A Study on Recognizing Mosquito Sounds in Audio Using Convolutional Neural Networks

TianYu Zhou[1]

[1] Beijing University of Posts and Telecommunications

Introduction

The project aims to use Convolutional Neural Networks (CNN) to identify mosquito sounds.

- Audio data processing
- Efficient detection with CNN models

Methods

1. **Data Collection:** HumBugDB: A large-scale acoustic mosquito dataset.
2. **Spectrogram Conversion:**The sound of mosquitoes has distinct frequency characteristics.

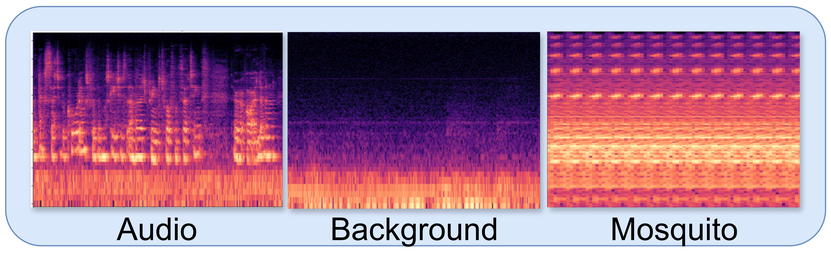


Figure 1: spectrogram

3. **Program & CNN Model Design:** Figure 2 shows a Convolutional Neural Network (CNN) architecture used to detect the presence of mosquito sounds in audio.

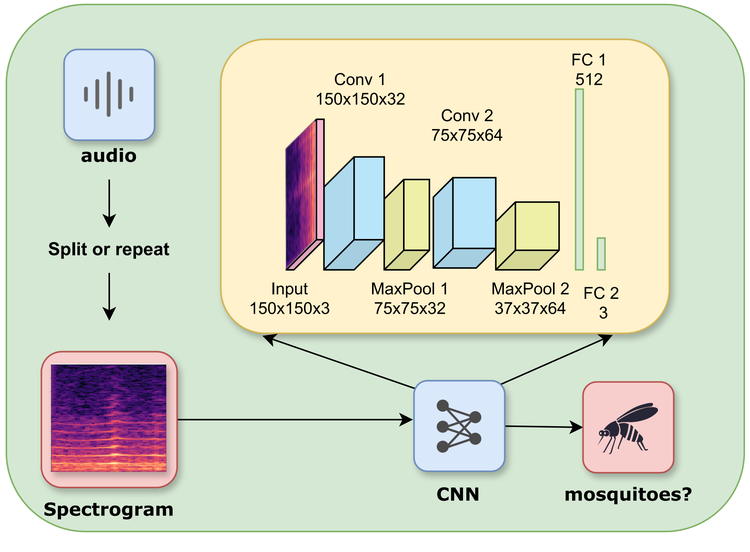


Figure 2: Architecture

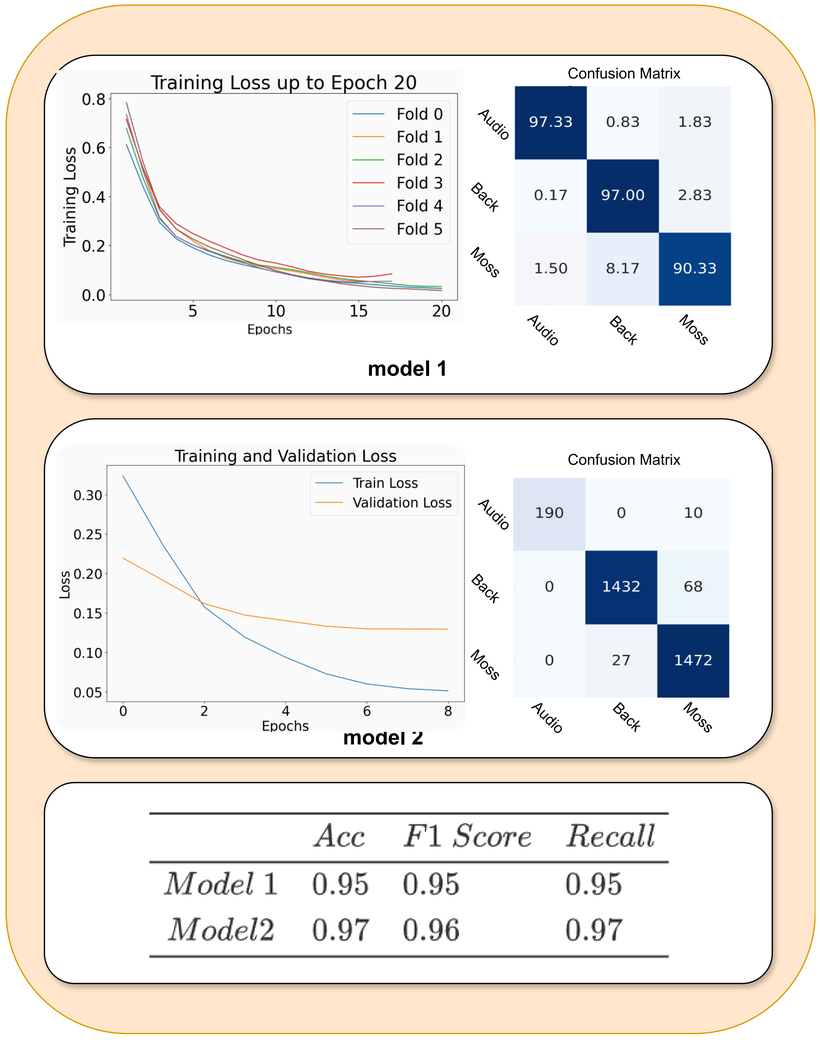
Experimentt and Performance

To address the data sample imbalance, two different methods were employed to train the model.

Model 1: Trained on small datasets using 6-fold cross-validation.

Model 2: Trained on large-scale data, with adjustments made to the weights of different categories.

Performance



	Acc	*F1 Score*	*Recall*
Model 1	0.95	0.95	0.95
Model2	0.97	0.96	0.97

Figure 3: model loss and performance

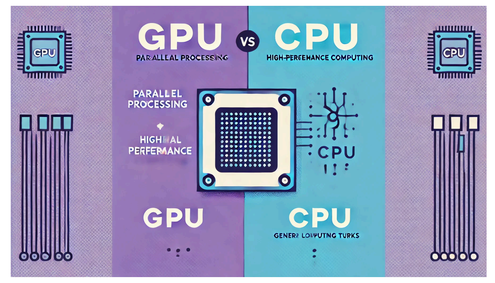
Model 1 has weaker performance but trains very quickly, whereas Model 2 has slower training speed but better overall performance, particularly in mosquito sound detection.

Tips

There are several tips to speed up model training:

Speed up computation

- Using GPU instead of CPU



Improve I/O speed

- Using Linux instead of Windows
- Use multithreaded read/write operations

By applying these methods, the model can converge within one minute on a small dataset of 1800 images and within approximately five minutes on a large-scale dataset of 30000 images.

Next Steps

To further enhance the performance and accuracy of the model, we will implement a series of optimization measures.

- Simultaneously use narrowband spectrograms and wideband spectrograms.
- Use more advanced models, such as Transformer.
- Incorporate data augmentation methods .

Extra Information

Click to access Spectrogram database

Poster Website

Click to access open-source code and documents