Artificial Neural Network for Marmoset Call Classification

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Introduction

Marmosets possess exceptional auditory abilities and a vast vocal repertoire, heavily relying on acoustic communication. Consequently, they stand as an ideal model for investigating neurophysiological aspects of vocal communication. However, current studies necessitate manual call classification, demanding expertise and extensive time investment. The development of an automated method for detecting and categorizing marmoset vocalizations not only streamlines this laborious process but also unlocks deeper insights into marmoset behavior and communication patterns.

Methods

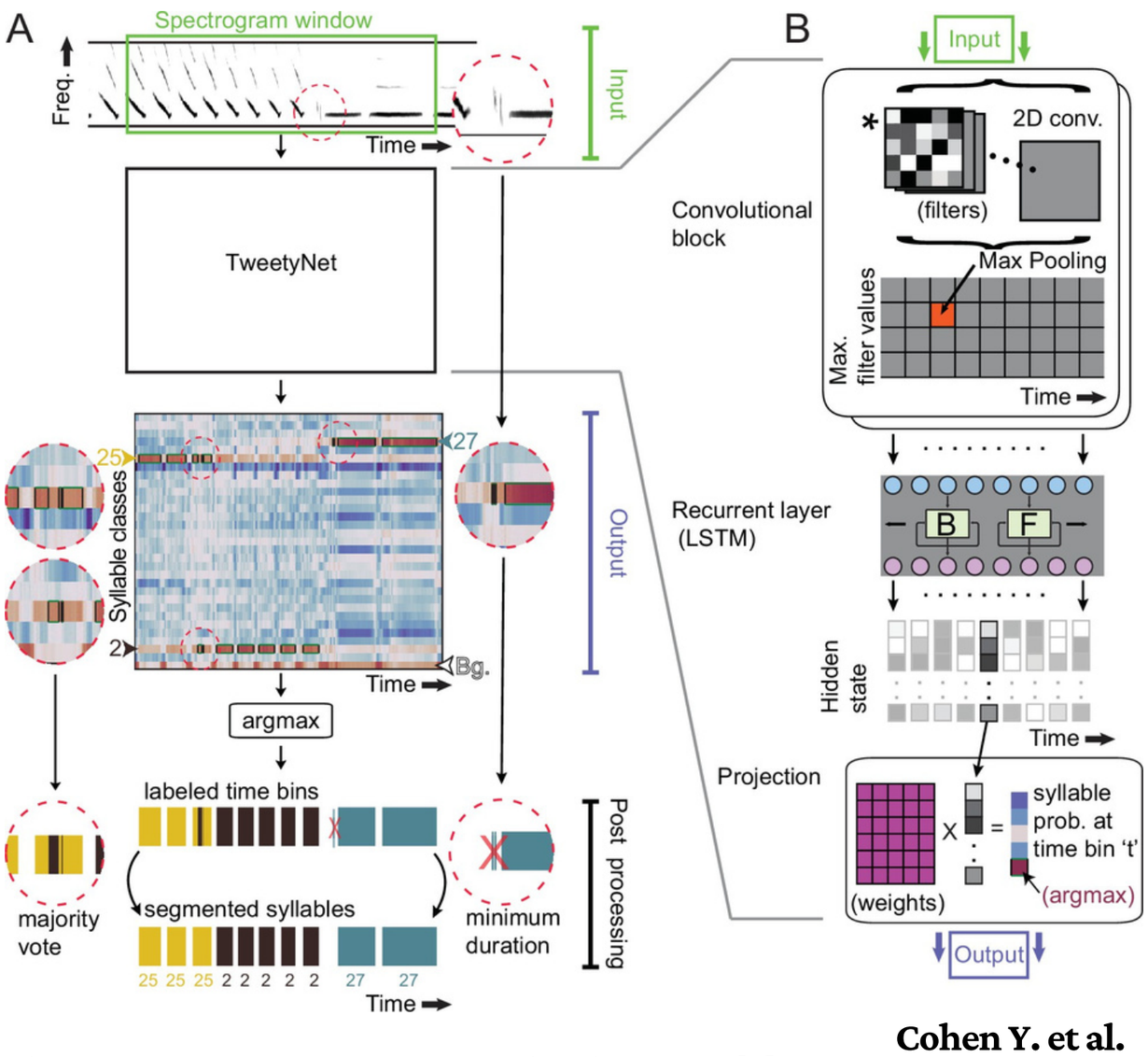

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Figure 1: TweetyNet operation and architecture [2].
(A) TweetyNet estimate probabilities for each time bin, assigns argmax operation and discarding segments shorter than a minimum duration.
(B) The internal structure consists of Convolucional and LSTM blocks.

