ACTN: Adaptive Coupling Transformer Network for Hyperspectral Image Classification

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Abstract Convolutional neural networks (CNNs) and Transformer networks have shown impressive performance in hyperspectral image (HSI) classification. However, these models usually concentrate on examining either local or global representations of HSI data, frequently falling short of capturing multidimensional representations. Furthermore, these methods fail to fully leverage the strengths of CNNs and Transformers. This article presents the adaptive coupling Transformer network (ACTN), a parallel-hybrid network aiming to improve representation learning for HSI classification. ACTN can capture different types of representation and facilitate mutual learning. Specifically, we introduce a parallel-hybrid module called the adaptive coupling module (ACM), which is designed to capture multifaceted representations from the HSI cube. The ACM consists of two branches: a CNN branch that extracts local contextual representations and a Transformer branch that captures global dependency representations. Our proposal is an adaptive response fusion module (ARFM) that interacts with the hybrid module to merge local and global representations at different resolutions in an adaptive way. In addition, we utilize a cosine similarity function to restrict the loss function in mutual learning, guaranteeing the preservation of both local and global representations to the maximum extent. Extensive experiments conducted on three public HSI datasets demonstrate that ACTN outperforms state-of-the-art methods based on Transformers and CNNs.

Keywords **Author Keywords:** Transformers; Feature extraction; Hyperspectral imaging; Image classification; Convolution; Convolutional neural networks; Neural networks; Training; Tensors; Principal component analysis; Convolution neura 34

network (CNN); hyperspectral image classification; mutual learning; Transformer network

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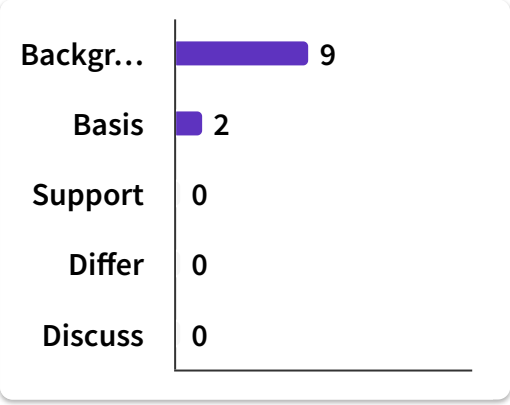

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