

DESIGN OF BIOMEDICAL ANTENNA FOR BRAIN TUMOR DETECTION: A MACHINE LEARNING BASED APPROACH

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This paper intends to discuss an approach of a software simulation approach towards designing a biomedical antenna for the detection of brain tumors, incorporating machine learning in its performance improvement. This project makes use of ANSYS HFSS and the Finite Element Method to design an ideal high-performance antenna for the detection of brain tumors. The antenna design pays attention to impedance matching, radiation patterns, and specific absorption rate analysis, which permits the detection of changes in tissue dielectric properties induced by tumors. It features classification of tumor and non-tumor regions by employing a supervised machine learning model, specifically, the KNN Algorithm based on the response of the signal coming from the antenna. The simulation creates a database of all the important features computed, such as return loss, gain, and radiation efficiency, and utilizes it for training a machine-learning model. Another critical step is performance against classification accuracy, precision, and recall. Promising integration between computational electromagnetics and machine learning shows enhanced accuracy for the detection of non-invasive brain tumors. The synergy between antenna design and machine learning is used to achieve a robust diagnostic tool in the project. It validates feasibility and indicates that it is one of the steps forward in biomedical applications, especially in early tumor detection.