Results and discussion

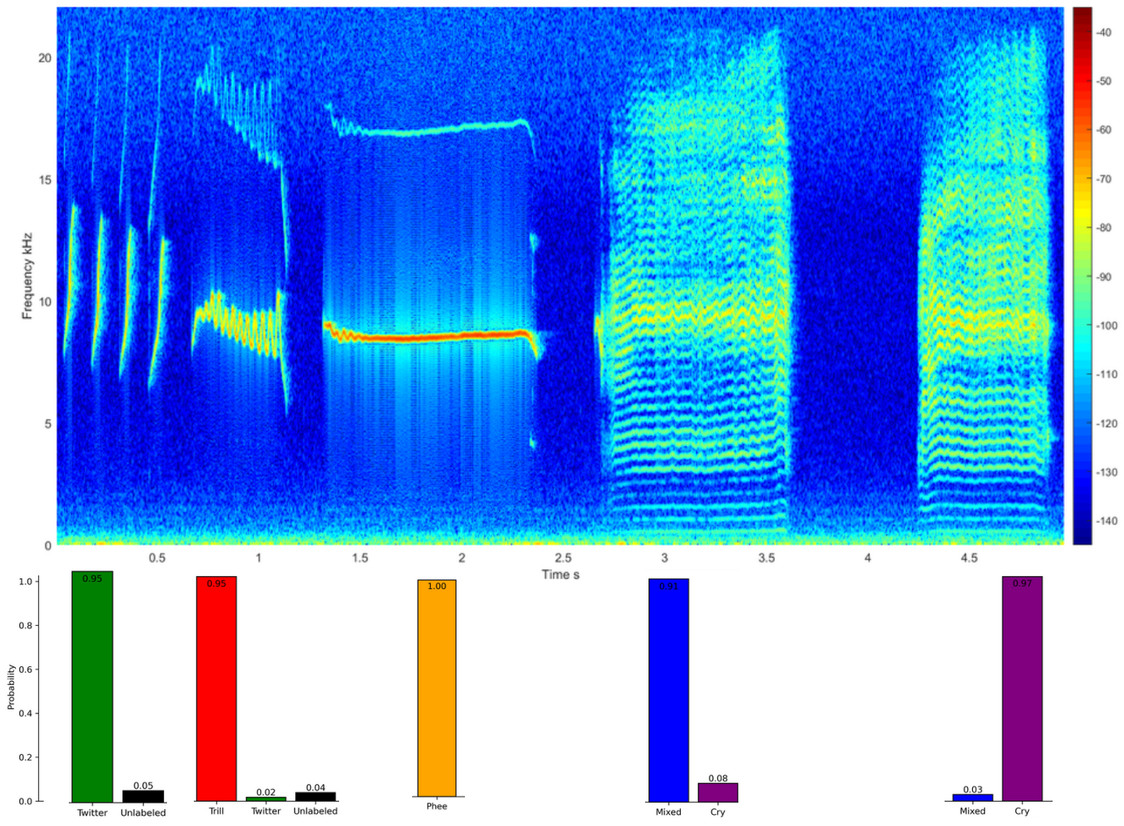

Figure 2: Probabilities for each vocalization on a spectrogram windows.

