

Detection of human echo locator waveform using gammatone filter processing

ABSTRACT

Human echolocation is a technique that is commonly used by blind persons to perceive their surroundings by analysing echo signals using an active signal (often tongue clicks). Over the years, studies into human echo location have explored vibrant disciplines, including the engineering perspective. The studies have been continuous and report on the human echo locator waveforms, which are individually unique, with the existence of multiple frequency components. However, possible explanations as to how blind people detect their own pair of transmitted and echo signals still remain vague. The detection process using the conventional matched filter has led to poor performance probably because the waveform consists of multiple frequency components. It was reported in a recent analysis that an ideal scheme for the detection of a human echo locator waveform click is possibly through the adoption of bio-inspired processing. Therefore, a similar detection mechanism based on a bio-inspired method incorporated with a gammatone filter was proposed in this paper for the transmitted-echo signal pair. The optimal detection output led to an ideal method for the detection of human echolocator signals. Furthermore, the need for alternative signal processing approaches for future man-made sensor systems has placed a demand on researchers to explore the perspectives in new fields of study. As such, the positive results explored in this paper can be beneficial for emerging concepts in new developments in the application of radar and sonar systems in the near future.

Keyword: Human echolocator; Gammatone filter; Matched filter; Basilar membrane; Correlation