INFORMATICS INSTITUTE OF TECHNOLOGY

In collaboration with

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"UPest"

Common Pest Detection in Urban Environment

Using Transfer Learning

A dissertation by

Mr. Sathurshan Ramachandran

Supervised by

Mr. Prasan Yapa

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Abstract

Pests mainly refers to species which causes harm and loss to people. Pests cause major harm and losses worldwide ranging from crop loss, economical good damage, property damage, food contamination and spread of disease. Accurate detection of pests is important for timely control and early prevention with limited use of pesticides. Pest identification is a laborious, time-consuming task which requires experienced professionals due to complex features of insects. The breakthrough in computer vision and deep learning technology has resulted in successful applications in agricultural sector for automated pest detection replacing manual detection. However, pest detection in urban environment was still done using traditional methods. A Critical analysis revealed the gap which was an absence of research on pest detection in urban domain and severe lack of data. This research aims to address the gap by proposing a convolutional neural network for urban pest identification using image classification based on transfer learning. This research also introduces a 10,300-image dataset of 10 types of common urban pests. In this experiment several pre-trained deep learning models such as ResNet, Inception, DenseNet, SqueezeNet, MobileNetV3 and MnasNet were evaluated based on accuracy, inference, and model size. MobileNetV3 emerged as the best model and further fine-tuning was applied with hyperparameter tuning. The accuracy rate of 88.51% was achieved with combination of transfer learning + fine-tuning and hyperparameter tuning. The model was further optimized to improve the inference to 30 – 70 Milli second detection time and reducing size to 2.1MB making it the current fastest and lightest urban pest detection model.

Keywords: Pest detection; Image classification; Computer Vision; Convolutional Neural Networks; Transfer Learning.

CCS Concepts

- Computing methodologies~Machine learning~Machine learning approaches~Neural networks

- Computing methodologies → Transfer learning

- Computing methodologies~Artificial intelligence~Computer vision~Computer vision problems~Object identification