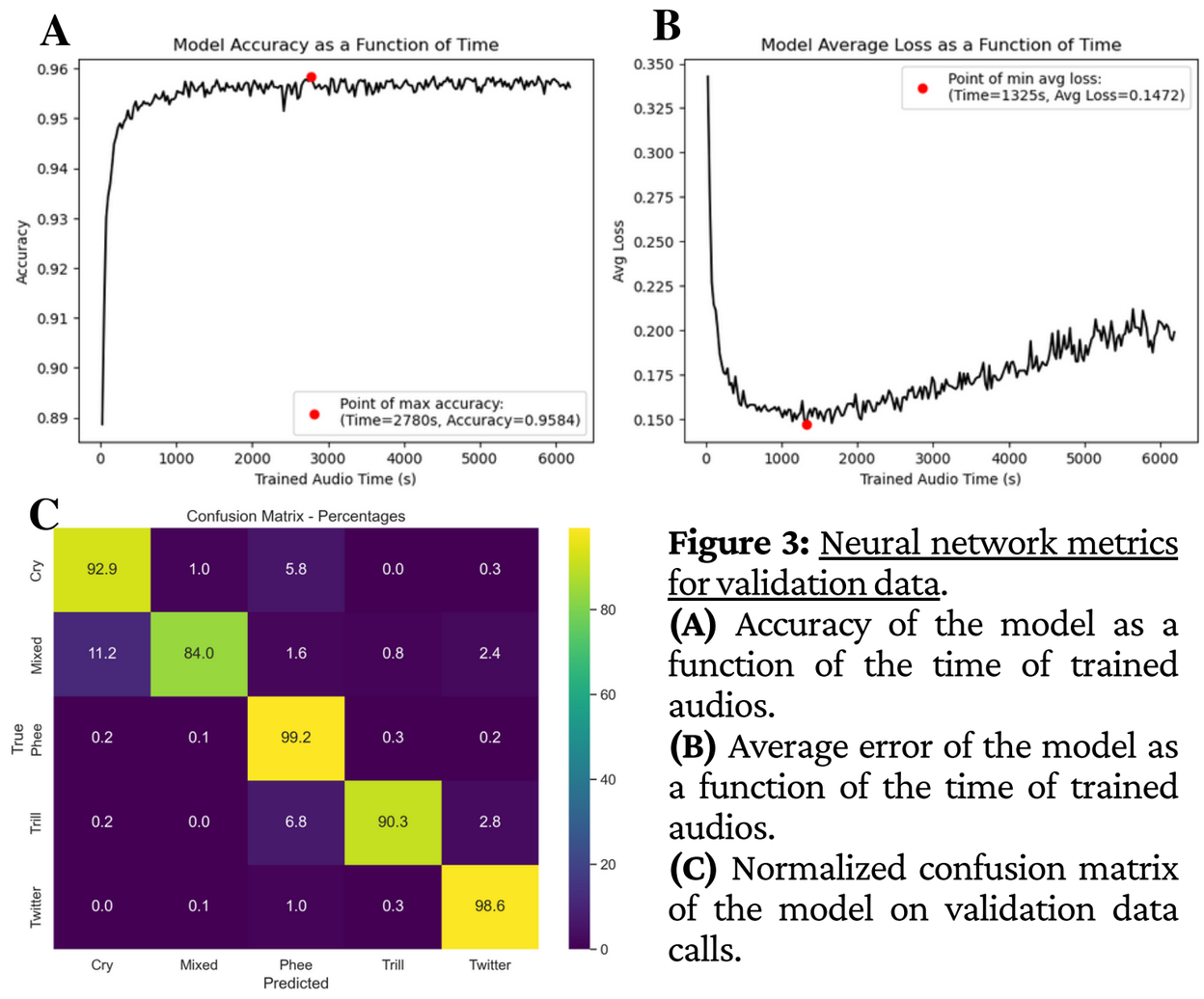

Figure 3: Neural network metrics for validation data.
(A) Accuracy of the model as a function of the time of trained audios.
(B) Average error of the model as a function of the time of trained audios.
(C) Normalized confusion matrix of the model on validation data calls.

