

Extracting insect information from entomological museum collections to identify potential insect pests and beneficials using deep learning methods

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Abstract

While the insect functional biodiversity of our agroecosystems is undermined by the agricultural intensification, their specific identification on the field remains tedious due to the lack of entomological expertise. Entomological collections are invaluable repositories of biodiversity records, crucial for understanding the temporal and spatial distribution of insects, especially insect pests and beneficials in our agroecosystems. Despite ongoing digitization efforts in a lot of natural museums, a significant challenge remains in linking species identification of an insect pest or beneficial from entomological collection boxes to field insects. The automated detection of an insect specimen from a collection box can be a difficult task owing to the remarkable morphological diversity inherent to these organisms. The advent of convolutional neural networks (CNNs) have greatly propelled the field of computer vision,

especially in object detection. In this research, deep learning approaches provide a simple basis for carrying out the task of insect detection and classification from high-resolution pictures of entomological collection. Several computer vision algorithms were tested on Lepidoptera and Coleoptera orders by setting-up trained models over more than 80 insect families. Automated detection and classification of insects in entomological collection pictures could be the first step to deeper use in biological control methods. In conclusion, the implementation of deep learning algorithms represents a significant step forward in the digitization and analysis of entomological collections, offering promising avenues for enhanced agricultural research and smart conservation efforts.