PROJECT TITLE: Leveraging AI to Monitor Insect Biodiversity

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Project keywords: Biodiversity, Ecology, Artificial Intelligence, Automated Monitoring

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Project description: Species monitoring forms an essential facet of conservation ecology and population biology, however many traditional methods incur an environmental cost. This issue is especially true in the case of insect surveillance, as trapping invariably kills target species in substantial numbers. Recent advances in AI and computer vision offer a promising alternative to this, as they enable passive monitoring and identification of species via image recognition, thus avoiding harm. The proposed project seeks to utilise deep learning to automatically identify and monitor insect biodiversity, and hence provide a leading-edge solution for applied research. Applicants will have the opportunity to collect training data in the field, use this to develop insect detection models, and deploy these utilising remote computing to explore biodiversity across local habitats. This work offers substantial scope for the development of student-led hypotheses, along with the flexibility to pursue questions of interest to the applicant. Support in data annotation, model development, and field deployment will be provided throughout the project, allowing applicants to focus on the aspects that interest them most, while gaining transferable skills. Notably, there will be a strong focus on successful applicants taking a leading role in project development, and hence receiving meaningful attribution for all resultant research impacts and outputs. In sum, this work aims to deliver an accessible introduction to applied AI and ecological research, offering the potential to substantially enhance current biodiversity monitoring efforts, while building transferable research experience to support candidates in their future careers.

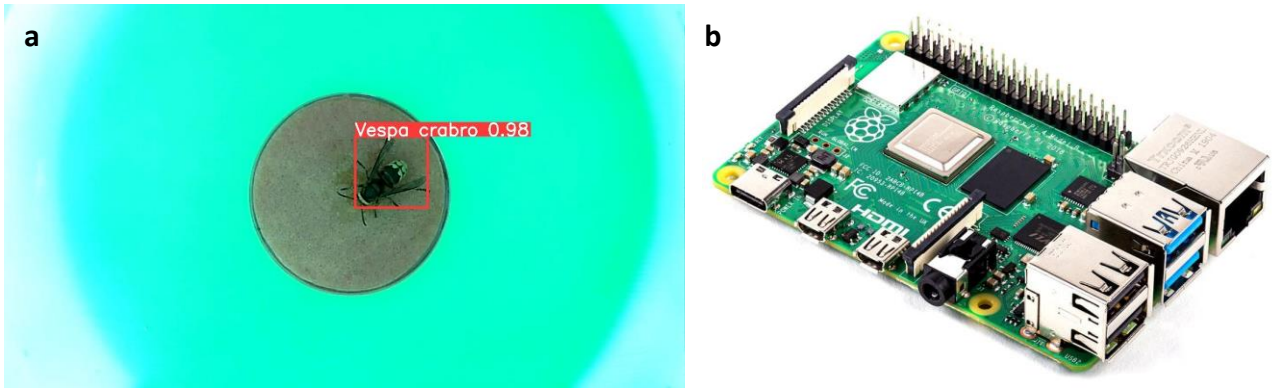

Figure 1. (a) Drawing on existing expertise, applicants will have the opportunity to collect and utilise their own data, and thus develop novel models for insect surveillance. (b) Resultant models will be deployed on Raspberry Pi processors for validation and field testing, enabling a rapid concept-to-application pipeline for iterative development.

Candidate requirements: While candidates with experience in computing, machine learning, or insect identification are encouraged; the only essential requirements are enthusiasm and a willingness to learn new skills. Due to the fieldwork component, certain sites will have limited access, however this aspect of the project is flexible if candidates have specific accessibility requirements. The ideal candidate will have an interest in both fieldwork and AI, and should be comfortable with working independently, and engaging the wider research group.

Background reading:

1. Høye, TT, Ärje, J, Bjerge, K, Hansen, OL, Iosifidis, A, Leese, F, et al. (2021). Deep learning and computer vision will transform entomology. *Proceedings of the National Academy of Sciences*, 118(2), e2002545117.

2. O'Shea-Wheller, TA, Corbett, A, Osborne, JL, Recker, M, & Kennedy, PJ. (2024). VespAI: a deep learning-based system for the detection of invasive hornets. *Communications Biology*, 7(1), 354.

3. Van Klink, R, August, T, Bas, Y, Bodesheim, P, Bonn, A, Fossøy, F, et al. (2022). Emerging technologies revolutionise insect ecology and monitoring. *Trends in ecology & evolution*, 37(10), 872-885.

4. Saoud, Z, Fontaine, C, Loïs, G, Julliard, R, & Rakotoniaina, I. (2020). Miss-identification detection in citizen science platform for biodiversity monitoring using machine learning. *Ecological Informatics*, 60, 101176.

Approximate Work Schedule in weeks (desk based/lab/report writing):

Week 1: Project planning and hypothesis generation.

Weeks 2-3: Data collection in the field and model development in the lab.

Weeks 4-6: Deployment of models in field and analyses of resultant data.

Weeks 7-8: Writeup of results and poster for presentation.