**ABSTRACT**

Personalized medicine is transforming cancer treatment by tailoring therapies to the genetic variations found in cancer cells, significantly improving patient responses to specific drugs. This project, titled "Leveraging ANN for Targeted Drug Sensitivity Prediction on GDSC Data", utilizes a machine learning approach with Artificial Neural Networks (ANN) to predict drug sensitivity in cancer cell lines using data from the Genomics of Drug Sensitivity in Cancer (GDSC) dataset. The model focuses on predicting IC50 values, a key measure of drug effectiveness, by integrating genomic features such as gene mutations, gene expression profiles, and copy number alterations (CNAs) to identify potential biomarkers for personalized therapies. The system employs an ANN architecture that captures complex nonlinear relationships within the genomic data, optimizing predictions with techniques like normalization, feature selection, and hyperparameter tuning. The approach uses a Flask-based web interface that enables users to easily input genomic data through labeled form fields, ensuring accessibility without the need for file uploads. The interface displays IC50 predictions in real-time, making it suitable for both clinical and research use. Model performance is evaluated using key metrics like Mean Squared Error (MSE) and R-squared (R²). Visualization tools further enhance interpretability, displaying the comparison between predicted and actual IC50 values. This project highlights the potential of ANN models in advancing personalized oncology treatment by providing actionable drug response insights based on genomic data. Future work will focus on integrating additional datasets, enhancing multi-omics data integration, and conducting clinical validation to ensure broader applicability in real-world cancer therapies.