ACOUSTICS2008/734
Auditory-motivated techniques for detection and classification of passive sonar signals

Guy Brown[a], Robert Mill[a] and Simon Tucker[b]
[a]University of Sheffield, Dept. of Computer Science, Regent Court, 211 Portobello Street, S1 4DP Sheffield, UK
[b]University of Sheffield, Dept. of Information Studies, Regent Court, 211 Portobello Street, S1 4DP Sheffield, UK

Hydrophone arrays used to make passive sonar recordings are becoming increasingly complex, thus placing great demands on sonar operators who are required to identify transient and tonal events. Machine hearing systems can mitigate this problem, by performing initial classification and detection of passive sonar signals based on perceptually relevant principles. We describe two such systems. In the first system, transient sounds are characterised using measures of timbre and acoustic pattern. Acoustic features relating to timbre were identified by a multidimensional scaling study, in which human listeners judged the similarity of transient sonar sounds. The perceptual features give improved classification performance compared to commonly-used statistical measures derived from the power spectrum. The second system is an auditory-motivated approach to narrowband detection, which is based on information in zero-crossing intervals rather than signal power. This is motivated by the observation that the fine time structure of an acoustic stimulus is preserved by the phase locking of auditory nerve fibres. We show that a power detector outperforms the interval detector when the signal is centred on the analysis filter. However, when the signal frequency deviates from the centre of the analysis band, interval-based detection improves and power-based detection worsens.