

Abstract

# How Unique Is Wing-beating Sound? Classifying Mosquitoes from Wing-Beating Sounds <sup>†</sup>

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**Abstract:** Mosquitoes are the vectors of numerous deadly diseases including Yellow Fever, Malaria, Dengue fever, Zika and Chikungunya. Numerous control measures are being implemented around the world to suppress this notorious insect. Mosquito systematics is essential to study the mosquito prevalence in a definite area, which helps entomologists to design and implement specific control measures for prevalent species. Traditional systematics methods are laborious and time-consuming, which can be overcome by different image-processing based machine-learning (ML) approaches. But due to small size and poor-quality images, ML approaches often fail to identify mosquitoes from images. Recently, wing beating sounds showed potential to be used as a classifier in mosquito systematics. The current study aims to develop an ML model to identify different genera and species of mosquitoes, based on wing-beating sounds and propose a computationally inexpensive and fast tool to be used in mosquito control programmes. Wing beating sounds of six mosquito species of three different genera were collected from publicly available sources, and several state-of-art ML models were implemented on raw sounds as well as in processed spectrograms. On raw sounds, the general neural network model with 3 dense layers perceptrons reached at 59% accuracy, whereas for processed spectrograms, Resnet-18 enhance the accuracy to 86.1%. The model also showed potential to enhance the accuracy for the identification of different mosquitoes' sexes. Our model has implications to be served as a mosquito prevalence monitoring tool and assist mosquito eradication program for specific mosquito genera, and finally will help medical practitioners to work on related pathogens.

**Keywords:** Mosquito; Machine Learning; Artificial Intelligence; Insect systematics; Wing-beating Sounds