

## Detection of wheezes and crackles using a multi-feature approach

L. Mendes<sup>1</sup>, I. M. Vogiatzis<sup>2</sup>, E. Perantoni<sup>3</sup>, E. Kaimakamis<sup>3</sup>  
I. Chouvarda<sup>4</sup>, N. Maglaveras<sup>4</sup>, C. Teixeira<sup>1</sup>, J. Henriques<sup>1</sup>, P. Carvalho<sup>1</sup>, R. P. Paiva<sup>1</sup>

<sup>1</sup> CISUC, University of Coimbra, CISUC, Portugal <sup>2</sup> General Hospital of Thessaloniki 'G Genimatas-Ag Dimitrios', Greece <sup>3</sup>General Hospital of Thessaloniki 'G. Papanikolaou', Greece <sup>4</sup> Laboratory of Medical Informatics, Aristotle University of Thessaloniki, Thessaloniki, Greece

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### ABSTRACT:

The automatic detection of adventitious sounds, such as wheezes and crackles, is a valuable non-invasive tool to detect and follow-up respiratory diseases such as chronic obstructive pulmonary disease. Crackles are short explosive sounds that seem to result from an abrupt opening or closing of the airways. Several methods have been proposed for automatic detection of crackles [1] based on wavelets and based on empirical mode decomposition. Wheezes are continuous sounds that are usually associated with obstructions in the air passages. Different methods were proposed to automatically detect wheezes, such as based on the detection of the wheezes signature in the spectrogram space (WS-SS) [2]. The performance of several features was tested for the detection of crackles and wheezes events. These features include thirty-one features usually employed in the context of Music Information Retrieval, the WS-SS [2] as well as the Teager energy and entropy. The classification was done using a logistic regression classifier. A leave-one-out (subject) cross-validation approach was used to test the performance of the two detectors. Sounds of twenty subjects, seventeen patients with manifestations of at least one type of adventitious sounds and three lung healthy subjects, were used in this study. The optimal detection parameters, such as the number of features, were chosen based on a grid search. Neighbourhood frames were grouped and considered as belonging to the same event. For the crackle detection, the best results were obtained using twenty-seven features. Using the optimal configuration [1], the positive predictive value (ppv) and the sensitivity (sen), measured in the data of the patients with events, equal to  $0.77\pm 0.22$  (mean  $\pm$  std) and  $0.76\pm 0.23$ , respectively. For the detection of wheezes the best results were obtained using nine features with a ppv and a sen equal to  $0.82\pm 0.27$  and  $0.78\pm 0.28$ , respectively. These results must be further validated.

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### REFERENCES

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