Iterative Misclassification Error Training (IMET): An Optimized Neural Network Training Technique for Medical Image Classification

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Deep learning models are being tested to analyze medical images for a variety of applications, ranging from identifying diseases to accurate predictions. However, the amount of data available for some medical conditions is extremely limited, which hinders model performance. In this research, Iterative Misclassification Error Training (IMET), a novel training technique, is proposed to optimize and improve the performance of deep learning models. IMET works by iteratively updating the training data for each train through both misclassification error and equal class sampling. The misclassification error per class is calculated after each train and comprises 50 percent of the data used for the next train. An equal sample from every class makes up the other 50 percent of the data, which ensures overfitting does not occur. The IMET technique achieved accuracies of 80.3% and 90.2% on the OCTMNIST and PneumoniaMNIST datasets, respectively, in comparison to 77.6% and 88.6% obtained by the benchmark models. The IMET technique outperformed the benchmark models with both a significantly lower parameter count (roughly 366 times smaller than the ResNet-18 and 765 times smaller than ResNet-50) as well as a lower number of training samples (87,000 in comparison to the 97,000 for OCTMNIST and 2800 compared to the 4700 for PneumoniaMNIST used by the ResNets). The proposed IMET technique therefore shows that, through the development of novel neural network training techniques, increased accuracy and enhanced performance on medical imagery can be achieved.