

Chapter 3

Pain Assessment through Facial Expression

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ABSTRACT

Pain, assumed to be the fifth vital sign, is an important symptom that needs to be adequately assessed in health care. The visual changes reflected on the face of a person in pain may be apparent for only a few seconds and occur instinctively. Tracking these changes is a difficult and time-consuming process in a clinical setting. This is why it is motivating researchers and experts from medical, psychology and computer fields to conduct inter-disciplinary research in capturing facial expressions. This chapter contains a comprehensive review of technologies in the study of facial expression along with its application in pain assessment. The facial expressions of pain in children's (0-2 years) and in non-communicative patients need to be recognized as they are of utmost importance for proper diagnosis. Well designed computerized methodologies would streamline the process of patient assessment, increasing its accessibility to physicians and improving quality of care.

INTRODUCTION

In a clinical setting, there is difficulty in reliably assessing and managing pain. Patient self-report is the most valid and widely used technique to measure pain due to convenience, does not demand advanced technology or specialized skills. It is typically checked and evaluated either through clinical interview, completing a questionnaire or by using a visual analogue scales (VAS). In the VAS, the intensity of pain is represented by marking a line on a horizontal scale, which is fixed at each end with words containing “no pain” and “worst pain”. Though useful, these self-report procedures have significant limitations

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(Lewis, Allesandri & Sullivan, 1990), as they represent inconsistent metric properties across scale dimensions, they may facilitate efforts at impression management or deception, they may show reactivity to suggestion, and there may be differences between clinicians and sufferers' conceptualization of pain (Keefe, Williams, & Smith, 2001). Moreover, use of self-report cannot be used in significant populations, such as young children, patients who cannot communicate, the mentally retarded, and patients who have the need for assisted breathing. In these situations, an observer rating is required, and the Faces Pain Scale is commonly used where the observer chooses a face on the scale which best resembles the facial expression of the patient (Prkachin, 1986). This is highly impractical and inefficient if the observer is required for long periods of time which could be the case for a patient in an intensive care unit (ICU).

In addition to self-report and observer measures being highly subjective, these measures do not give a continuous output over time, as the only output measured coincides when the patient is at their emotional apex (e.g. highest pain intensity). They do not provide information on the patient's emotional state at times other than these peak periods. In an effort to address these shortcomings, many researchers have pursued the goal of obtaining a continuous objective measure of pain through analysis of tissue pathology, neurological "signatures", imaging procedures, testing of muscle strength and so on (Williams, 2002). These approaches are complex because they are often inconsistent with other evidence of pain, in addition to being highly invasive and constraining to the patient. Another aspect to this potential solution is to code pain using facial expressions.

Significant efforts have been made over a period longer than two decades, in identifying such facial expressions (Darwin, 1872; Hollander, 1939; Landis, 1929; Prkachin & Solomon, 1998). This measure of pain can be obtained by examining videotapes at each time step (video frame), and is the only such measure available. A limitation of this approach is that it needs to be performed offline, where manual observations are time-consuming and costly, which makes clinical use prohibitive. However, real-time automatic system can be used to train using such information which could provide significant advantage in cost reduction and patient care.

Faces in human species have evolved to express rich information for social interaction, including expressions of pain and emotions (Barlett, Littlewort, Frank & Kanglee, 2014). These expressions reflect behavioral sources of evidence about pain. Parents monitor their infant's facial expressions overtime, because they provide information about changes in their infants' affective states (Lewis, Allesandri & Sullivan, 1990; Rosenstein & Oster, 1988). Only the parent or carer can identify the source of distress, and they are the only ones who can take action to relieve physical discomfort. At this age, the facial expression of the infant is one of the few behaviors an infant uses to change its world.

(Keefe, Bradley & Crisson, 1990) described pain behaviour as: People, who perceives pain, may vocalize their suffering by moaning, crying, complaining or may show signs of body postures or facial expressions related to pain. These are classified as verbal or nonverbal behaviors originating from pain behaviors, as they serve to communicate the information that pain is being experienced. Their description emphasizes that pain behaviours are informative and easily communicable. However, communication such as direct and indirect can be distinguished. Behaviours, for instance, facial expressions, appear to be exclusively adapted for social communication (Prkachin, 1986; Williams, 2002). Certain behaviours communicating pain serve primarily to modify it (e.g., rubbing an irritated part of the body). Pain expressions can be defined as salient behaviours, in any modality which accompany and are specific to pain, and appear to be adapted to function in interpersonal contexts. In principle, this definition includes other kinds of behaviour, such as vocalizations. The prime focus in this chapter is on the distinct features of facial expressions.

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