嬰兒認知與氣質之規模化行為分析與智能應用

Intelligent Behavior Analytics for Infant Cognition and Temperament Analysis and Application

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In this project, we complete three aspects: a database collection, a deep learning algorithm for crying reason detection, and a study of temperament. We will briefly describe each in below:

1. The Baby Care Center Databases

The database consists of 7 babies (3 male and 4 female) whose age are between 3 months and 8 months. We recorded nine days of video and audio data. Each recording lasts 8 hours per day. Every recording includes two kinds of annotations. One is the event annotations. There are 7 different kinds of event label, water sound, human speech, human emotional expression, percussive sound, infant cry, infant fussing sound, radio sound. Another is cry reason annotations. Six observers (with an early childhood education background) were assigned to three pairs and coded episodes as crying events by the NOVA behavior analysis tool. Observer reliability of each group was 0.83, 0.71, and 0.89. The cry reasons are defined strictly into 5 class, diaper, love, hungry, angry, sleepy. All in all, there is total of 8952 samples (Love: 3957, Sleepy: 2061, Hungry: 2035, Angry: 899).
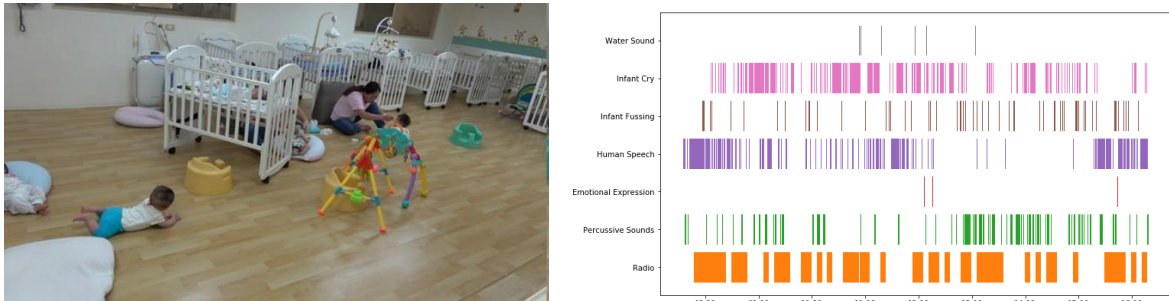

Figure 1 : the scene of the baby care center (left) and Status of event for specific day in the baby care center. It shows routine annotation of baby care center in a day from around 8 a.m. to 4 p.m. (right).

2. Crying Reason Recognition

Crying is the only communication way from infants due to immature larynx and pharynx. It usually represents the urgent demand from infants [1]. Caregivers and parents need to solve the urgent demand as soon as possible. However surrounding sound event in the center may induce infants cry due to sensitivity to environment of infants. In this section, we proposed a deep network that learns context information from the cry sound and leverages the event and environment factor to increase the performances of reason classification. Figure 2 shows our framework. The network leverages the event information to the audio context to increase the performance of the results. Furthermore, we see environmental information are more sensitive to love and angry reason detection.
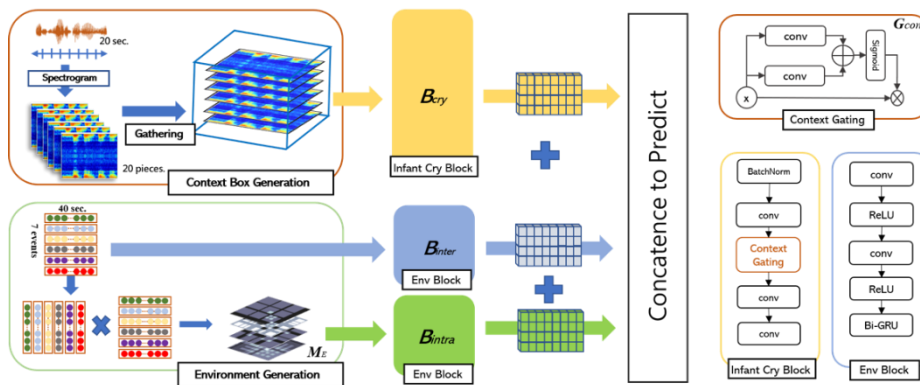
Figure 2 : Figure shows our proposed framework we proposed. Context box generate the acoustic feature with spectrogram with 20 seconds as well as environmental information are presented with inter-environmental vector and intra-environmental vector, then fusion with simple concatenate to predict the result.

3. Temperament Research

Temperament is the fundamental of the psychological mechanism of behavioural functioning [2]. This study aimed to investigate the relationship between the infant's temperament (scores on the Chinese Infant Temperament Scale) and the infant's daily crying. In addition, the frequency and duration of infants' crying due to six physiological needs (hunger, full appetite, sleepy, not sleepy, and not sleep well) and two emotional needs (angry and attachment) were analysed. All infants' crying audios were extracted to the voice-related low-level descriptors (LLD). Temperament dimensions (the higher the dimension scores, the more negative the temperament rating) and dependent variables were summited to correlational analyses to examine the relationship between temperament, crying behaviours, and acoustic cry characteristics of infants. The results are as Figure 3. The findings suggested that activity level, adaptiveness, and persistence were the temperament dimensions most associated with the infant's crying behaviours and acoustic cry characteristics.
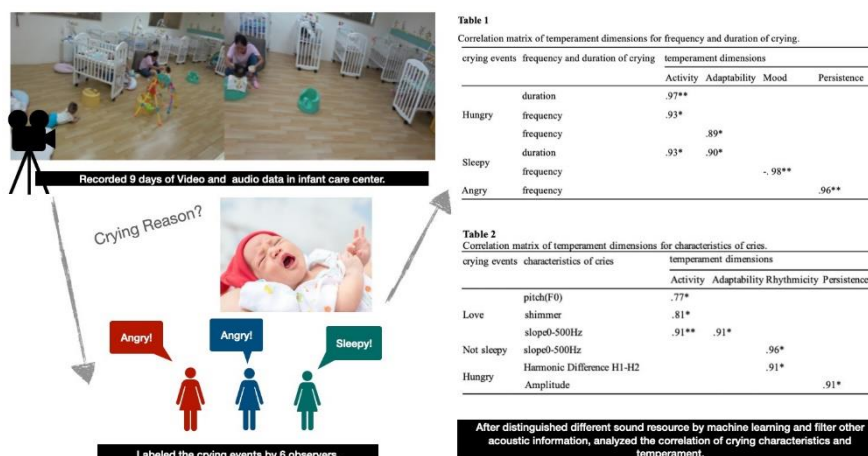

Figure 3 : Figure shows the framework to analyse the temperament from babies.

References

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