Application of Artificial Intelligence in the Scientific Study of Insects

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Abstract: *The intersection of Artificial Intelligence (AI) and entomology is reshaping how scientists observe, classify, and interpret insect behavior, biodiversity, and ecological impact. This paper presents a comprehensive review of recent advancements (2015–2025) in applying AI technologies—particularly machine learning, deep learning, and computer vision—in the scientific study of insects. By analyzing 25 peer-reviewed studies, we identify five key application domains: species identification, pest detection and control, behavioral and ecological modeling, citizen science integration, and insect-inspired robotics. Deep learning models such as YOLOv8, VGGNet, and transfer learning techniques have demonstrated high accuracy in insect classification and lifecycle tracking. IoT-enabled smart traps, lab-on-a-chip behavioral platforms, and explainable AI frameworks are enhancing real-time monitoring and ecological forecasting. Case studies from agriculture, public health, and conservation underscore the growing relevance of AI-driven entomology. Despite the progress, challenges persist in data standardization, model generalization across taxa, and equitable technology deployment. This study concludes that AI is not merely augmenting insect science—it is redefining its methodological foundations and future directions.*

Keywords: artificial intelligence, entomology, insect identification, pest monitoring, deep learning, computer vision, citizen science, smart agriculture, explainable AI