Title: Machine Vision based Chili Species Recognition

Author names: Md. Ataur Rahman; Zaed Bin Monir Atib; Md Shamim Hossen; Saddam Hossen Sourov; Md Abdul Alim; Md. Tarek Habib

Abstract: This study presents a comprehensive exploration of automated chili species classification using deep learning. We cover the full pipeline—data collection, preprocessing, model selection, and experimental analysis. A dataset of chili pepper images spanning multiple species was manually curated and augmented to increase diversity and size, then split 80/20 into training and test sets. Three state-of-the-art CNN backbones, InceptionV3, MobileNetV2, and Xception, were employed with transfer learning, initializing from large-scale image recognition weights. Each model was fine-tuned and optimized for accurate chili classification. Experiments yielded strong results, with the best configuration achieving 93% test accuracy. For each species, we report precision, recall, and F1-score, showing consistent performance across classes and validating both the model choices and the augmentation strategy. Beyond the technical results, the work has practical implications for agriculture, biodiversity research, and plant breeding programs. An automated chili species classification system can streamline field operations, enable precise species identification, and support monitoring of plant diversity and conservation efforts. Overall, our findings demonstrate that modern deep learning, coupled with careful dataset design, provides an effective and scalable approach to fine-grained plant identification. The approach is lightweight enough for deployment on modest hardware and can be extended to related crops with minimal additional labeling effort.

DOI: 10.1109/ICIPCN67432.2026.11438258