

# DEEP LEARNING-BASED CLASSIFICATION OF INDONESIAN TRADITIONAL MUSICAL INSTRUMENTS USING ACOUSTIC FEATURES



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Volume: 23

No: **Special issue on Icon3E'25**

Pages: 338-348

Publication Date: **August 2026**

Publication Type: **Open-Access Publication**

DOI: <https://doi.org/10.35453/NEDJR-Icon3E2025-011-R1>

## Abstract:

The preservation of traditional musical heritage increasingly requires computational approaches capable of organizing and interpreting acoustic information. However, automatic recognition of indigenous musical instruments remains challenging because existing audio classification datasets and models are largely dominated by Western instruments, while many regional instruments with unique acoustic characteristics remain underrepresented. This study develops a deep learning framework for recognizing four Indonesian traditional musical instruments: Angklung, Gamelan, Sape, and Seruling. A dataset containing 2,000 audio recordings was constructed, consisting of 500 samples for each instrument category. The recordings underwent standardized preprocessing, including resampling, mono-channel conversion, noise reduction, and amplitude normalization. Mel-Frequency Cepstral Coefficients (MFCCs) were extracted as acoustic representations, while pitch shifting, time stretching, and additive noise augmentation were applied to the training data to improve model robustness. A lightweight Convolutional Neural Network (CNN) architecture was subsequently developed and evaluated using independent testing data. The experimental results demonstrate that the proposed CNN achieved an accuracy of 85.71%, with average precision, recall, and F1-score values of 0.86, 0.84, and 0.85, respectively. Compared with conventional machine learning approaches using identical MFCC representations, including Support Vector Machine, Random Forest, and k-Nearest Neighbors, the proposed model achieved superior classification performance. The findings

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indicate that CNN-based acoustic feature learning can effectively capture distinctive sound characteristics of Indonesian traditional instruments despite variations in recording conditions and instrument structures. This research contributes an empirical framework for indigenous musical instrument recognition and provides a practical foundation for AI-assisted cultural preservation, digital music education, and interactive heritage applications. Future investigations will explore larger multilingual cultural audio datasets and pretrained audio representation models to improve scalability and cross-cultural generalization.

**Keywords:**

Traditional musical instrument recognition; Indonesian cultural heritage; Acoustic feature learning; Convolutional Neural Network; Mel-Frequency Cepstral Coefficient; Audio classification; Digital heritage preservation.

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