Rapid Prototyping of an Inexpensive Camera with Low-Code Deep Learning Wildlife Recognition for Pangolin Conservation Research in Thailand

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Abstract

Machine learning can often be too complex and inaccessible to non-data science users despite its potentials to solve their problems. Our work is a case example of how an open-source low-code machine learning platform can help Thai conservationists and engineers to collaborate to help save pangolins, the world's most trafficked endangered species from extinction. Understanding their behaviours and habitat are important for conservationists to protect the wild species. While conservation work has been done on pangolins worldwide, knowledge of the species in Thailand is limited. The Zoological Society of London Thailand has conducted pangolin research in Thailand by studying their images and videos of the animals recorded using wildlife trap cameras installed in national parks. Currently, the cameras must be imported and are costly which means limited numbers are deployed. Moreover, the cameras were not designed for the local environment in Thailand. Conservationists are often challenged with a vast amount of pictures and videos to process. Manually inspecting the images one by one can be laborious and tiring.

Our new system consists of an affordable microcomputer, a camera module and a passive infrared sensor (PIR) sensor for motion detection. The camera records images and videos when it senses a movement. A deep learning model based on ResNet-50 V2 [1] was easily built using a no-code machine learning platform by a wildlife conservation expert by training the model with 260 random images of pangolins and other animals previously recorded from the field work and obtained from the internet. The training images were labelled as "Pangolin" and "Not Pangolin" with roughly the same amounts which were then automatically augmented to create variations to reflect the field data. The model utilised transfer learning with pre-trained weights from the ImageNet dataset[2], fast-tracking the development process. Subject to 65 randomly selected labelled images, the trained model achieved a prediction accuracy of higher than 99%. The model was then saved as a TensorFlow Lite model and embedded to the system running a Python programme to perform the binary image classification. Images of pangolins are stored in a different folder to other images for ease of use. Our system consisting of a mechanical design could be prototyped within a few days.

Further work is required to study the deployment of the system in the real world. As never has been achieved previously, the new system can potentially simplify conservationists' task and save time. Our low-cost system and framework may be adopted to improve other conservation work, allowing fast cross-field collaboration and rapid prototyping of machine learning applications.

Key words: Wildlife Conservation, Deep Learning, Image Recognition, Rapid Prototyping

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