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Seed Germination Detection System Using AI

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Abstract: *Seed germination analysis is an important process in agriculture, as it helps evaluate seed quality and overall crop productivity. Conventional methods rely on manual observation, which can be time-consuming, labor-intensive, and subject to human error. This work proposes an automated deep learning-based approach for detecting and classifying seed germination from images. The system uses an object detection model to identify individual seeds and a transformer-based classifier to determine their germination status. The approach follows a two-stage pipeline where seeds are first localized and then categorized as germinated or non-germinated. Experiments were performed on a publicly available dataset containing multiple seed species, demonstrating strong performance in both detection and classification tasks. In addition, a desktop application was developed to support image input, result visualization, performance evaluation, and real-time analysis using a webcam. The proposed system reduces manual effort and provides an efficient solution for automated germination monitoring.*

Keywords: *Seed germination, YOLOv8, DINOv2, Vision Transformer, object detection, agricultural AI, deep learning, computer vision*

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