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Department	School of Engineering and the Built Environment
Supervisors	Dr. Luigi La Spada (DoS) Dr. Pratick White (Second Supervisor) – School of Applied Science Dr. Melanie Findlay (External Industry Partner) – Findlay Ecology Systems
Funding Status	Funded PhD Project (Worldwide)
Application Deadline	14/04/2022
Project Title	Multifunctional AI sensing platform for wildlife monitoring and conservation

PROJECT DESCRIPTION

The WWF's living Plant Index shows that global vertebrate populations have declined by an average of 68% since 1970 and the UN has included halting biodiversity loss withing its sustainable development goals. Monitoring is a key component of species conservation, providing early warning systems for species in decline, and helping design and assess conservation measures. Wildlife monitoring has undergone a technological transformation in recent decades, with sensing technologies such as camera traps and passive acoustic monitoring devices seeing exponential rises in use and scientific reporting. For example, camera-traps are used to monitor otters, by using multiple cameras and audio-recordings. These devices should be time synched, and then watch back through all footage manually, excluding nuisance triggers and non-target species, and then manually build up an interpretation from the information across the various devices. This represents a significant investment of time. The substantial problem we aim to solve with this project is: (i) to overcome the lack of integration of these sensors, and (ii) obtain reliable and real-time analysis of their outputs to detect and track specific species. In this project we will use:

(i) multi-functional device able to compile different information at the same time. Such a device is an integrated sensor platform able to detect different features from the subject under observation, such as infrared images, thermal information, and ultrasound outputs.

(ii) Artificial Intelligence (AI) approaches, able to synthesise all the outputs of point (i) together; and use algorithms to analyse and identify what species are present. Moreover, depending on requirements, they will be able to track such species and record their movement and behaviour. Thanks to advances in hardware and computing power, along with machine learning techniques, computers now can learn on their own using huge amounts of data. The latest developments in AI in solving complex problems certainly represent a valid investigation tool

The main advantages of the integration of both multi-functional sensors and AI this project, among the others, are:

(i) complete tasks typically done manually by researchers. With this project we can identify individual animals from photos (and other features) for population studies to categorise the many data gathered by field scientists.

(ii) greatly accelerate conservation decision-making. Biodiversity is declining across the globe at a catastrophic rate, especially climate change that places enormous pressure on wildlife populations. This project will assist conservation biologists with the daunting task of surveying wildlife populations and making informed policy recommendations/decisions to governments and industry, such for example what species need legal protection from hunting to protect biodiversity.

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Academic qualifications
A first degree (at least a 2.1) ideally in Electrical and/or Electronic Engineering with a good fundamental knowledge of electromagnetics, electronics and circuit theory.

English language requirement
IELTS score must be at least 6.5 (with not less than 6.0 in each of the four components). Other, equivalent qualifications will be accepted. Full details of the University's policy are available online.

Essential attributes:

- Experience of fundamental sensors modelling and design
- Competent in signal and imaging processing
- Knowledge of classical mechanics, thermodinamics
- Good written and oral communication skills
- Strong motivation, with evidence of independent research skills relevant to the project
- Good time management

Desirable attributes:
Basic knowledge in in a relevant discipline such as computer science, informatics, computer engineering, neural network, machine learning techniques, artificial intelligence

Indicative Bibliography	Findlay et al. (2020) Component processes of detection probability in camera-trap studies: understanding the occurrence of false-negatives. Mammal Research 65:167-180 Luigi La Spada Luigi, et al. "Artificial intelligence and COVID-19: deep learning approaches for diagnosis and treatment", IEEE Access 8, 109581-109595, 2020.
Funding notes	This project may be funded by a scholarship of the School of Engineering and Built and Environment. Please see School-funded PhD scholarships - RESEARCH AND INNOVATION (napier.ac.uk) for information on the scholarships and how to apply for them.
Enquiries	For informal enquiries about this PhD project, please contact Dr. Luigi La Spada l.laspada@napier.ac.uk
Web page	https://www.napier.ac.uk/research-and-innovation/research-degrees/application-process

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