

RECOGNITION OF EMOTIONS FROM TIME AND TIME-FREQUENCY FEATURES USING FACIAL ELECTROMYOGRAPHY SIGNALS

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ABSTRACT

The recognition of emotions plays a crucial role in healthcare and human-computer interaction. This paper reports an attempt to classify the emotional states using Facial Electromyography (facial EMG) using the affective dimensional approach. For this purpose, the facial EMG signals recorded from the zygomaticus major muscle are obtained from the publicly available DEAP database. These signals were collected from thirty-two healthy subjects, and participant ratings were recorded based on the affective dimensions. In this work, the two orthogonal dimensions, namely, valence and arousal, are considered for the analysis. The facial EMG signals are categorised into positive and negative classes in valence, and high and low classes in arousal dimensions based on the participant ratings. These signals are subjected to Short-Time Fourier transform, the mean and median frequencies are extracted from the instantaneous power spectrum. The statistical variations, namely mean and standard deviation of these features are computed. In addition, the time domain feature, root mean square of the facial EMG signal is extracted. The results indicated that most of the features could differentiate the two classes in both dimensions ($p<0.05$). The model developed using support vector machine achieved an accuracy of 67.24% and 60.08% for valence and arousal dimensions, respectively.

Keywords: Emotion recognition, Facial electromyography, Support Vector Machine.

INTRODUCTION

A complex psycho-physiological process sparked by an unconscious or conscious awareness of a situation or an object that influences our persona, temperament, attitude, and inspiration is called an Emotion. Human communication relies heavily on various emotions articulated through non-verbal signs such as voice tones, facial expressions, and gestures, or verbally through the emotional dictionary. Majority of the new human-computer interaction (HCI) systems cannot translate this information and endure the absence of emotional intelligence [1]. The study of emotional states can also be a propitious method to differentiate several neurological disorders such as Parkinson's disease and autism [2]. When equipped with smart interfaces, the human-computer interaction systems would enhance the accessibility of the user in various applications such as online teaching, smart classrooms, and medical applications for patients with intellectual disability [3] or neurological disorder. Thus, emotion recognition is essential to understand human beings' various emotional states in many research fields like healthcare and human-computer interaction (HCI)[2, 4-8].