OPEN ACCESS

International Journal of Engineering Innovations in Advanced Technology
ISSN: 2582-1431 (Online), Volume-4 Issue-4, December 2022

# Analyzing Baby Voice For Feeling And Health Detection Using Machine Learning

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***Abstract-*** **Crying is a form of communication for children to express their feelings. A baby's cry is characterized by its natural, periodic tone and vocal changes. This project provides an overview of current research on the analysis of infant cry signals and classification tasks. Detecting baby cries in audio signals is an important step in applications such as remote baby monitoring, and is also important for scientists studying the relationship between baby cry signal patterns and other developmental parameters. This tone detection study involves feature extraction and classification by determining tone patterns. We use MFCC as feature extraction method and K-Nearest Neighbor (K-NN) for classification. K-Nearest Neighbour (KNN) is a classification technique commonly used for audio data. The ANN classifier shows significantly better results compared to other classifiers.**

***Keywords-*** **KNN, Crying, Communication, Audio Signal, Baby Monitoring.**

## I. INTRODUCTION

Cry signals or cry patterns have been analyzed in research for many years. Scientists and analysts have found that crying can provide a detailed picture of a newborn's physical and mental state. 72% of infant deaths occur in the first week of life and up to two-thirds of infants are saved alive. The sooner we know the cause. Recognizing the early signs of infant health and hygiene Technologies that enable us to help reduce infant mortality more specifically, the overarching goal of our paper is to develop a reliable system that can detect disease based solely on vocal tests. To develop or implement the development of these types of systems first addresses the problem of finding reliable bark components or patterns in the input waveform. An NCDS system can be confused if the input audio signal contains unwanted noise other than the scream signal. Therefore, a major challenge in designing and implementing a diagnostic system is implementing an automatic recognition engine to accurately search for the aspiratory and expiratory portions of the crying pattern. After much research on sickness and crying signals and their relationship, some useful results have emerged for developing automatic speech segmentation of the expiratory and aspiratory parts of infant screams. The ability to segment acoustic scream signals and examine significant portions of the recorded audio signal would be very helpful and easy to develop fully automated systems to help us understand disease. This system could definitely be used to support our decision to understand infant cries. This allows early recognition of symptoms and the ability to take necessary measures in an efficient and cost-effective manner.

Recent studies on infant crying show that infants cry for a variety of reasons, such as hunger, fatigue, discomfort, pain, and many other reasons as needed. Researchers and academics, such as paediatricians and health care professionals, can associate different types of infant cries, so they can predict the needs of the first infant based on their cries, gestures, and other behaviors increase. But this is a real-time and serious problem (problem). For inexperienced parents and those who are not good at taking care of babies. This project provides an automated method for classifying infant cries, trained on five different infant cries datasets. Therefore, the main goal is to extract useful features from scream audio signals. H. Test infant cries and unknown cries with a professional trainer to know the meaning of infant cries and care for the infant accordingly.

*A. Need for baby cry classification:*

Crying is thought to be one of the primary means by which infants communicate with their environment, alerting caregivers of stress and need for attachment. The automatic detection of a baby's cries from an audio signal can be used for a variety of uses, from everyday applications to academic research. This baby/infant cry detection allows you to respond to the needs of infants.

Manuscript received October 17, 2022; Revised November 16, 2022; Accepted November 25, 2022

## II. LITERATURE REVIEW

There is lot of literatures published before on the same task; some papers are taken into consideration from which idea of the project is taken.

[1] A paper proposed by Kuo in 2010 states that the main problem is that the detection of screaming noise in systems recorded in a noisy home local environment cannot be easily solved by a VAD (Voice Activity Detection) module. It is stated. VAD deals with retrieval problems. Alternatively, find audio patterns from other auditory active regions of the audio signal under consideration. Other acoustic activity patterns can be of any type, such as silence, noise, doorbell alerts, etc. Signal-to-noise ratio "SNR" is an important parameter and can lead to many unwanted errors. VAD is important in several speech communication systems such as automatic speech recognition, telephony and other digital resources, and real-time transmission of speech. His popular and very widely used VAD methods include his two basic and important methods: feature extraction and decision making. Signal properties including computation of energy, cepstrum coefficients and ZCR, Marzinzik and Kollmeier proposed spectral analysis in 2002, and Wang and Tasi proposed wavelet and entropy transforms in 2008. Juan et al. I proposed a very simple rule for frame-based decision rule computation and thresholding. In 2009, we applied the well-known Rabiner-Sambur VAD algorithm and the G.729b method to detect shouting parts or segments.

