Infant Cry Detection and Pain Scale Assessment: A Pilot Study

N. Sriraam, Centre for Medical Electronics and Computing, M. S. Ramaiah Institute of Technology, Bangalore, Karnataka, India
S. Tejaswini, Centre for Medical Electronics and Computing, M. S. Ramaiah Institute of Technology, Bangalore, Karnataka, India

ABSTRACT

A biological alarm system that connects mother and new born is referred as infant cry. Infant cry is a first means of communication through which mother understands the level of distress/needs. Infant cry can be considered a multimodal behavior which involves limb movements, facial expressions which changes over time to identify the needs of an infant. The cry of the baby cannot be predicted accurately and it is hard to identify for what it cries for. The infant’s cry is mainly a vocal signal which is a way of communication that aims to get attention of the listener to a physical state like hunger, pain, discomfort, fear, illness, wet diaper etc., Pain is one of the most common symptoms experienced world over. Pain is an unpleasant feeling that is conveyed to the brain by sensory neurons. The discomfort signals actual or potential injury to the body. This pilot study gives an insight on the current state of works in infant cry analysis and pain scale assessment and also concludes with thoughts about the future directions for better representation and interpretation of infant cry signals.

Keywords: Artificial Neural Network (ANN), Illness, Infant Cry, Mel Frequency Cepstrum Coefficient (MFCC), Pain Scale Assessment

1. INTRODUCTION

The cry serves as the primary means of communication for infants. It is their first linguistic manifestation. Infant cry comprises important information regarding their emotional, physical and health status. The analysis of biological signals has been essential mean for detecting pathologies and recognizing physiological and neurological states of the human body. One of the common biological signals is the infant cry, which according to specialists; it could contain valuable information about the state of the baby including hunger, pain, fear and physiological abnormalities. The frequency of infant cry is 250Hz – 600Hz and the voiced sounds are harmonics. First cry represents an ‘overwhelming sense of inferiority at thus suddenly being

DOI: 10.4018/ijbce.2014010104
confronted by reality without ever having had to deal with its problems’. The feeling of inferiority at least serves a useful function in ventilating the lungs. Infant cry analysis is of great importance to identify the characteristics present in the cry wave, as they provide additional information that allows recognizing variations and similarities between normal and pathological cry (Ali Messaoud, et al., 2011, Azlee Zabidi, et al., 2010, J. Saraswathy, et al., 2012, Ramu Reddy Venpada, et al., 2012, Rohilah Sahak, et al., 2010).

Pain assessment in patients who are unable to verbally communicate is a challenging problem in patient critical care. Depending on the patient group (e.g., neonates, children, adults, etc.) pain scale assessment have been developed, and indicators of pain in each group is different. Infants are unable to directly report their level of pain, and hence, medical staff is responsible for pain assessment for neonates. Pain and distress behaviors in neonates, include facial expression, cry, and body movement, and a series of methods have been suggested to objectively assess pain in neonates based on aforementioned behaviors.

The International Association for the study of Pain has defined pain as “an unpleasant sensory and emotional experience associated with actual or potential tissue damage or described in terms of such damage”. The interpretation of pain is subjective. Neonates cannot verbalize their pain; they depend on others to recognize and manage their pain. Therefore, health care professionals can diagnose pain only by recognizing the neonates associated behavioral and physiological responses. (Pritam Pal, et al., Rasha Srouji, et al., 2010).

2. RELATED BACKGROUND

Almost half decades ago, the attention has been made on acoustic analysis of infant cry and pain scale assessment to investigate the relationship between cry signal and physiological or physical status of new born infants.

2.1. Infant Cry

The infant cry signal used for the study is taken from Chillanto, Mexican data base which is used for the study of characteristics of the cry with conditions such as normal, pain, hunger, deaf and Asphyxia. The full recording and the segmented of each recording are used as the preliminary study infant cry recordings. The data base gives us the details about all the mentioned cry and these cries can be used reference for the recorded cry in this project. It is similar to Automatic Speech Recognition system process which comprises two main stages. They are signal processing and pattern classification. The main aim of this system is to discriminate the different types of cries and identify the pathology cry. In signal processing step raw cry signal is preprocessed such as cleaning, filtering and normalization. Then smoothed signal is analyzed and by suitable feature extraction techniques the salient features are derived.

One of the most popular feature extraction techniques used to provide inputs to the ANN is Mel Frequency Cepstral Coefficients (MFCC). MFCC extraction is highly dependent on its extraction is highly dependent on its extraction parameters (Ali Messaoud, et al., 2011, J. Saraswathy, et al., 2012, Ramu Reddy Venpada, et al., 2012). The characteristics of the cry can be attributed to the characteristics of vocal tract system and excitation source and supra segmental characteristics. The spectral peaks, bandwidths and slopes are unique for each condition of cry. Hence if we extract this information one can discriminate the infant cry condition (Rohilah Sahak, et al., 2010). Pitch is one of the important and distinguished acoustic features to analyze the infant cry. Linear prediction analysis is a time domain analysis which has been used frequently in infant cry analysis. Linear prediction analysis attempts to predict a speech sample through linear combination of several previous samples.

The extracted features are further processed for acquiring the required signal cry signal. It
A Computer Aided Diagnostic Tool for the Detection of Uterine Fibroids
www.igi-global.com/article/a-computer-aided-diagnostic-tool-for-the-detection-of-uterine-fibroids/96826?camid=4v1a