user, taking the form: (timeInterval-1, Table-1) ….(timeInterval-n, Table-n) specifying the series of stops experienced by the user during the visit. Note that users can perform consecutive stops at the same table
- The outcome of the above analysis

PROJECT 2

Goal: compare a few analytical methods presented during the course. The students shall report:

1. Statistics on the dataset
2. Apply, evaluate and compare at least 3 of the following methods:

- Density Kernel Estimation

- DBSCAN
- ST-DBSCAN
- StayPoint Detection (to be implemented)

Expected outcome:

- Define suitable parameters
- Analyze the output: explain the meaning of the clusters/segments with respect to the application.
- Describe the advantages and limitations of each method
- Which method(s) do you recommend to analyze the stop-movement behavior of the visitors?

GUIDELINES FOR THE EXAM

- Before the exam: submit a report describing for the selected project, the methodology adopted to solve the problem and the results. The results, also those at intermediate steps, can be presented through maps and possibly integrated with additional information. If any code is developed, it should be added as appendix. The report is unique for each group. It should be sent to maria.damiani@unimi.it, fatme.hachem@unimi.it, at least two days before the exam. The QGIS project, in case, or code is not needed ;
- During the exam: make a PowerPoint presentation of about 7-10 minutes. In addition, make sure to bring the code, the possible QGIS project and what is needed to show the implementation. The presentation is unique for each group