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Physiological Signal-Based Emotion Recognition

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INTRODUCTION

Physiological signals are the most reliable form of signals for emotion recognition, as they cannot be controlled deliberately by the subject. Existing review papers on emotion recognition based on physiological signals surveyed only the regular steps involved in the workflow of emotion recognition such as pre-processing, feature extraction, and classification. While these are important steps, such steps are required for any signal processing application. Emotion recognition poses its own set of challenges that are very important to address for a robust system. Thus, to bridge the gap in the existing literature, in this paper, we review the effect of inter-subject data variance on emotion recognition, important data annotation techniques for emotion recognition and their comparison, data pre-processing techniques for each physiological signal, data splitting techniques for improving the generalization of emotion recognition models and different multimodal fusion techniques and their comparison. Finally, we discuss key challenges and future directions in this field.

DESCRIPTION

Emotion is a psychological response to some external stimulus and internal cognitive processes, supported by a series of physiological activities going on in human body. Thus, emotion recognition is a promising and challenging work area which enables us to recognize the emotions of a person for stress detection and management, risk prevention, mental health and interpersonal relations. Emotional response also depends on the age [1]. Socio-cognitive approaches suggest that the ability to understand emotions should be well maintained in adult aging. However, neuropsychological evidence suggests potential impairments in processing emotions in older adults. However, long term depression in any age can lead to chronic diseases. The pandemic of COVID-19 affected the emotions of people across the globe. The prevalence of a high suicide risk increased from pre-pandemic to during the pandemic, appearing to be largely influenced by social determinants, in conjunction with the implications of the COVID-19 pandemic [2]. Emotion recognition is an emerging research area due to its numerous applications in our daily life. Applications include areas such as developing models for inspecting driver emotions, health care, software engineering and entertainment. Different modalities of data can be used for emotion recognition. They are commonly divided into behavioral and physiological modalities. Behavioral modalities include emotion recognition from facial expressions, from gestures and from speech, while physiological modalities include emotion recognition from physiological signals such as electroencephalogram, electrocardiogram, galvanic skin response, electro-dermal activity and so on. Different modalities of data can be used for emotion recognition. They are commonly divided into behavioral and physiological modalities [3]. Behavioral modalities include emotion recognition from facial expressions, from gestures and from speech while physiological modalities include emotion recognition from physiological signals such as electroencephalogram, electrocardiogram, galvanic skin response, electro-dermal activity and so on [4].

CONCLUSION

In this paper, we provide a review on the physiological signal-based emotion recognition. Existing reviews on the physiological signal-based emotion recognition presented only the generic steps of emotion recognition such as combined techniques for data pre-processing, feature extraction and selection methods, selection of machine learning techniques and classifiers, but did not elaborate on the most important factors that are crucial for the performance of emotion recognition systems and their generalization. These important factors include the challenges during data annotation, specific data pre-processing techniques for each physiological signal, effect of inter-subject data variance, data splitting methods and multimodal fusion. Thus, in this paper, we address these all challenging factors to bridge the gap in the existing literature. In this research, we provide comprehensive review on these factors and report our key findings about each factor. We also discuss the future chal-

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lenges about physiological signal-based emotion recognition based on this research.

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CONFLICT OF INTEREST

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