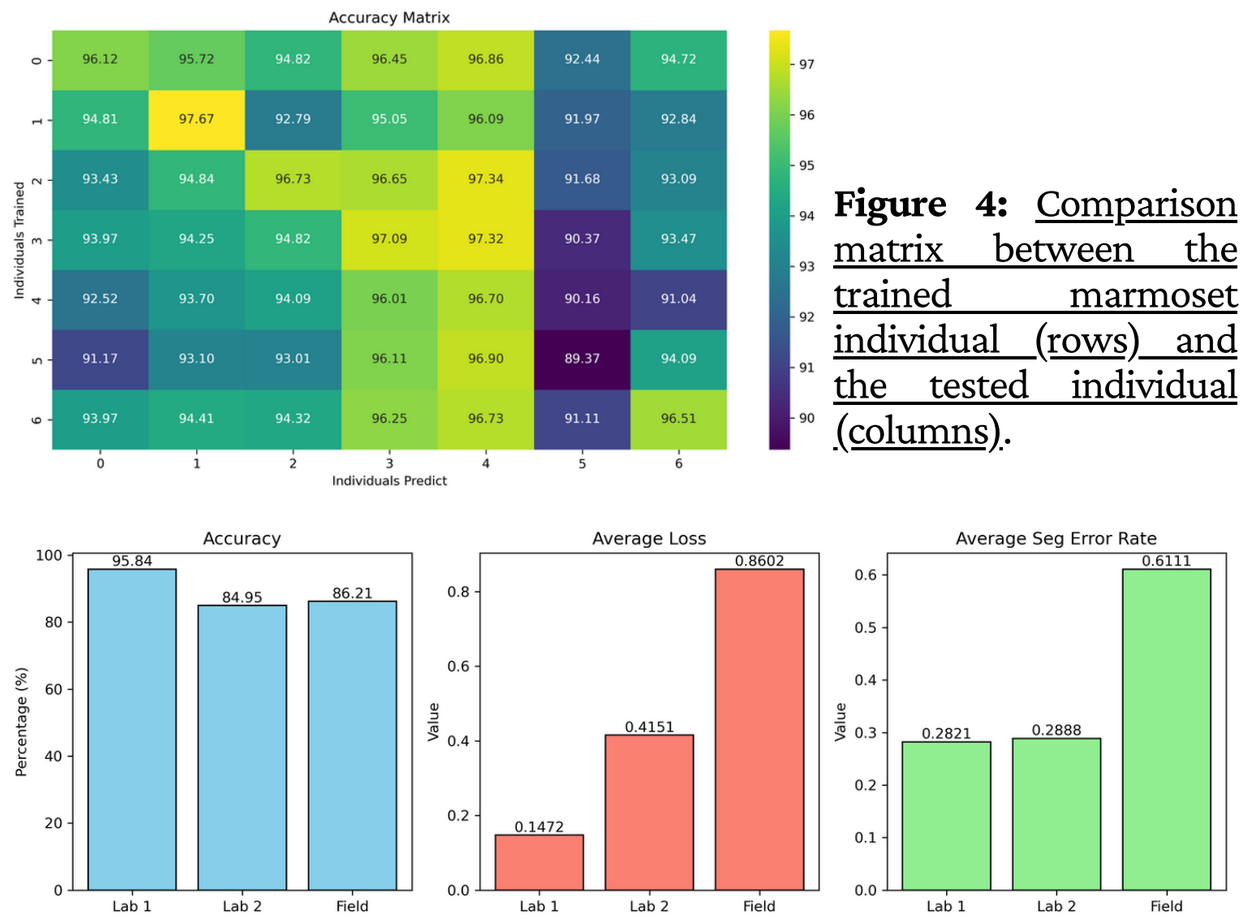

Figure 4: Comparison matrix between the trained marmoset individual (rows) and the tested individual (columns).

Figure 5: Model metrics for three different environments.
(A) Accuracy. **(B)** Average Loss. **(C)** Average Segmentation Error Rate.

Conclusion

The model demonstrates high accuracy and significant generalization potential, both within individuals and across various calls. As anticipated, field data exhibit higher errors compared to those acquired in controlled environments. Nonetheless, considering the accuracy rates, they showcase substantial potential for improvement through the implementation of pre-processing techniques.

Reference

Turesson HK, Ribeiro S, Pereira DR, Papa JP, de Albuquerque VHC (2016). **Machine Learning Algorithms for Automatic Classification of Marmoset Vocalizations**. PLoS ONE 11(9): e0163041. https://doi.org/10.1371/journal.pone.0163041. [1]

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Acknowledgment

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