Mining popular routes in urban environments

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Modern applications and localization technologies have given rise to large quantities of location data. Itineraries of taxis and urban transporation services, drivers' trajectories, runners' and cyclists' routes, tourist trails, they all contain valuable information for analysing the collective movement of humans. Our focus is to extract popular routes from a collection of trajectories of individual mobile users in urban environments.

One difficulty in this is that people do not follow exactly the same routes end-to-end, but only meet in the middle segments. As a result, clustering algorithms on complete or segmented trajectories fail to recover the exact routes many users have followed. In [1] we address the problem of finding long and popular paths in a road network, for GPS trajectory data. We consider a sensor network and propose a distributed randomized solution that finds almost all popular paths with high accuracy and at significantly smaller cost and time compared to a basic deterministic approach. Our algorithm is differentially private, protecting the participant users against inference attacks. We find that popular paths can be reliably used to predict short-term motion of groups of mobile users.

A variation of the problem is to compute popular paths from spatially and temporally sparse location data, such as call-detail-records or social network check-ins. The main challenge here is that the locations of such datasets are highly inaccurate and sparse. As a result, exact routes are hard to distinguish. In current work[1], we study the problem of finding the popular routes users take to commute between two particular areas in a city, from call-detail-records. We show preliminary results and outline the challenges and limitations of the task.

References

[1] P. Katsikouli, M. S. Astefanoaei, and R. Sarkar. Distributed mining of popular paths in road networks. *DCOSS*, 2018.

[1]Collaboration with Razvan Stanica (University of Lyon, CITI Lab, INSA Lyon, INRIA), Marco Fiore (CNR-IEIIT) and Angelo Furno (Universite de Lyon, IFSTTAR, ENTPE)