Real-Time Pest Detection and Identification System Using Deep Learning

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Abstract: *Agriculture faces significant economic losses due to pest infestations, with timely and accurate identification being a critical challenge for farmers and agronomists. Traditional pest detection relies heavily on manual inspection by experts, which is time-consuming, costly, and impractical at scale. This paper proposes an end-to-end intelligent pest detection system leveraging YOLOv8-based object detection to identify three common agricultural pests—aphids, fruit flies, and scale insects—directly from smartphone images. The trained model is served via a FastAPI backend exposed through ngrok tunneling, enabling a native Android mobile application to provide farmers with real-time pest identification and confidence scores without expert involvement. The system achieves a mean average precision (mAP@0.5) of 48.3%, a precision of 57%, and a recall of 46.9% on the test dataset, demonstrating a viable foundation for scalable precision agriculture.*

Keywords*: YOLOv8, object detection, pest detection, precision agriculture, deep learning, FastAPI, Android, aphid detection, fruit fly detection, scale insect detection, convolutional neural networks, transfer learning, CLIP semantic filtering*