Title: Regression supervised model techniques THz MIMO antenna for 6G wireless communication and IoT application with isolation prediction

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Abstract: This article presents unique research on the application of machine learning techniques to enhance the efficiency of antennas for wireless communication and Internet of Things (IoT) applications in the Terahertz (THz) frequency band. This work utilizes Computer Simulation Technology (CST) Microwave Studio modelling techniques considering the compact dimensions of 120 × 200 μm^2 and a polyimide substrate. The design attains a peak gain of 12.116 dB, isolation exceeding 36 dB, and an efficiency of 88.86 %, covering a broad frequency range of 2.6 THz (7.2438–9.84 THz). The outcomes from the CST were verified by designing and simulating a similar RLC circuit in ADS. Both CST and advanced design system (ADS) simulators produced comparable reflection coefficients. The supervised regression machine learning technique accurately predicted the antenna's isolation. The performance of machine learning (ML) models can be assessed using criteria such as variance score, R squared, mean square error (MSE), mean absolute error (MAE), and root mean square error (RMSE). Gradient Boosting Regression demonstrated the smallest error and highest accuracy among the six ML models tested. The isolation prediction accuracy exceeds 94 %, as indicated by the R-squared and variance scores. The proposed antenna utilizing simulations, multiple regression machine learning models, and an equivalent Resistance-Inductance-Capacitance (RLC) circuit model are strong contenders for THz band applications.

Key words: THz antenna 6GRLC Machine learning Isolation

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