

Texture classification using spectral entropy of acoustic signal generated by a human echolocator

ABSTRACT

Human echolocation is a biological process wherein the human emits a punctuated acoustic signal, and the ear analyzes the echo in order to perceive the surroundings. The peculiar acoustic signal is normally produced by clicking inside the mouth. This paper utilized this unique acoustic signal from a human echolocator as a source of transmitted signal in a synthetic human echolocation technique. Thus, the aim of the paper was to extract information from the echo signal and develop a classification scheme to identify signals reflected from different textures at various distance. The scheme was based on spectral entropy extracted from Mel-scale filtering output in the Mel-frequency cepstrum coefficient of a reflected echo signal. The classification process involved data mining, features extraction, clustering, and classifier validation. The reflected echo signals were obtained via an experimental setup resembling a human echolocation scenario, configured for synthetic data collection. Unlike in typical speech signals, extracted entropy from the formant characteristics was likely not visible for the human mouth-click signals. Instead, multiple peak spectral features derived from the synthesis signal of the mouth-click were assumed as the entropy obtained from the Mel-scale filtering output. To realize the classification process, K-means clustering and K-nearest neighbor processes were employed. Moreover, the impacts of sound propagation toward the extracted spectral entropy used in the classification outcome were also investigated. The outcomes of the classifier performance herein indicated that spectral entropy is essential for human echolocation.

Keyword : Spectral entropy; Acoustic signal; Human echolocation; Classification; MFCC