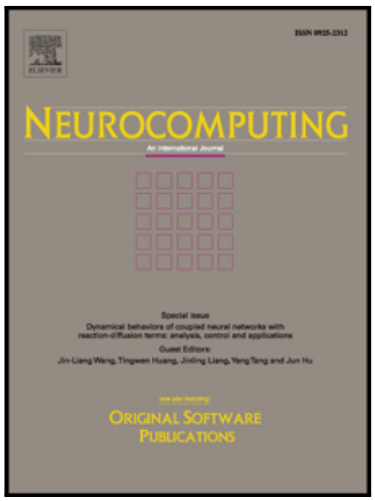

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Brain Voxel Classification in Magnetic Resonance Images Using Niche Differential Evolution Based Bayesian Inference of Variational Mixture of Gaussians

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Abstract

Classification of brain voxels into gray matter, white matter, and cerebrospinal fluid (CSF) using magnetic resonance imaging (MRI) is pivotal for quantitative brain analyses. In spite of its computational effectiveness, the most commonly used statistical classification models are less capable of handling the intensity non-uniformity (INU) and partial volume effect (PVE), and hence may produce less accurate results. In this paper, we propose a novel approach, namely the VMG-NDE algorithm, to improve brain voxel classification in MRI images by considering all effects simultaneously. There are four planks in this algorithm, including (1) using variational mixture of Gaussians (VMG) model to characterize the variation of voxel values caused by PVE, (2) training a cohort of local VMG models on small data volumes extracted from the image to reduce the impact of INU, (3) employing the niche differential evolution (NDE) to infer each local VMG model, aiming to avoid falling into local optima, and (4) constructing a probabilistic

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