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Certificate

This is to certify that the work contained in the thesis titled **Antenna Design with Machine Learning**, submitted by **Om Singh**, **Prateek** and **Pritam Rauniyar** in the partial fulfillment of the requirement for the award of Bachelor of Technology in Electronics and Communication Engineering to the Electronics and Communication Engineering Department, Motilal Nehru National Institute of Technology, Allahabad, is a bonafide work of the students carried out under my supervision.

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Abstract

In this report, our team is attempting to implement various machine learning techniques into Antenna Design Optimization. As a reference antenna, our team has used a Cylindrical DRA (Di-electric Resonator Antenna) with appropriate design parameters. This Antenna Model is designed in the HFSS (High-Frequency Structure Simulator) environment, using which we generated the data-set and verified results.

Studying these ML algorithms, we are trying to prove the efficiency and reliability of these techniques over conventional optimization methods. Each method is analyzed adequately by first training the learning model with the generated data-set. Training is followed by predictions made by each model for given input, comparing the prediction with actual results helped in the accuracy analysis. Further a detailed comparative analysis of these predicted values with the HFSS results was carried out to verify the accuracy.

With our study we tried to conclude the best possible algorithms and also presented the future prospects of work which can be carried on further in the same direction. All these optimization techniques were also compared to opt out the most suitable algorithm for specific use-cases.

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List of abbreviations

1. CDRA Cylindrical Dielectric Resonator Antenna
2. ANN Artificial Neural Network
3. KNN K Nearest Neighbors
4. ML Machine Learning
5. DL Deep Learning
6. HFSS High Frequency Structure Simulator
7. EM Electro-Magnetic
8. MLP Multilayer-perceptron
9. LM Levenberg-Marquardt
10. FOM Figure of Merit
11. IoT Internet of Things