

Application of ConvNeXt Models for Indian Spices Classification

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Abstract:

The visual classification of spices is of critical importance in various industrial applications such as food processing, quality control and commercial classification. However, this problem is quite challenging due to factors such as cross-class similarities in images, different lighting conditions, and visual diversity. For example, different types of spices may have similar colors and textures, which slows down manual classification and makes it prone to error. This situation reveals the need for a fast, reliable and automated solution. The Indian Spices Image Dataset provides an ideal dataset for testing deep learning based classification approaches in this context. The dataset contains a total of 10,991 high-resolution images belonging to 19 classes, with each class representing a specific type of spice. In this study, the ConvNeXtTiny, ConvNeXtSmall, and ConvNeXtBase models from the ConvNeXt family, an innovative architecture that updates traditional convolutional neural networks inspired by Vision Transformer (ViT) architectures, were used to solve the problem of visual classification of spices. In the study, the 10-fold cross validation method was used for the reliable evaluation of the data set. The learning rate of 0.0001 and batch size 32 were selected as the model parameters. These settings have allowed the models to be trained decisively and generalizable results to be obtained. As a result of the classification, 98.09%, 98.28% and 98.20% accuracy values were obtained for the ConvNeXtTiny, ConvNeXtSmall, and ConvNeXtBase models, respectively. The obtained results show that ConvNeXt architectures are effective in complex classification problems.