Industrial Engineering Journal
ISSN: 0970-2555
Volume : 52, Issue 2, No. 1, February : 2023

OH, MY BABY IS CRYING!

Dhanashree Salvi, Poorna Rajesh Pimpale, Suchetadevi Gaikwad, Renuka Nagpure, Assistant Professor Information Technology Department Atharva College of Engineering, Mumbai, India

Abstract:
The paper reviewed research work on comparative analysis of baby crying. N numbers of literature papers are reviewed on cross domain, signal processing technique and machine learning techniques. Crying is one of the forms of communication where infants try to communicate with the surrounding people. The paper depicts comparative analysis between Algorithm CNN, KNN and RNN applied on features of sound collected while the baby is crying on the basis of Body pain, hunger, colic, sleep, Pee and Poop and fake crying of a baby. The existing model monitors the baby crying speech signal and understands the crying signal pattern for Body pain, Hunger, colic, sleep Pee and Poop and Fake crying.

Index Terms – Algorithm

I. INTRODUCTION

Nowadays it has become a very major issue to find what exactly is wrong with the baby when the baby cries. There might be many reasons for crying such as colic, hunger, body pain, pee and poop. These are quite basic reasons of baby crying but there might be major issues when the baby cries such as NRDS i.e Newborn Respiratory Distress Syndrome, vomiting, difficulty in swallowing, due to slow growth of their vital organs, also when the baby is premature as their vital organs are not developed eg: lungs, heart. It becomes very difficult to analyze why exactly the baby is crying. In this paper, the model is proposed to analyze the reason of baby crying using the features such as pitch, amplitude, and frequency of sound of baby cry. These features are trained using the machine learning algorithms such as K-nearest neighbor, Convolutional Neural Network, RNN, Linear Regression, Random Forest, Naive Bayes, Support Vector Machine, Natural Language Processing.

II. OBJECTIVE

System is developed to support and understand the emotion and feeling of an infant baby. System can help to take the required step when the infant cries. It would be a contributing factor in understanding infant feelings and many of the infant lives can be saved and comfort can be provided if the cause is much known on prior basis. For eg. Colic.

III. LITERATURE REVIEW

1. Title: Why is my Baby Crying? An in-depth Analysis of Paralinguistic Features and Classical Machine Learning Algorithms for Baby Cry Classification.
Published year: 2018, 41st International Conference on Telecommunications and Signal Processing. This paper helped to explore baby cry characteristics by looking at different features such as emotion recognition, deception sincerity and native language from speech recognition.
2. In this paper the author has used a classifier which is Deep Neural Network That determines the baby cry considering its fundamental frequency with methods like short time energy linear prediction and also analyzes the baby cry using FFT at initial stages. Title: System for Infant Cry Emotion Recognition using DNN
Published in year: Third International Conference on Smart Systems and Inventive Technology (ICSSIT).
3. Title : Extraction of acoustic features of infant cry for emotion detection based on pitch and formants. In this paper the characteristic feature such as pitch and acoustic formants are considered. K Means algorithm is used on acoustic feature vector to determine the reason of baby cry

and its classes
Published in year: 2019

4. Title : Deep Learning Assisted Neonatal Cry Classification *via* Support Vector Machine Models , 10th June 2021
This article has helped us to understand neonatal cry using Support Vector Machine Models (SVM). In this paper the author has used support vector machine model on the auditory signal from neonatal cry, this signal is transformed using short time fourier transform in to spectrogram image. The images are then trained with Deep CNN and passed
to the Support vector machine classifier .

IV. EXISTING SYSTEM

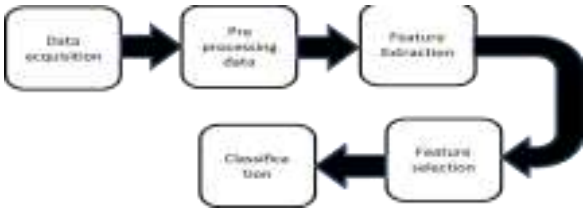

Figure.1. Existing System

A. Data Acquisition
In this module, the dataset is being collected from available resources such as kaggle and the data set is sampled for acquiring the digital numeric values. The sampling techniques that are intended to use in this module are Simple random sampling, cluster sampling, systematic sampling, stratified sampling, probability sampling. Using this method the sound waves i.e the sound of baby cry is converted to digitized value.

