

# Differential Privacy Trajectory Data Protection Algorithm Based on Polar Coordinate Transformation



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## Introduction

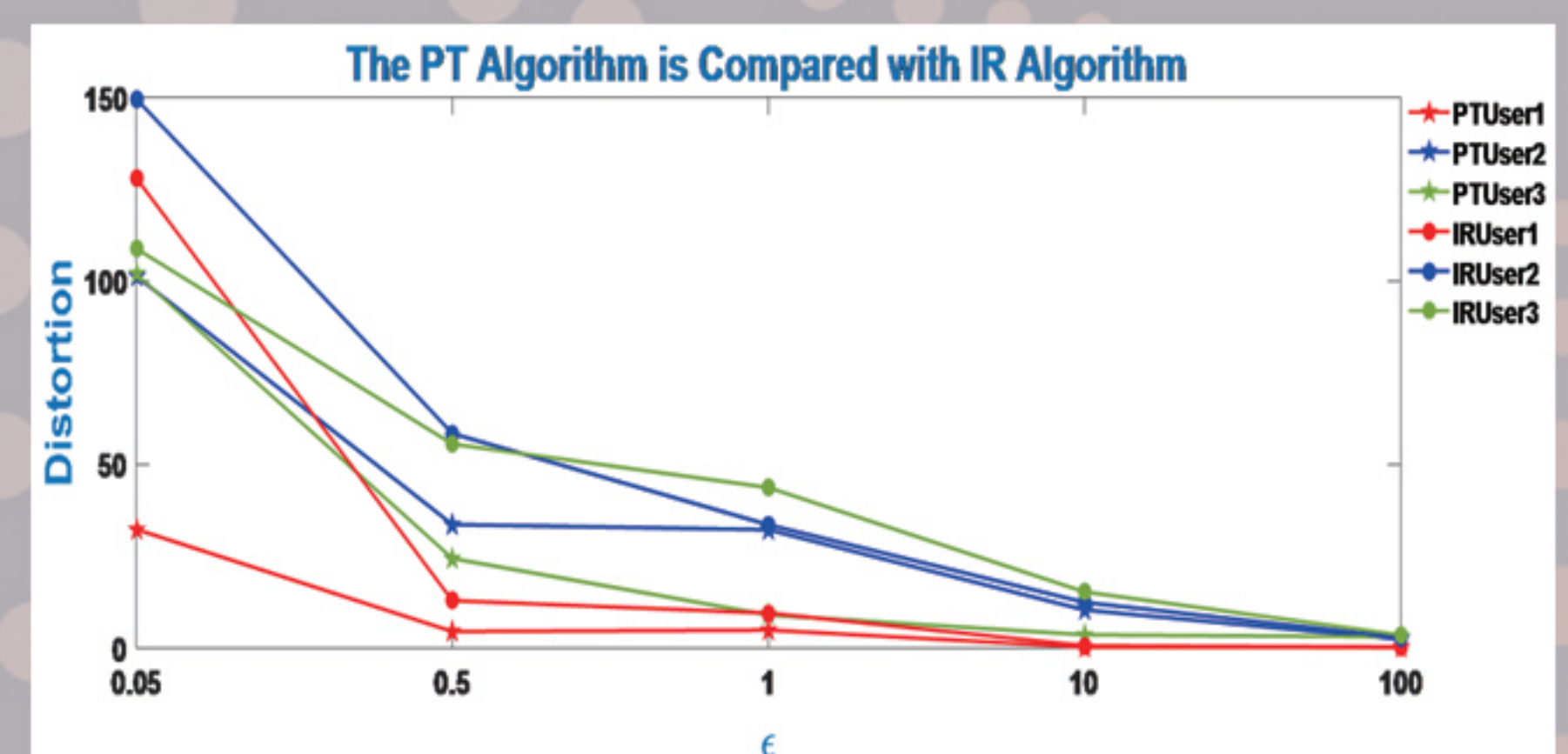
Differential privacy technology has been widely used in the issue of trajectory data release. Improving the availability of data release under the premise of ensuring privacy and security is one of its basic research goals. At present, most trajectory data release methods use a rectangular coordinate system to represent location information. Research has shown that the availability of published data cannot be optimized through the rectangular coordinate system. In order to improve the effect of trajectory data release, this paper proposes a differential privacy trajectory data protection algorithm based on polar coordinates. First, the stay point detection method is used to find frequent stay points in the trajectory and the key location points related to personal privacy are detected by the type of location points. Then, this paper converts the rectangular coordinate system representation of the key position points to the polar coordinate system representation, and implement differential privacy trajectory data release by adding noise to the key position points represented by the polar coordinates. Experiments show that the algorithm proposed in this paper effectively improves the usability of trajectory data on real data sets.

## Methods

The algorithm includes two steps. First step, find frequent stops, and then Baidu Map API technology is used to get the POI for the position type, so as to determine the key location points which easily leak privacy. Second step, Transform the rectangular coordinate system representation of the privacy position points into the polar coordinate system representation. Then, using the differential privacy protection mechanism to add noise to the key location points in the polar coordinate representation. Finally generate the trajectory data after user privacy protection.

## Graphics / Images

Some results of the method (PT) in this paper compared with the frontier method (IR) are shown in the figure. It is verified that the algorithm in this paper can greatly improve the usability of trajectory data in the process of safely publishing trajectory data.



## Conclusions

For the release of the trajectory data set, this paper connects the position with reality, and proposes a differential privacy trajectory data protection algorithm based on polar coordinate conversion. Experiments show that this algorithm greatly improves the availability of data. However, the trajectory also contains a lot of other real information, such as speed, transportation, etc. Combining this real information to set different privacy protection levels can make the protected data more realistic and improve the usability of the data. Therefore, how to use other realistic information to achieve better trajectory data privacy protection and release is the next research direction.