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Trajectory and Policy Aware Sender Anonymity in Location Based Services

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Abstract

We consider Location-based Service (LBS) settings, where a LBS provider logs the requests sent by mobile device users over a period of time and later wants to publish/share these logs. Log sharing can be extremely valuable for advertising, data mining research and network management, but it poses a serious threat to the privacy of LBS users. Sender anonymity solutions prevent a malicious attacker from inferring the interests of LBS users by associating them with their service requests after gaining access to the anonymized logs. With the fast-increasing adoption of smartphones and the concern that historic user trajectories are becoming more accessible, it becomes necessary for any sender anonymity solution to protect against attackers that are trajectory-aware (i.e. have access to historic user trajectories) as well as policy-aware (i.e they know the log anonymization policy). We call such attackers TP-aware.

This paper introduces a first privacy guarantee against TP-aware attackers, called *TP-aware sender k-anonymity*. It turns out that there are many possible TP-aware anonymizations for the same LBS log, each with a different utility to the consumer of the anonymized log. The problem of finding the optimal TP-aware anonymization is investigated. We show that trajectory-awareness renders the problem computationally harder than the trajectory-unaware variants found in the literature (NP-complete in the size of the log, versus PTIME). We describe a PTIME l-approximation algorithm for trajectories of length l and empirically show that it scales to large LBS logs (up to 2 million users).

A copy of this technical report can be obtained by sending an email request to **deutsch@cs.ucsd.edu** or **avinash.vyas@alcatel-lucent.com**.

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