

Abstract

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Deep Learning Techniques for Automatic Detection of Embryonic Neurodevelopmental Disorders

The increasing rates of neurodevelopmental disorders (NDs) are threatening pregnant women, parents, and clinicians caring for healthy infants and children. NDs can initially start through embryonic development due to several reasons. Up to three in 1000 pregnant women have embryos with brain defects hence, the primitive detection of embryonic neurodevelopmental disorders (ENDs) is necessary. Related work done for embryonic ND classification is very limited and is based on conventional machine learning (ML) methods for feature extraction and classification processes. Feature extraction of these methods is handcrafted and has several drawbacks. Deep learning methods have the ability to deduce an optimum demonstration from the raw images without image enhancement, segmentation, and feature extraction processes, leading to an effective classification process. This article proposes a new framework based on deep learning methods for the detection of END. To the best of our knowledge, this is the first study that uses deep learning techniques for detecting END. The framework consists of four stages which are transfer learning, deep feature extraction, feature reduction, and classification. The framework depends on feature fusion. The results showed that the proposed framework was capable of identifying END from embryonic MRI images of various gestational ages. To verify the efficiency of the proposed framework, the results were compared with related work that used embryonic images. The performance of the proposed framework was competitive. This means that the proposed framework can be successively used for detecting END.