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Implementation of Wavelet Analysis on Thermal Images for Affective States Recognition of Children with Autism Spectrum Disorder

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Abstract

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Children with Autism Spectrum Disorder are identified as a group of people who has difficulties in socio-emotional interaction. Most of them lack the proper context in producing social response through facial expression and speech. Since emotion is the key for effective social interaction, it is justifiably vital for them to comprehend the correct emotion expressions and recognitions. Emotion is a type of affective states and can be detected through physical reaction and physiological signals. In general, recognition of affective states from physical reaction such as facial expression and speech for autistic children is often unpredictable. Hence, an alternative method of identifying the affective states through physiological signals is proposed. Though considered non-invasive, most of the current recognition methods require sensors to be patched on to the skin body to measure the signals. This would most likely cause discomfort to the children and mask their 'true' affective states. The study proposed the use of thermal imaging modality as a passive medium to analyze the physiological signals associated with the affective states nonobtrusively. The study hypothesized that, the impact of cutaneous temperature changes due to the pulsating blood flow in the blood vessels at the frontal face area measured from the modality could have a direct impact to the different affective states of autistic children. A structured experimental setup was designed to measure thermal imaging data generated from different affective state expressions induced using different sets of audio-video stimuli. A wavelet-based technique for pattern detection in time series was deployed to spot the changes measured from the region of interest. In the study, the affective state model for typical developing children aged between 5 and 9 years old was used as the baseline to evaluate the performance of the affective state classifier for autistic children. The results from the classifier showed the efficacy of the technique and accorded good performance of classification accuracy at 88% in identifying the affective states of autistic children. The results were momentous in distinguishing basic affective states and the information could provide a more effective response towards improving social-emotion interaction amongst the autistic children. © 2013 IEEE.

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