P23001 Improvement of pig vocal and non-vocal classification in smart livestock farming using deep learning

Vandet Pann*, Jong-Bok Kim, Kyeong-Seok Kwon, Byeonghyeon Kim and Dong-Hwa Jang
Animal Environment Division, National Institute of Animal Science,
Rural Development Administration, Wanju 55365, Korea

The accurate classification of pig vocalization is paramount for optimizing pig welfare and productivity in the realm of smart livestock farming. This study uses deep learning networks to distinguish between pig vocalizations and non-vocalizations, leveraging a meticulously curated dataset from a real pig farm. Various audio feature extraction methods were evaluated individually to enhance the discrimination performance, including Mel-spectrogram, MFCC (Mel-frequency cepstral coefficients), Chroma, and Tonnetz. This study proposes a novel approach called Mixed- MMCT to improve pig vocal classification accuracy by integrating Mel-spectrogram, MFCC, Chroma, and Tonnetz features. This innovative feature extraction method demonstrates superior performance compared to individual techniques, particularly in the context of pig vocalization classification. A dataset of 4,000 audio files (2,000 vocalizations and 2,000 non-vocalizations), each with a duration of three seconds, was gathered from an actual pig farm. By conducting rigorous experimentation, implementing these feature extraction methods, and classifying using a deep learning network, the classification accuracies of Mel-spectrogram, MFCC, Chroma, Tonnetz, and Mixed-MMCT were 98.38%, 92.50%, 91.00%, 82.12%, and 98.88% with validation dataset, and 96.72%, 90.00%, 87.97%, 79.69%, and 97.97% with test dataset, respectively. This study used the K-Fold cross-validation (K=5) technique to evaluate the predictive model. The average accuracy of 5-fold cross-validation on the Mel-spectrogram, MFCC, Chroma, Tonnetz, and Mixed-MMCT reached rates of 96.68%, 91.65%, 87.87%, 80.09%, and 97.71%, respectively. The results confirmed that the Mixed-MMCT feature extraction method outperforms other methods and improves pig vocalization classification.

Key words : smart livestock farming, pig vocalization, audio classification, feature extraction, deep learning network

This work was carried out with the support of “Cooperative Research Program for Agriculture Science & Technology Development (Project No. PJ01681003)” Rural Development Administration, Republic of Korea. This research was supported by the “RDA Research Associate Fellowship Program” of the National Institute of Animal Science, Rural Development Administration, Republic of Korea.