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Automated Identification of Vehicular Accidents from Acoustic Signals Using Artificial Neural Networks

Renique Murray [a,Ψ], and Aaron D'Arbasie [b]

Department of Mechanical and Manufacturing Engineering, The University of the West Indies, St. Augustine, Trinidad and Tobago, West Indies;
[a] E-mail: Renique.Murray@sta.uwi.edu;
[b] E-mail: darbasieaaron@yahoo.com
[Ψ] *Corresponding Author*

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Abstract: *As a consequence of its critical impact upon societies, the occurrence of vehicular traffic accidents is a globally studied phenomenon. Much effort has been directed towards the understanding and identification of causal factors, with the intention of minimising the occurrence. In a related area, the development of methods for the identification and classification of vehicles has also received necessary attention. However, little work has been done on the development of methods for the identification of motor vehicle accident occurrences. Thus, this work sought to develop an automated system for the identification of motor vehicular accidents. It utilises an artificial neural network approach to estimate the probability of occurrence, based on recorded acoustic signals. More specifically, it first characterises accident acoustic signals by 9 selected signal features, in both the time and frequency domains. It then develops a dual layer artificial neural network, which accepts as its input the 9 characterising signal features and as its output calculates the probability of occurrence. The system was built and tested in the MATLAB environment, utilising 22 sample signals in the design phase and a further 53 for testing. An evaluation of the system found it have an accuracy of 86% and a precision of 76%, with a 100% identification of actual accidents. Additionally, it was found that the system prioritises the time domain signal features over those of the frequency domain, in the identification process. These results validate the structure of the system used and demonstrate its potential for real-world applications.*

Keywords: *Vehicular accident detection; artificial neural network; signal processing; time domain; frequency domain; acoustic signals*