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Mini Review

Human Emotion Analysis for Use in Intelligent Applications

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Submission: April 21, 2022
Published: June 17, 2022

Volume 2 - Issue 2

How to cite this article: Carreño FS*, Romero LS. Human Emotion Analysis for Use in Intelligent Applications. COJ Rob Artificial Intel. 2(2). COJRA. 000531. 2022.

Introduction

This paper presents the development of a set of intelligent algorithms for human emotions' classification as fundamental elements to trigger stress. Emotions are an essential part of people, although they began studying in the second half of the twentieth century [1]. Currently, human emotions are considered by a significant number of researchers from different disciplines, making them a prolific asset in the medical, neurosciences, biological, sociological, and economic areas. Emotions constitute a complex response of the organism where mental, physiological, and motor aspects converge [1,2]. In the year 1872, Charles Darwin [3] published the results of one of the most controversial works of the last hundred years, in which he presented the results of the compilation of information from his thirty years of studies on emotions. . In these results Darwin manifested two fundamental ideas; emotions are innate and universal, and emotions are products of evolution. Likewise, Darwin assures that facial expressions are a reflection of emotions and that these are not exclusive to humans [4]. However, the references [5,6] state that smiling and crying are exclusive to humans as a manifestation of emotions and as adaptive mechanisms of the species [7]. Emotions can generate different responses in the organism [2], both favorable and adverse, which can be: fullness, joy, sadness, anger, and displeasure, amongst others. These emotions are subject to social and cultural conditions, which affect people's behavior and, therefore, influence the perception of reality that triggers these emotions [2,8,9].

Taking into account what was stated by [1,10], the following list of basic emotions emerges, which from its compounds, give rise to secondary emotions, so interest, joy, surprise, sadness, anger, disgust, contempt or disdain, fear or dread, shame or shyness, and guilt are listed. Hence, a secondary emotion could be, for example, fright, a product of fear with surprise. Emotions that reach too intense levels and occur too frequently tend to produce changes in behavior so that health aspects are left aside, and addictive behaviors begin to develop that affect the state of health, triggering physiological reactions that determine stress. [11].

Stress underlies emotions, as its effects affect physical and mental health both in terms of work performance and social performance of people [12]. The problem of stress is associated with the requirements of modernity, focused on the search for alternatives for a better quality of life, and therefore the consequences on the physical and mental health of the people affected are not evaluated [12,13]. When stressful stimuli are received, physiological reactions are produced as a response of the corticotropic axis, activating the vegetative nervous system [14,15] which produces the release of hormones responsible for changes in the organism [16,17]. On the one hand, it produces glucocorticoids and androgens that affect infectious processes, reduce protein levels, increase blood sugar, increase calcium levels, increase strength, muscle mass, and male characteristics. On the other hand, it produces adrenaline and

noradrenaline, which in turn cause dilation of the pupils, increased coagulation, increased heart rate, muscle vasodilation, reduced estrogen and testosterone, and increased energy [16,17]. Stress can produce favorable or unfavorable reactions in individuals, depending on the stressor stimuli [18]. It can then be presented mild, medium, or moderated way, depending on the characteristics of the particular situations of the individual [16,18].

Each of these divisions represents human emotions characterizing them as anger, disgust, fear, joy, sadness, surprise, and lastly, the absence of emotions, or null emotion [10]. Adaptation to change depends on the reaction of glucocorticoid hormones, androgens, adrenaline, and noradrenaline within their normal range of functioning, producing three different stress levels [16,12]; eustress, distress and optimal level of stress. Emotional states play a fundamental role in human adaptation in the short and long term [19]. Generally, it is easy to identify the adaptive value of feeling happiness, relaxation, or satisfaction; however, even for specialists, recognizing the benefits of negative emotional states, such as anxiety, depression, and chronic pain, requires above-average clinical observation skills. It has been accepted that the adrenal cortex produces three main classes of steroids: 1) glucocorticoids, 2) mineralocorticoids and 3) androgens. The functioning of the adrenal gland is important in regulating a large number of daily life actions such as, for example, intermediate carbohydrate metabolism, immune response, blood pressure, vascular volume, electrolytes and secondary sexual characteristics. The hypothalamic-pituitary-adrenal axis also influences the stress response, which rapidly increases cortisol levels [20].

Stress has been a topic of interest and concern for various scientists of human conduct [20], since its effects affect physical and mental health and an individual's work and academic performance. It can cause worry, and anxiety resulting in personality disorders, family, and even social disorders [20,12]. The current situation of organizations has led to stress situations in the collective of workers in production and service companies [21], being this the principal cause of the proliferation of diseases at the level of the cardiovascular system, gastrointestinal system, and dermal system [11,20,22]. These diseases and other ailments produced by stress indirectly affect people's efficiency and, therefore, productivity in organizations representing an increase in absenteeism due to medical rest due to work accidents and, or occupational diseases [12,23,24].

Several researchers have developed software systems for emotional treatment; however, the main results were found using intelligent tools such as artificial neural networks, state vector machines, and the like. The development of intelligent applications for emotion estimation could be an alternative for advanced robotic systems, health monitoring systems, security systems, and other applications that can serve as a resource for the improvement of people's health status, stress status and job stability, and more sophisticated applications in aircraft pilots, rocket or military performance ships.

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