[2] The study in Osmani A., Hamidi M., Chibani A. Machine learning approach for infant cry interpretation emphasized the importance of automatic recognition of infant cries to develop an application that would improve the quality of life of the infant and their parents. The study generated real-time datasets from infant cries and selected the most relevant sound attributes that affected the experimental results and helped monitor infants. The framework automatically detects instances of discomfort signals, which are common among 25 percent of infants, using machine learning techniques. The study included an ensemble technique through which low-level audio features were selected from labeled precry recordings and high level features relevant to the envelop of crying. The inclusion of precry signals helped understand infant needs better, providing the opportunity to develop superior quality of baby monitors.

[3]The study in Barajas-Montiel S. E., Reyes-Garcia C. A. Identifying pain and hunger in infant cry with classifiers ensembles performed an experimental analysis using two ensemble models to classify infant cry. The two models used are a boosting ensemble of artificial networks and a boosting ensemble of support vector machines. The study highlighted the superiority of the neural network-based ensemble model in the classification of infant cry. The challenges of the study included the difficulty of collecting cry samples from normal babies without any pathology, pain, or hunger issues. The availability of a larger number of samples would help generalize the results achieved and justify the possibility of its application in real time.

[4] The study in Orlandi S., Reyes Garcia C. A., Bandini A., Donzelli G., Manfredi C. Application of pattern recognition techniques to the classification of full-term and preterm infant cry highlighted the importance of infant cry analysis as a noninvasive complementary tool for the assessment of the neurological conditions of premature neonates. The study emphasized on identifying the distinctions between full-term and preterm neonatal cry using automatic acoustical analysis in association with various data mining techniques.

[5] The study in Ashwini K., Pm D. R. V., Srinivasan K., Chang C. Y. Deep convolution neural network based feature extraction with optimized machine learning classifier in infant cry classification implements a deep learning-based feature extraction technique followed by machine learning algorithms for the classification of infant cry. The audio signal of 4-second duration was transformed into a spectrogram image and then fed into the DCCN for extraction of features. The extracted features were further classified using ML algorithms, namely, SVM, Naïve Bayes, and KNN. The framework was evaluated with the Bayesian hyper parameter optimization technique. The results highlighted the superiority of SVM in the classification of infant cry due to hunger, pain, or sleepiness.

[6] The study in Dezecache G., Zuberbühler K., Davila-Ross M., Dahl C. D. A machine learning approach to infant distress calls and maternal behavior of wild chimpanzees implemented machine learning techniques to analyze distress calls among infant chimpanzees. The exemplars were extracted from the distress call episodes, and the external events that caused such calls and the distance from the mother were analyzed to identify any correlations. The results revealed that such distress calls could provide information on discrete problems faced by the infants and their distance from the mother. These factors would act as a guide for

maternal decision making. However, the role of acoustic cues in this regard has remained a topic of future scope of research.

[7] The study in Maghfira T. N., Basaruddin T., Krisnadhi A. Infant cry classification using cnn–rnn analyzes different types of emotional necessity as communicated by infants through their cry, namely, due to hunger, sleepiness, stomachache, uneasiness, and need to burn. A combination of CNN and RNN is used for feature extraction and classification. The CNN-RNN method when implemented in the study outperforms the traditional methods in terms of accuracy up to 94.97%. The use of IoT and smart devices has helped develop state-of-the-art infant incubators that would enable caregivers to respond quickly to the specific needs of the infants. The baby voices are classified using machine learning using the open voice database.

[8] The sensor-based incubator as proposed in the study Sutanto E., Fahmi F., Shalannanda W., Aridarma A. Cry recognition for infant incubator monitoring system based on internet of things using machine learning would help in reporting the infant's condition. The use of IoT technology would enhance the function of the actuators inside the incubator. Finally, the combination of historical data and the live data collected by the sensors would provide extensive information on the infant's condition and the environment.

[9] The study in Savareh B. A., Hosseinkhani R., Jafari M. Infant crying classification by using genetic algorithm and artificial neural network used neural networks to analyze the source of infant crises. The work combined the genetic algorithms, ANN in association with linear predictive coding (LPC) and MFCC for the classification of infant cries. The results justified the superiority of the proposed method when compared with other traditional approaches.

[10]The study in Jiang L., Yi Y., Chen D., Tan P., Liu X. A novel infant cry recognition system using auditory model-based robust feature and GMM-UBM used Gaussian mixture model–universal background model for the recognition and analysis of infant cry signals even when there are channel imbalances and corroded signals. The results proved to be much superior when compared with high-order spectral features ensuring enhanced accuracy.

