A multisensory non-invasive system for laughter analysis

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Abstract— **Laughter is an important non-verbal human social signal. Clarifying the mechanism of laughing would be useful in a variety of studies on health or sociology. In this paper we introduce a non-invasive multisensory system for real-time laughter detection and analysis. We focus only on the audio laughter recognition, present the preliminary results we obtained, and discuss the possible application of this system in the medical field.**

I. Introduction

Laughter is a highly stereotyped human social signal [1]. Physically and physiologically speaking, the act of laughing is a movement that involves a variety of muscles to produce a typical sound, called laughter.

In this paper we introduce a non-invasive multisensory system for objective laughter detection, measurement and analysis. This device could be used to measure and quantify laughter and its effects on healthy subjects; and also to detect and discriminate pathological laughter, as an early symptom of behavioral disorders and other pathological conditions. In fact, a quantitative approach will allow a consistent and comprehensive study of laughter; helping in establishing logical connections between physical and physiological signals changes correlated with laughter.

II. Materials and Methods

To analyze and measure laughing and laughter, we need a system to measure:

1. the subject's movements
2. the subject's physiological parameters
3. the actual sound output.

We decided to use IMUs (Inertial Measurement Units) and EMG sensors to measure 1 and 2, and the preliminary results we obtained have already been described in [2].

We now focused on 3. We used a microphone to acquire the laughter sound, and we analyzed the audio signal real-time using a speech recognition system based on Kaldi [3].

A preliminary experiment was carried out with one healthy volunteer, 35 years old. The subject was recorded while engaged on a video call with a close relative for 1 hour. Before starting the video call session, the subject was asked to forcedly laugh for 10s to provide data for forced (unnatural) laughing. During the video call session, the subject was free to talk and act naturally. The audio recognizer output rate is 1s.

Figure 1.   Experiment setup

III. Results

The recorded video has been then analyzed offline. In 1h, 41 laughter events were identified. We discarded 4 events of duration in time smaller than 1s, the maximum resolution of our audio recognizer. The rest, 37 events, were of duration variable between 1s and 15.4s, with an average duration of 3.4s and a variance of 7.3s. In terms of simple detection, the system had a correct laughter detection rate against speech, laugh-speech and other vocalized noises of 85%.

IV. Discussion, Conclusions and future works

The system allows acquiring and analyzing the audio characteristics of laughter, and can detect laughter and distinguish it from speech if the laughter event is longer than its time resolution. However, at the present state, it is not precise in detecting laughter onset and duration, and does not distinguish between forced and spontaneous laughter.

In the future, we plan to refine the system, to clearly identify the audio characteristics of forced and spontaneous laughter, and also of various types of laughter.

References

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