Abstract

Chronic inflammatory bowel diseases, such as Ulcerative Colitis (UC), pose significant global health challenges, impacting patients' quality of life and increasing cancer risk. Early detection of UC is critical due to its high association with cancer. Traditional in vivo methods for measuring UC penetration are expensive, complex, and time-consuming. This study proposes an alternative in-silico approach using machine learning to predict UC permeability efficiently. We developed a predictive model for UC by integrating Artificial Neural Networks (ANN) with the Firefly Algorithm (FA) for feature selection and hyperparameter optimization based on high-dimensional microarray data. The ANN model's architecture was carefully designed to balance complexity and performance, with the FA enhancing efficiency by selecting relevant features and fine-tuning parameters. The optimized ANN model, employing one hidden layer, ReLU activation, and the Adam optimizer, achieved an accuracy of 0.73 and an F1-score of 0.79. These results indicate that the ANN model optimized with FA provides a reliable method for early UC diagnosis and treatment response assessment.