Scooter Trajectories Clustering

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Mirco De Marchi - VR445319

***Abstract*—The aim of this report is to present the main unsupervised learning techniques used for scooter trajectories clustering. The dataset that I used contains a big amount of positions taken in rentals that run through some cities in Italy. The objective is to find recurrent places crossed by the trajectories. This report presents some analysis on the positions and an implementation of heuristics that manage data in a systematic way: *timedelta heuristic*, *spreaddelta heuristic*, *edgedelta heuristic* and *coorddelta heuristic*. Then I performed the most traditional machine learning clustering techniques on the generated dataset: *K-Means*, *Mean Shift*, *Gaussian Mixture*, *Full Hierarchical Agglomerative*, *Ward Hierarchical Agglomerative*. All the features are extracted with *Principal Component Analysis (PCA)* with an improvement that select the components to focus on and have been integrated with the informations obtained from the heuristic procedures in order to optimize feature extraction.**

I. Motivation

Motion trajectories are really difficult to analyse and handle because of the amount of data. There could be errors in position tracking, due to localization issues, and usually data are not organized as you expect. Consequently trajectories are difficult to represent, filter and manage in relation with themselves or other informations. First of all, trajectories clustering is a challenge for its intrinsic difficulty in being treated and today is an ambitious topic in data science research. Moreover, trajectory clustering can help for several applications:

- Monitoring: understand main points of interest and common places visited by tourists;
- Forecasting: prediction of possible destinations starting from the current position and previous ones;
- Viability: traffic monitoring and kind of user's activity extracting semantic concepts from trajectories;
- Smart city: data support to city plan and smart transportation management;
- Security: trajectories which are significantly different from others in terms of some similarity metric may be viewed as outliers;
- Video analysis: movement pattern analysis from video (after extracting trajectories from video data);

II. State of art

III. Objectives

The objectives of this project is grouping trajectories in order to find common locations crossed by people that rent a scooter to visit a city in Italy. The model built has to be able to distinguish for example the positions related to a trajectory that takes from the train station to the city centre, the ones that move in the city centre, the ones that run through the periphery and so on.

IV. Methodology

V. Results

VI. Conclusion