Activity Recognition of Multiple Construction Equipment Using Generated Sound Data

Behnam Sherafat, S.M.ASCE,[1] Abbas Rashidi, M.ASCE,[2] and Sadegh Asgari, M.ASCE[3]

[1]Department of Civil and Environmental Engineering, University of Utah, Salt Lake City, UT 84112; PH (801) 558-1001; FAX (801) 585-5477; e-mail: behnam.sherafat@utah.edu
[2]Department of Civil and Environmental Engineering, University of Utah, Salt Lake City, Utah 84112; PH (801) 581-3155; FAX (801) 585-5477; e-mail: abbas.rashidi@utah.edu
[3]Department of Civil Engineering, Merrimack College, North Andover, MA 01845; PH (978) 837-3421; FAX (978) 837-5000; e-mail: asgaris@merrimack.edu

ABSTRACT

Automatically monitoring construction equipment and their activities using sound data has been an active research area in recent years. Despite their contribution to the literature, the previous studies can only be applied to isolated single-machine scenarios. However, most construction job sites consist of multiple machines performing activities simultaneously, and the generated sound signals are mixed. Therefore, there is a need to develop a robust approach that identifies multiple machines' activities. To do so, we propose a novel software-based method using a single-channel microphone and Convolutional Neural Network (CNN). This method eliminates the need for using microphone arrays that require specific setup and configurations. We also propose a data augmentation method for generating synthetic mixed data to increase the method's accuracy. We test the method on one synthetic and one real-world equipment sound mixture. The results demonstrate the capability of the proposed method in identifying activities with an accuracy higher than 80%.