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Big Data goes Personal: Privacy and Social Challenges

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Abstract: The Big Data phenomenon is posing new challenges in our modern society. In addition to requiring information systems to effectively manage high-dimensional and complex data, the privacy and social implications associated with the data collection, data analytics, and service requirements create new important research problems. First, the high volume of personal data generated by users' devices (e.g. credit card transactions, GPS trajectories from mobile devices and medical data) can be used, much like a fingerprint, to identify the person who created it with the risk of disclosing sensitive information such as: political inclination, financial status and medical condition. Second, popular social networks (e.g. Facebook, Foursquare, Yelp) not only enable users to share locations and preference but also create opportunities for them to establish complex interactions (e.g. forming communities, planning trip). This creates the needs for location based services to provide services to groups of users rather than individuals. In this dissertation, we present effective solutions for both these privacy and social challenges. In the privacy domain, we propose new privacy preserving techniques to provide individual users with formal guarantee of privacy while at the same time preserve meaningful information of the data released. We demonstrate the effectiveness of our solutions in different domains such as: sequential pattern mining, record linkage, and computation of statistics over data streams. In the social domain, we propose a new type of group query aiming to find a route that all users can traverse while maximizing the group preference for the locations jointly visited. The ability of solving such query can greatly benefit many existing and emerging tools that allow users to share route information (e.g. Uber, Waze) and plan group outings or trips (e.g. QuickCliqs). Extensive empirical studies demonstrate the effectiveness of our solutions and provide us with important insights for future research directions.

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