## III. REVIEW FINDINGS

In a noisy home environment, it is difficult to select threshold settings. During data acquisition, conventional VAD modules cannot distinguish between EXP and INSV (scream signal segments) and recorded speech signal segments. Conventional VAD modules cannot distinguish between the expiratory (EXP) and inspiratory (INSV) parts of the scream audio signal.

Crying is the only means of communication for children to express their feelings. Given that her 72% of infant deaths occur within the first week of life and that up to two-thirds of infants are saved, a baby's cry is characterized by its natural, periodic intonation and vocal changes can be attached. The sooner you can identify the cause of the crying, the sooner your baby's health can be cured. It is also of utmost importance to correctly identify that the baby is crying. Misinterpreting a baby's cries or mishandling them can also lead to their death.

**Problem Statement:**

If decision support systems were developed to understand infant cries, the emotions could be identified and necessary actions taken accordingly. This can be a contributing factor in understanding the emotions of infants and could save many lives if the cause is known.

## IV. PROPOSED IDEA

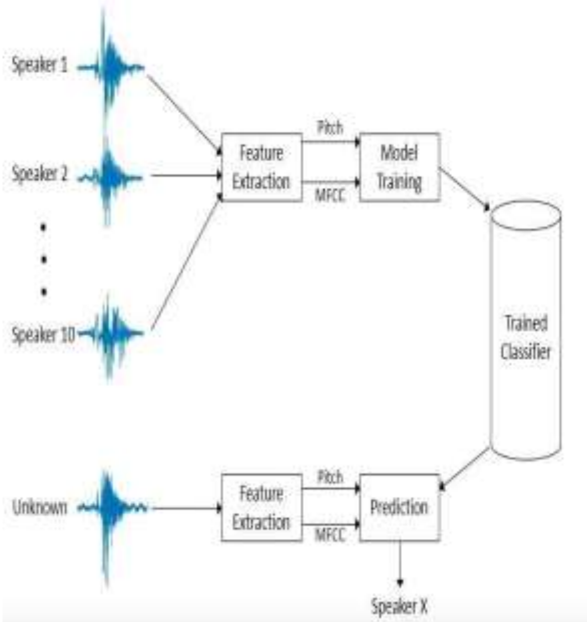
Based on the above literature review, we finally implemented this project using MFCC (Mel Frequency Cepstral Coefficients) for feature extraction and efficiently used the machine learning model KNN to classify the reasons for baby crying. This model is not only efficient, but also gives better results with speech-based classification and audio files.

This approach has following steps as follows:

- An audio file containing the unknown baby cry and whose reason is to be classified is uploaded.
- The input audio file is preprocessed to remove empty audio frames and unwanted noise.
- Then the audio is converted to cepstral coefficients to extract the features (here MFCC technique is used to obtain cepstral coefficients)
- Once the cepstral coefficients are obtained, the mean of the coefficients is taken for further process.
- Next, the KNN classifier is applied to classify the reason from the already trained model.

• The reason for baby cry is obtained by considering the 'n' nearest neighbor which has the highest accuracy.
• The reason for the baby cry is displayed as output.

**SYSTEM ARCHITECTURE:**




The flow of the system architecture goes like this:
• Various audio files containing baby cries are taken.
• Then the feature extraction is done for the audio files.
• After feature extraction, the output will be pitch and MFCC (Mel Frequency cepstral coefficients)
• In feature extraction, the noise is removed and unwanted empty segments of the audio file are removed.
• The outputs of feature extraction are used for training the model.
• For training the model, the MFCCs for each audio file is observed and the mean of the coefficients are taken for further classification.
• Then the classifier is trained with all the available data.
• Now, an unknown audio file is given for classification.
• The audio file is pre-processed and the features are extracted

## V. CONCLUSION

In this study, we used the sound of babies' cries to decipher their emotions. Through cry-speech recognition, our developed application can assist parents, caregivers, and medical professionals in determining a child's requirements. In order to provide the right answers, the pertinent parties (parents, doctors, etc.) can quickly assess the child's status through these feelings. Through their various cries, the baby's emotions are represented in our programmed. The suggested method of figuring out a baby's emotions from their screams worked well for us. This AI-based technique has practical uses. Given that several emotions can be expressed by a child's cry, we will use our suggested method to ascertain the emotions of many more kids in the future. We will also add new frequencies to aid in identifying different emotions in order to help parents and medical professionals.

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