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Executive Summary

Traffic Flow Estimation Prediction on the Highway Road Network

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Long regarded as a core and essential component of Intelligent Transportation Systems, traffic flow forecasting Traffic prediction systems boost the flexibility and efficiency of transportation networks by giving an accurate and timely estimation of the traffic situations. They make a significant contribution to increasing traffic efficiency and information, which results in better mobility. Technology advancements and the accessibility of a wealth of traffic data have fuelled the advancement of traffic flow forecasting studies. TFP has always been a difficult undertaking because of the stochastic nature of traffic and dynamic factors like weather, the calendar (such as the time of day and day of the week), accidents, events, etc.

An example of a non-parametric technique is artificial neural networks (ANNs), which can automatically extract temporal properties from unprocessed data. ANN has demonstrated remarkable success for traffic prediction problems due to their many benefits (such as the strong forecasting performance, ability to work with multidimensional data, and high adaptability). In this work, N stations connected to a centralized server are chosen by the authors. Based on the historical information from numerous sites, they seek to estimate the vehicle flow. Each participating station works together to train an LSTM model using the same structured information (historical traffic flow).

In this paper, the authors present FL-LDP, a traffic flow forecasting system that blends local differential privacy with federated learning. This enables collaborative training of prediction models across numerous stations without compromising the privacy of user data. More precisely, attackers are unable to extract sensitive user data by perturbing the computed gradients using the LDP technique (from their shared gradients). Based on the PeMS traffic flow statistics, the performance of the suggested approach is assessed.

According to the findings, our method successfully predicted MAE, MSE, RMSE, and MAPE scores by 8.03, 103.24, 11.16, and 18.76%, respectively. However, thorough assessments show that the addition of the LDP mechanism improves the framework's performance in terms of providing robust user privacy.

Source: Information

KEYWORDS

Traffic flow forecasting; federated learning; privacy-preserving