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Path Loss Prediction for V2I Communications Systems: A Performance Analysis of Propagation Models
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Abstract
This paper presents a comprehensive analysis of path loss prediction models for V2I communication in urban environments, focusing on the impact of non-line-of-sight (NLOS) conditions. Field tests conducted in Bologna, Italy, provided a dataset encompassing four distinct NLOS scenarios. Linear regression and random forest (RF) models were trained and evaluated using meticulously prepared data. Our findings demonstrate the superior performance of the RF model in capturing complex data relationships, as evidenced by lower RMSE, MSE, and MAE values compared to both the linear regression and the standard 3GPP model. Furthermore, the application of a Kalman filter significantly enhanced the RF model's accuracy, achieving near-zero error levels in certain scenarios. In contrast, the 3GPP model exhibited limited improvement, revealing its inadequacy in accurately modeling path loss under complex urban conditions. This research underscores the potential of advanced machine learning techniques, like RF, combined with noise reduction strategies for achieving highly accurate and reliable path loss predictions for V2I communication systems. © 2024 IEEE.

Author Keywords
3GPP; Kalman filter; Non-line-of-sight; Path loss; Random Forest; V2I communication

Index Keywords
Decision trees, Linear regression, Noise abatement, Prediction models; 3GPP, Communications systems, Nonline of sight, Path loss, Path loss prediction, Performances analysis, Propagation models, Random forest modeling, Random forests, V2I communications; Kalman filters

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