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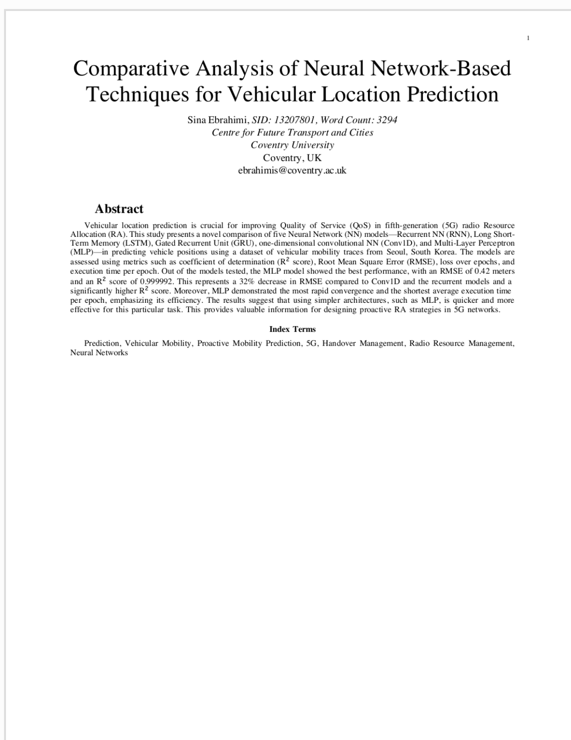
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Comparative Analysis of Neural Network-Based Techniques for Vehicular Location Prediction

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Abstract

Vehicular location prediction is crucial for improving Quality of Service (QoS) in fifth-generation (5G) radio Resource Allocation (RA). This study presents a novel comparison of five Neural Network (NN) models—Recurrent NN (RNN), Long Short-Term Memory (LSTM), Gated Recurrent Unit (GRU), one-dimensional convolutional NN (Conv1D), and Multi-Layer Perceptron (MLP)—in predicting vehicle positions using a dataset of vehicular mobility traces from Seoul, South Korea. The models are assessed using metrics such as coefficient of determination (R^2 score), Root Mean Square Error (RMSE), loss over epochs, and execution time per epoch. Out of the models tested, the MLP model showed the best performance, with an RMSE of 0.42 meters and an R^2 score of 0.999992. This represents a 32% decrease in RMSE compared to Conv1D and the recurrent models and a significantly higher R^2 score. Moreover, MLP demonstrated the most rapid convergence and the shortest average execution time per epoch, emphasizing its efficiency. The results suggest that using simpler architectures, such as MLP, is quicker and more effective for this particular task. This provides valuable information for designing proactive RA strategies in 5G networks.

Index Terms

Prediction, Vehicular Mobility, Proactive Mobility Prediction, 5G, Handover Management, Radio Resource Management, Neural Networks