Deep learning systems for automatic diagnosis of infant cry signals [9]

the contributions of our paper can be summarized as follows:

We pioneer the evaluation of the performance of various deep learning systems in the task of infant cry record classification to distinguish between healthy and unhealthy infants. Specifically, deep feedforward neural networks (DFFNN), long short-term memory (LSTM) neural networks, and convolutional neural networks (CNN) are evaluated and compared.

The Hidden Markov Models trained with segmented cry signals achieved 83.79% accuracy, the probabilistic neural network trained with prevalence of fundamental frequency glide, resonance frequencies dysregulation, and Mel-frequency cestrum coefficients yielded to an accuracy varying from 67.00% to 88.71%, the linear SVM trained with Mel-frequency cepstral coefficients, tilt, and rhythm features obtained 67.80% accuracy, and deep feedforward neural networks achieved 100% accuracy.

The database is composed of expiration (EXP) set with 2638 cry signals (1319 healthy signals and 1319 unhealthy signals) and inspiration set (INS) with 1860 cry signals (930 healthy signals and 930 unhealthy.

Various topologies of CNN and various number of hidden neurons in DFFNN are examined since the performances of these networks depend on such factors.

We extend our previous work by using cepstrum based-coefficients as inputs to deep learning architectures.

Our study enriches the literature on infant cry record classification for medical diagnosis purpose by applying, evaluating and comparing deep learning techniques.

IoT-BBMS: Internet of Things-Based Baby Monitoring System for Smart Cradle [10]

The parents cannot continuously monitor their babies’ conditions either in normal or abnormal situations. Therefore, an Internet of Things-based Baby Monitoring System (IoT-BBMS) is proposed as an efficient and low-cost IoT-based system for monitoring in real time. We also proposed a new algorithm for our system that plays a key role in providing better baby care while parents are away. In the designed system, Node Micro-Controller Unit (NodeMCU) Controller Board is exploited to gather the data read by the sensors and uploaded via Wi-Fi to the AdaFruit MQTT server. The proposed system exploits sensors to monitor the baby’s vital parameters, such as ambient temperature, moisture, and crying. A prototype of the proposed baby cradle has been designed using Nx Siemens software, and a red meranti wood is used as the material for the cradle. The system architecture consists of a baby cradle that will automatically swing using a motor when the baby cries. Parents can also monitor their babies’ condition through an external web camera and switch on the lullaby toy located on the baby cradle remotely via the MQTT server to entertain the baby. The proposed system prototype is fabricated and tested to prove its effectiveness in terms of cost and simplicity and to ensure safe operation to enable the baby-parenting anywhere and anytime through the network. Finally, the baby monitoring system is proven to work effectively in monitoring the baby’s situation and surrounding conditions according to the prototype.

Biomedical Diagnosis of Infant Cry Signal Based on Analysis of Cepstrum by Deep Feedforward Artificial Neural Networks [13]

In this work, we propose a new CAD system to distinguish between healthy and unhealthy infant cry signals.

four major steps. First, the original cry signal is pre-processed to remove background noise and artifacts. This step also includes signal segmentation to differentiate between expiration and segmentation episodes. Second, the resulting pre-processed cry signal is analyzed to obtain its cepstrum. Third, the obtained cepstrum coefficients are fed to a deep feedforward neural network (DFFNN) for training and classification. Fourth, the performance of the cepstrum-DFFNN system is evaluated by standard classification performance metrics.

infant cry signals have been recorded in the neonatology departments of the following hospitals: Sainte-Justine hospital (Montreal, Canada), Al-Sahel hospital (Beirut, Lebanon), and Al-Raee hospital (Saida, Lebanon), two sets: expiration (EXP) set and inspiration (INS) set. The EXP set has 2638 cry signals and INS set has 1860 cry signals.

EXP (Accuracy): SVM 56.63%, NB 57.32%, PNN 53.83%, DFFNN 100.00%

INS (Accuracy): SVM 54.62%, NB 57.10%, PNN 52.80%, DFFNN 100.00%