Evaluation of Transfer Learning Pipeline for ADHD Classification via fMRI Images

Nur Atiqah Kamal, Ahmad Fakhri Ab. Nasir, Anwar P. P. Abdul Majeed, M. Zulfahmi Toh, and Ismail Mohd Khairuddin

Abstract In recent times, diverse machine learning models have been employed in this field of technology. Nevertheless, the implementation of learning models for image classification remains uncertain and has proven to be challenging. The utilization of transfer learning (TL) has been showcased as a potent technique for extracting crucial features and can significantly reduce training time. Moreover, the feature extractor model has demonstrated excellent performance in the TL method across numerous applications. As of now, there has been no evaluation of using these methods for ADHD classification through functional magnetic resonance imaging (fMRI) applications. The objective of this study is to identify an appropriate pipeline consisting of transfer learning and conventional classifiers for effectively discriminating between individuals with ADHD and those without. For feature extraction, InceptionV3, VGG16, and VGG19 models were employed, which were subsequently combined with either k-nearest neighbor (k-NN) or support vector machine (SVM) classifiers. A dataset consisting of 556 images was collected from the ADHD-200 competition dataset. The data were divided into an 80:20 ratio, with 80% used for training and 20% for testing. The hyperparameters of both k-NN and SVM were optimized using the grid search method. The experimental results revealed that the optimal pipelines were achieved using InceptionV3 coupled with k-NN classifier, where the best parameters were determined as the Minkowski distance metric and a *k*-value of 1. The pipeline demonstrated a macro-average classification accuracy of 1.00 for the training set and 0.95 for the test set. In summary, the results demonstrate that TL models have successfully exhibited the capability to differentiate fMRI images for ADHD classification.

N. A. Kamal · A. F. Ab. Nasir (✉) · M. Z. Toh
Faculty of Computing, Universiti Malaysia Pahang Al-Sultan Abdullah, 26600 Pekan, Pahang, Malaysia
e-mail: afakhri@umpsa.edu.my

A. P. P. A. Majeed
School of Robotics, XJTLU Entrepreneur College (Taicang), Xi'an Jiaotong-Liverpool University, Suzhou 215123, China

I. M. Khairuddin
Faculty of Manufacturing and Mechatronic Engineering Technology, Universiti Malaysia Pahang Al-Sultan Abdullah, 26600 Pekan, Pahang, Malaysia

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