

Title: Enhancing Transfer Learning for Medical Image Classification with SMOTE: A Comparative Study

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Abstract: This paper explores and enhances the application of Transfer Learning (TL) for multilabel image classification in medical imaging, focusing on brain tumor class and diabetic retinopathy stage detection. The effectiveness of TL-using pre-trained models on the ImageNet dataset-varies due to domain-specific challenges. We evaluate five pre-trained models-MobileNet, Xception, InceptionV3, ResNet50, and DenseNet201-on two datasets: Brain Tumor MRI and APTOS 2019. Our results show that TL models excel in brain tumor classification, achieving near-optimal metrics. However, performance in diabetic retinopathy detection is hindered by class imbalance. To mitigate this, we integrate the Synthetic Minority Over-sampling Technique (SMOTE) with TL and traditional machine learning(ML) methods, which improves accuracy by 1.97%, recall (sensitivity) by 5.43%, and specificity by 0.72%. These findings underscore the need for combining TL with resampling techniques and ML methods to address data imbalance and enhance classification performance, offering a pathway to more accurate and reliable medical image analysis and improved patient outcomes with minimal extra computation powers.

Key words: Transfer learning Medical image classification Deep learning

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