Vehicle Positioning Using GSM and Cascade-Connected ANN Structures

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References:


Abstract:

Procuring location information for intelligent transportation systems is a popular topic among researchers. This paper investigates the vehicle location algorithm based on the received signal strength (RSS) from available Global System for Mobile Communications (GSM) networks. The performances of positioning models, which consisted of cascade-connected (C-C) artificial neural network (ANN) multilayer feedforward structures employing the space-partitioning principle, are compared with the single-ANN multilayer feedforward model in terms of accuracy, the number of subspaces, and other positioning relevant parameters. C-C ANN structures make use of the fact that a vehicle can be found only in a subspace of the entire environment (roads) to improve the positioning accuracy. The best-performing C-C ANN structure achieved an average error of 26 m and a median error of less than 5 m, which is accurate enough for most of the vehicle location services. Using the same RSS database obtained by measurements, it was shown that the proposed model outperforms kNN and extended Kalman filter (EKF)-trained ANN positioning algorithms. Moreover, the presented ANN structures replace not only the positioning algorithms but the overloaded map-matching process as well.

Keywords:

Space-partitioning, GSM, Received Signal Strength, Artificial Neural Networks, Location