Influence of Event Duration on Automatic Wheeze Classification

INTRODUCTION
Respiratory sounds are a simple, objective, and noninvasive marker to assess patients’ respiratory condition. Adventitious sounds are abnormal sounds that are superimposed on the normal respiratory sounds and are used for diagnostic purposes in several respiratory conditions. They can be discontinuous (crackles) or continuous (wheezes), shown in Fig.1.

LIMITATIONS OF RELATED WORK
Traditionally, the field has relied on small or private data collections that do not contain environmental noise. Additionally, neglected experimental design has led to overestimated and non-generalizable results.

Therefore, we decided to study the impact of event duration on the largest publicly available respiratory sound database, containing sounds from 126 patients.

MATERIALS AND METHODS

To study the impact of event duration on the classification performance, we experimented with the design of the negative class (Other), which consisted of random events containing speech, cough, crackles, and background noise:

1. Fixed Durations (FD): events with 150 ms
2. Variable Durations (VD): events with durations belonging to the same distribution of wheeze events

We followed both the traditional approach of feeding extracted features to classifiers and a deep learning approach, in which a convolutional neural network (CNN) was fed spectrogram images.

EVALUATION
As displayed in Fig.2, the performance decreased significantly between the FD and the VD experiments.

False negatives are concentrated around 150 ms on FD and encompass all durations on VD.

Classifiers are implicitly learning an irrelevant characteristic of the dataset, event duration.

Robust experimental design is crucial for realistic evaluation of wheeze classification algorithms.

Fig.1: Example of wheeze spectrogram
Fig.3: Distributions of false negatives
Fig.2: Matthews Correlation Coefficient