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A Novel Stochastic Layer for Redundancy Reduction in CNNs: Application to Plant Disease Classification

Communication Info

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Abstract

Convolutional neural networks (CNNs) have achieved remarkable success in various artificial intelligence domains, particularly in pattern recognition, image processing, and speech recognition. However, the growing complexity of these models introduces challenges related to parameter redundancy, significantly impacting CNN performance. This paper addresses the issue of increasing parameter redundancy, specifically filter redundancy during CNN training. The proposed approach involves the regularization of the initialization filters to reduce redundancy at each convolutional layer. A novel layer, PFCosSim, is introduced, computing the Cosine similarity between filters used in CNN training to ensure filter homogeneity. We reset the filters using an Orthogonal initialization based on the random choice of kernels concerning all filters in the same layers. The method is tested on a three-layer CNN model and extended to common architectures like LeNet and VGG16. Validation is performed through plant disease classification using datasets: Plant Pathology 2020 and Plant Disease Recognition. The application of this approach yields significant accuracy improvements, exceeding 99%.

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