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Human emotions detection based on a smart-thermal system of thermographic images

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Abstract

This work presents a noninvasive methodology to obtain biomedical thermal imaging which provide relevant information that may assist in the diagnosis of emotions. Biomedical thermal images of the facial expressions of 44 subjects were captured experiencing joy, disgust, anger, fear and sadness. The analysis of these thermograms was carried out through its thermal value not with its intensity value. Regions of interest were obtained through image processing techniques that allow to differentiate between the subject and the background, having only the subject, the centers of each region of interest were obtained in order to get the same region of the face for each subject. Through the thermal analysis a biomarker for each region of interest was obtained, these biomarkers can diagnose when an emotion takes place. Because each subject tends to react differently to the same stimuli, a self-calibration phase is proposed, its function is to have the same thermal trend for each subject in order to make a decision so that the five emotions can be correctly diagnosed through a top-down hierarchical classifier. As a final result, a smart-thermal system that diagnose emotions was obtained and it was tested on twenty-five subjects (625 thermograms). The results of this test were 89.9% successful.

Keywords: *Infrared thermography, Emotion, Region of Interest, Diagnostic, Self-calibration and Biomarker*

1. Introduction

Nowadays, noninvasive systems to monitor and diagnose health problems have been booming. Infrared thermography (IRT) is a technology that allows measuring the radiation of energy that a body emits in a noninvasive way and without the limitations arising from the use of invasive sensors [1]. Therefore, the use of IRT has been increased as a solution to analyze different problems in different fields of human knowledge [2]. Specifically, humans are an important case of study where many investigations have emerged [2–7] because the temperature is one of the most common health indicators [8]. In this context, emotions play an important role in the life of living beings considering that the main function of any emotion is to mobilize the body to quickly deal with interpersonal

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