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Enhancing Brain MRI Image Classification: Combining VGG16 and ResNet50 with a Multi-Verse Optimization Approach

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Case Study

Brain MRI image classification plays a crucial role in diagnosing and treating neurological disorders. The development of advanced techniques to improve the accuracy and efficiency of such classification has been a key focus in medical imaging. In this context, this study explores an innovative approach by integrating two state-of-the-art convolutional neural networks, VGG16 and ResNet50, with a Multi-Verse Optimization algorithm. The combined framework leverages the strengths of both CNN architectures and the optimization method to enhance classification performance [1].

VGG16, known for its simplicity and depth, excels at feature extraction, while ResNet50, equipped with residual learning, effectively handles the vanishing gradient problem, allowing for deeper network architectures. By fusing these networks, the proposed model harnesses their complementary capabilities, enabling more robust feature representation. To optimize the classification process further, the MVO algorithm is employed. Inspired by the concept of parallel universes in physics, MVO identifies the optimal hyperparameters and feature subsets, ensuring improved performance while reducing computational overhead. Extensive experiments on publicly available brain MRI datasets demonstrate the superiority of this integrated approach. The proposed model outperforms standalone CNNs and traditional methods, achieving higher accuracy, precision, and recall. This success can be attributed to the synergy between the feature extraction power of VGG16 and ResNet50 and the optimization efficiency of MVO [2].

This research provides a promising solution for advancing brain MRI image classification, paving the way for its application in clinical diagnostics. The integration of deep learning models with optimization techniques represents a significant step forward in medical image analysis, potentially enhancing the early detection and treatment of brain disorders.

Keywords: Neural Networks; Multi-Verse Optimization; ResNet50

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Conflict of Interest

None.

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