B. Pre-Processing Data
In this module the data acquired is pre-processed in order to convert raw data i.e baby cry orsound of baby cry in desired digitized format.

C. Feature Extraction
The data which is pre-processed is trained with the algorithms in order to achieve the features such as pitch, amplitude, frequency of sound of baby cry.

D. Feature Selection
As per the medical studies for detecting the issues in the sound of baby cry, the features are selected to determine the reason why the baby is crying.

E. Classification
Once the desired data is met using the feature selection process, the data is classified using machine learning algorithms.

V. PROPOSED SYSTEM

Baby cry has been proven to be an issue when it becomes difficult to understand why the baby is crying as the cry can be healthy cry and unhealthy cry. The cry has been distinguished on the basis of medical coefficient value achieved through this proposed system.

A. Speech Signal Acquisition

The baby cry or the analog signals acquired are passed through a sampling module where sampling algorithms such as Simple Random Sampling, Cluster Sampling etc.
Sampling module will produce the required discrete signal which is then passed through the Quantization module. Quantization model converts the discrete signal into the desired digital signal which would be passed to the next model for further processing.

Industrial Engineering Journal
ISSN: 0970-2555
Volume : 52, Issue 2, No. 1, February : 2023

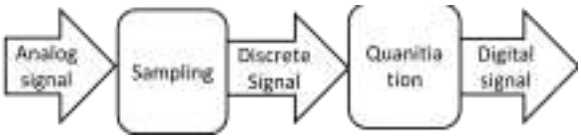

Fig.1 Block Diagram

B. Block diagram for MFCC

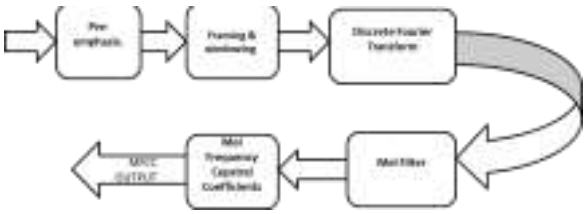

Fig.2 Block Diagram for MFCC

The output acquired from the Speech signal Acquisition model is trained through *Normalisation.*

Pre-emphasis is a process in which the frequencies are trained in order to improve the signal-to noise ratio by minimizing the distortion or saturation of recording media.

Framing and windowing

Once the signal to noise ratio is improved the digitized signal undergoes framing where signal is divided in to frames or blocks.

Windowing

The frames are now trained through windowing where the blocks are splitted into temporal segments by using Discrete Fourier Transform.

Discrete Fourier Transform

The signal acquired or the frames in the form of segments acquired through windowing are trained with DFT in order to achieve the frequency-domain spectral representation of the signal.

Mel Filter

The purpose of Mel filter is to decompose the audio signal using mel frequency scale to separate frequency bands that would mimic the nonlinear human perception of sound. Discrete Cosine Transform

Once the frequency band of the baby cry sound is determined using mel frequency scale it is passed through

Discrete Cosine Transform where a finite sequence of data points in terms of an oscillating cosine functions at various frequencies.

Mel Frequency Cepstral Coef icients

The signal trained with DCT are the compared with the mel frequency cepstral coefficient which would determine the baby cry whether it is healthy or unhealthy. Here using mel frequency the vocal tract is determined which is comparatively smooth as per the source of voice speech which can be modeled as an impulse train. After MFCC model the desired signal with the coefficients is achieved which is being compared to the medical coefficients of the sound in order to conclude that the cry of the baby is healthy or unhealthy.

