

Chapter 3.19

Analysis of Human Emotions Using Galvanic Skin Response and Finger Tip Temperature

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ABSTRACT

Emotion is the excited mental state of a person caused by internal and external factors. In this work, a person's physiological parameters are measured to decide emotional status. A generalized system measures changes occurring in the body of a subject, such as heart rate, blood pressure, respiratory rate, electro-dermal (Galvanic skin resistance) activity, and arm and leg motions. These measurements are then compared with the normal levels of the subject. The present work monitors the physiological parameters by connecting sensors at specific points on a test body. Two physiological parameters are considered: galvanic skin response (GSR) and finger tip temperature (FTT). The heart rate is predominant in deciding the emotion of a person. This system, in conjunction with a certified examiner, is used to analyze a subject's stress. A system is constructed that measures physiological parameters along with signal conditioning units. These measurements are transmitted to a LabVIEW add-on card for further data processing and analysis. LabVIEW is a graphical programming language that includes all tools necessary for data acquisition, data analysis, and presentation of results. The results obtained are realistic and provide a measure of accuracy.

1. INTRODUCTION

Without emotions, life is experienced as having little meaning or purpose, and the pleasures that are derived from rewarding experiences

are considerably reduced. Emotionless actions are often related to machines, which execute a sequence of pre-programmed commands. While this common-place perception of the role emotions play in everyday life is pertinent as it is somewhat limited in scope.

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The Galvanic Skin Response (GSR) is one of several electro dermal responses (EDR). EDR is actually the medically preferred term for change of electrical skin resistance due to psychological condition. EDRs are changes in the electrical properties of a person's skin caused by an interaction between environmental events and the individual's psychological state. The change is caused by the degree to which a person's sweat glands are active. Psychological stress tends to make the glands more active and this lowers the skin's resistance. Our physical body and mind are interactive. Physical disease may cause mental disorders and mental discomfort may have adverse influence on physical health. When a person is subjected to stress beyond what he or she can withstand, physical or mental disorders may therefore develop. The mechanism is that the stress, when our brain senses it, may cause dysfunction of our automatic nervous system, endocrine system and immune system via the effect of neurological pathways.

In clinical practice, biofeedback machine is used to find a way to detect an emotional tension caused by stress. But in the conventional method of measuring fingertip temperature, the biofeedback machine is large and expensive. It has the sensor which contacts the patient's skin to detect the finger tip temperature. The measured temperature value is converted into an electronic signal which is displayed on a monitor to tell the patient if he/she is in a relaxed condition. Since it is impossible that a medical staff or a large machine is always

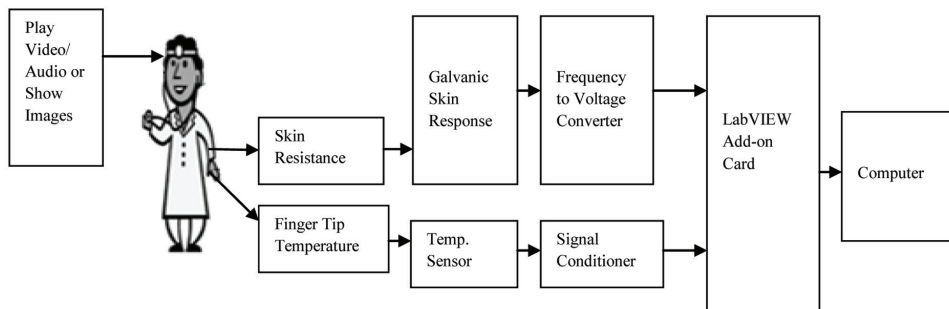
readily available for the patients, it is desirable to develop an auxiliary medical instrument which can be conveniently worn by the people and help the wearer or adjust them at any time.

2. STIMULUS FOR EMOTIONS

Emotional content can modify and update the goals and consequently alter the direction of attention to the presented stimuli (Figure 1). Emotions and goals are strongly intertwined in the sense that the immediate relevance of any stimulus to a goal defines the emotionality of the stimulus. The relationship between emotions and the personal goals and concerns of individuals is often suggested to be the basis for emotion elicitation and differentiation by appraisal theorists.

For instance the emotional tag of fear can be attached to a threatening stimulus in so far as the latter can potentially impede the goal of survival. Another example is the emotional tag of happiness that can be assigned to any stimulus that advances the goal of well-being. In a similar fashion numerous emotional tags can be given to stimuli that promote or hinder the attainment of goals ranging from basic individual survival goals to more complex social interaction goals (Table 1). This vast range of emotions and the related goals is not likely to have been formed concurrently. Rather, emotions evolved from very simple mechanisms that ensured harm avoidance and

Figure 1. Block diagram of the designed system



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