

Using of SVM Sound Recognition Technique in Source Separation of Packaging Wastes: A New Approach for Reverse Vending Machines

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Reverse Vending Machines (RVMs) are used in the recycling of packaging wastes. They use RFID, barcode reading and image processing techniques to identify the waste type. Tagging all the packaging materials with an RFID tag is expensive to implement and it is also harmful to the environment. In order to use barcode reading, waste should be undamaged which in waste management it may not always be possible. Image processing requires expensive high definition cameras which increases the cost of the RVM. In this study, A sound recognition technique is used to identify the waste type. Sound recognition doesn't require anything to be tagged on the wastes; it can identify deformed wastes with the help of cheap microphones.

165 unit of packaging wastes namely used metal, plastic, glass and cardboard were used in this study. In order to generate sound, wastes were free fallen from a constant height. Generated sounds were recorded with dynamic and condenser microphones. For voice recognition studies, a model was developed by using Support Vector Machine (SVM) approach. In the SVM model, parameters were determined by 10-fold cross validation. MFCC coefficients were extracted from the signals for every 25 ms using a time window of 25 ms. Training and test of the acoustic model was done in MATLAB with one versus rest approach and without any silence/utterance alignment before feature extraction of data. Approximately 85% of the recordings were used in the trainings and 15% of them were used in the tests.

SVM model identified the waste type with the minimum classification accuracy of 85.7% (94.6% glass, 91.1% cardboard, 85.7% metal, 89.9% plastic) for dynamic microphone and 88.1% (94.6% glass, 90.5% cardboard, 88.1% metal, 92.3% plastic) for condenser microphone. According to the results, it can be said that the proposed new approach could provide a high separation performance for RVMs.