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Bioacoustic Signal-Based Insect Classification System Using Machine Learning

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Abstract: Orthoptera species are effective bioindicators due to their sensitivity to environmental changes, particularly those linked to climate change, making their acoustic behavior a reliable measure of ecosystem health. Recent advancements in Artificial Intelligence, particularly in Machine Learning, enabled automated detection and classification of these species through their bioacoustics signals. The WaveNet model, which processes raw audio and learns to distinguish the unique waveforms of different species, was used in this study. This effectively captures temporal patterns in sound, featuring causal and dilated convolutions that enable accurate species classification. WaveNet has achieved a precision, recall, and F1-score of 98.0%. The WaveNet model was successfully deployed on a Jetson Nano, a compact edge computing device equipped with a MEMS microphone, allowing real-time recording, processing, and analysis of insect sounds directly in the field.

Key Words: Orthoptera species; Machine Learning; Edge Computing Device; Jetson Nano; WaveNet

Authors: ABUNDA, Ariane Pearl (Department of Computer Engineering and Mechatronics); SOLEDAD, GERALDINE (Department of Computer Engineering and Mechatronics); SATOR, Renemy (Department of Computer Engineering and Mechatronics); MAGLINTE, Kevin (Department of Electronics Communication Engineering); MONDEJAR, Eddie (Department of Biological Sciences, College of Science and Mathematics, Mindanao State University - Iligan Institute of Technology); VILLAME, Cherry Mae (Center for Artificial Intelligence Research, Mindanao State University - Iligan Institute of Technology)

Presenter: ABUNDA, Ariane Pearl (Department of Computer Engineering and Mechatronics)

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