



**DEVELOPMENT OF MATLAB® GUI
FOR INFANT CRY SIGNAL ANALYSIS USING FFT**

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ABSTRACT

Crying is a universal act in infancy and an essential signal that activates care-giving behavior. It is a normal, healthy means of expression and communication especially to newborn infants. At this stage, crying is the only way to communicate their needs. The cry signal has enormous potential diagnostic value. A very high-pitched cry tells that something may be wrong with the infant and this signal can be an early warning leads to further neurological testing.

Infant cry analysis, reported in the literature, has been a topic for quite a number of researchers for the past 40 years. In previous works on the analysis of infant cry, it has been shown that there exist significant differences among the several types of crying, such as healthy, pain, hunger and pathological infant cry. In a recent investigation of infant cry analysis, Zaidi Shaari [3] attempted to analyze the infant cry signals using Short Time Fourier Transform (STFT). The goal of Zaidi Shaari was to differentiate between both pain and hunger cries by analyzing the distribution of energy in both frequency and time.

The thesis is an enhancement of the previous work of Zaidi Shaari. The main objective of this thesis is to develop a Graphical User Interface (GUI) in MATLAB for infant cry signal analysis. The audio signals of the infant cry were obtained from a database available on the website (DISAT, Universita degli Studi di Milano-Bicocca, Milano, Italy) [7]. The signals were recorded from a total of six normal newborn babies of age four days regardless of gender. Two types of cry signals namely hunger and pain were being analyzed. FFT analysis and Hilbert transformation were used to extract information embedded in both cry signals Algorithms and programming utilizing MATLAB R2007b were written to search for the fundamental frequency of each cry signal and to identify the type of signal uniquely according to its fundamental frequency. The development of GUI requires a good understanding and skills in programming the M-File code and it was the most challenging part for this study.

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CHAPTER 1

INTRODUCTION

1.1 BACKGROUND OF STUDY

Crying in an infant is a normal, healthy and vitally important means of expression and communication. Before the use of signs or words, crying is the only way of communication that the baby has in the first months of life. The characteristics of a cry can indicate not only the baby's needs and feelings, but also problems in a baby's nervous system, as well as sudden infant death syndrome (SIDS). Therefore, it is necessary to recognize the characteristics in order to understand and interpret the 'full message' of the cry.

This study is an enhancement of the previous work of Zaidi Shaari [3] who attempted to analyze the infant cry signal using Short Time Fourier Transform. The main goal of Zaidi Shaari was to differentiate between both pain and hunger cry signals by analyzing the distribution of energy in both frequency and time. However, the work presented here introduces a development of graphical user interface (GUI) in MATLAB for the infant cry analysis. There are two main innovations of this study namely the feature extraction techniques and the use of MATLAB Graphic Users Interface (GUI). Fast Fourier Transform and Hilbert Transform techniques are used to extract the fundamental frequency which is the feature of the cry signal. In addition, a GUI is created not only to perform the cry signal analysis but also to detect the type of signal according to its fundamental frequency.

Applications that provide GUIs are generally easier to learn and use since the person using the application does not need to know what commands are available or how they work. The action that results from a particular user action can be made clear by the design of the interface.