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UnTrap

Automated Recognition of Sri Lankan Wildlife in Camera Trap Images Using Deep Learning

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ABSTRACT

Sri Lanka, an island renowned for its abundant faunal biodiversity and endemism, addresses the challenges of monitoring and understanding its diverse wildlife by employing motion-triggered camera traps. Yet, the manual sorting of the vast volume of generated images is labour-intensive and inefficient. As technology advances, automated wildlife recognition systems that use deep learning continuously emerge. Nevertheless, the efficacy of these image recognition systems relies on substantial and well-balanced training data, including the desired target data for optimal performance. Furthermore, wildlife researchers often lack the technical knowledge to decipher the processes of such systems, leading to scepticism or confusion regarding their results.

This paper introduces 'UnTrap,' a comprehensive solution aimed at tackling the challenges associated with wildlife recognition in Sri Lankan camera trap images. Using a novel, small-scale, and heavily imbalanced dataset, UnTrap employs deep convolutional neural networks, transfer learning, and sampling techniques within a two-stage pipeline. The first stage is a binary classification model that distinguishes between empty and wildlife images. The second stage features a multiclassification model capable of identifying 16 wildlife species classes. Additionally, the system incorporates a feature visualisation model for improved explainability by employing guided backpropagation, Grad-CAM, and guided Grad-CAM techniques.

The binary classification model, using the ResNet50V2 architecture and over sampling, achieves an accuracy of 97.3% in discerning between empty and wildlife images, and an accuracy of 96.3% when applied to out-of-distribution data, consisting of professional camera images, validating the model's generalisability. Similarly, the multiclassification model, which uses the VGG16 architecture and over sampling, achieves a maximum accuracy of 86.9% in wildlife identification. These outcomes show the potential of the proposed system to revolutionise the automation of Sri Lankan camera trap image processing, offering heightened interpretability and operational efficiency.