Feasibility Study

Main concern is about obtaining the real time data set. CNN, RNN etc. have to apply on exciting dataset .Various maternity hospital, pediatrician clinics are approached to acquire the data.

VI.CONCLUSION

This paper aims at proposing a model which determines why exactly the infant is crying using the sound waves acquired from the baby and training the dataset with various machine learning

algorithms to achieve the coefficients that determine healthy and unhealthy cry.

References

[1] Crying Baby - Before 3 Months Old Is this your child's symptom? Last Reviewed:02/06/2023 Last Revised: 12/30/2022Schmitt Pediatric Guidelines

[2] Convolutional Neural Networks for Audio-Based Continuous Infant Cry Monitoring at Home Jiali Xie , Xi Long , Senior Member, IEEE, Renée A. Otte, and Caifeng Shan , Senior Member, IEEE. Published in the Year :IEEE SENSORS JOURNAL, VOL. 21, NO. 24, DECEMBER 15, 2021

[3] Deep Learning Assisted Neonatal Cry Classification via Support Vector Machine Models.RIGINAL RESEARCH article.Front. Public Health, 10 June 2021 Sec. Digital PublicHealth Volume 9 - 2021 |

[4] System for Infant Cry Emotion Recognition using DNN. 2020 Third InternationalConference on Smart Systems and Inventive Technology (ICCSIT).2020

[5]A review of infant cry analysis and classification, Chunyan Ji, ,Thosini Bamunu Mudiyanselage, Yutong Gao & Yi Pan EURASIP Journal on Audio, Speech, and Music Processing. 2021, Article number: 8 (2021)

[6] Infant Cry Language Analysis and Recognition: An Experimental Approach Lichuan Liu, Senior Member, IEEE, Wei Li, Senior Member, IEEE, Xianwen Wu, Member, IEEE and Benjamin X. Zhou Published in the year : IEEE/CAA JOURNAL OF AUTOMATICA SINICA, VOL. 6, NO. 3, MAY 2019

[7] Infant cry classification using CNN – RNN Universitas Indonesia, Indonesia Published in the Year:4th International Seminar on Sensors, Instrumentation, Measurement and Metrology Journal of Physics: Conference Series 1528 (2020)

[8]. Fixed-Frequency MCCF Based Grid Synchronization Technique. Published in the year: 2018 IEEE International Conference on Power Electronics, Drives and Energy Systems (PEDES).2018 [9] Model Reduction of Multivariable Systems by Using New Combined Approach.Published in the year: 2019 IEEE 16th India Council International Conference (INDICON).

[10]Sampling Methods. (2021). Statistical Quality Control, 89–121. Published in the year: 2021 [11] . A Brief Review of Conditions, Circumstances and Applicability of Sampling Techniques in Computer Science Domain. Published in the year: 2020 IEEE 23rd International Multitopic Conference (INMIC). [12]An Infant Cry Recognition based on Convolutional Neural Network Method.Published in the year: 2019 12th Biomedical Engineering International Conference (BMEiCON).

[13] Why is My Baby Crying? An In-Depth Analysis of Paralinguistic Features and Classical Machine Learning Algorithms for Baby Cry Classification. Published in the year: 2018 41st International Conference on Telecommunications and Signal Processing (TSP).

[14] Multiple-Complex Coef icient-Filter-Based PLL for Improving the Performance of Shunt Active Power Filter under Adverse Grid Conditions. Published in the year: 2018 IEEE Power & Energy Society General Meeting [15] The extraction of acoustic features of infant cry for emotion detection based on pitch and formants.Published in the year: International Conference on Instrumentation, Communication, Information Technology, and Biomedical Engineering 2009.

[16]EMOTION DETECTION FROM INFANT FACIAL EXPRESSIONS AND CRIES
Yantorno, Electrical & Computer Engineering Department, Temple University 12th & Norris Streets, Philadelphia,Published in the year 2006 IEEE International Conference on Acoustics Speed and Signal Processing Proceedings.