Chapter 7
Identification of High Risk and Low Risk Preterm Neonates in NICU:
Pattern Recognition Approach

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ABSTRACT

Infant cries are referred as the biological indicator where infant distress is expressed without any external stimulus. One can assess the physiological changes through cry characteristics that help in improving clinical decision. In a typical Neonatal Intensive Care Unit (NICU), recognizing high-risk and low-risk admitted preterm neonates is quite challenging and complex in nature. This chapter attempts to develop pattern recognition-based approach to identify high-risk and low-risk preterm neonates in NICU. Four clinical conditions were considered: two Low Risk (LR) and two High Risk (HR), LR1- Appropriate Gestational Age (AGA), LR2- Intrauterine Growth Restriction (IUGR), HR1-Respiratory Distress Syndrome (RDS), and HR2- Premature Rupture of Membranes (PROM). An overall cry unit of 800 (n=20 per condition) was used for the proposed study. After appropriate pre-processing, Bark Frequency Cepstral Coefficient (BFCC) was estimated using three methods. Schroeder, Zwicker

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and Terhardt; and Transmiller; and a non-linear Support Vector Machine (SVM) Classifier were employed to discriminate low-risk and high-risk groups. From the simulation results, it was observed that sensitivity specificity and accuracy of 91.47%, 91.42%, and 92.9% respectively were obtained using the BFCC estimated for classifying high risk and low risk with SVM classification.

INTRODUCTION

Recognition of low risk and high-risk neonates of preterm condition in a typical neonatal Intensive Care Unit (NICU) is quite challenging for clinical community. Factors such as low birth weights, under weights or over weight for gestation age, Apgar score (low/ minute score), mothers with complicated pregnancy have generally categorise as high risk infant. Preterm neonates are often refined as high risk as their birth happens before 37 completed weeks of pregnancy. Most preterm neonates are born between 32 and 37 weeks of gestation and needs special clinical attention (Ronald S Illingworth, 1972). For neonates born before 28 weeks gestation intensive care is essential to monitor closely the condition of the neonate in terms of its survival. Further preterm neonates with less than 2000 gm weight will considered as high risk with symptoms such as respiratory distress syndrome, apnoea, hyperglycaemia, congenital heart disease, hypoxia- ischemic encephalopathy (Abou-Abbas et al., 2017)

Preterm neonates admitted to NICU need to be monitored continuously understand the level of complication and to provide necessary clinical care. At any instant of time, clinician and the staff nurse need to know the level of risk of an individual neonate and the manual routine that is adopted in the current clinical practice is found to be cumbersome procedure (Kamińska et al., 2013) (Da Motta et al., 2015). Neonatal cry, the fundamental biological means of communication conveys valuable information to the mother, caretaker as well as the neonatologist in the typical NICU environment (Liu, Li, & Kuo, 2018) (Lubis & Gondawijaya, 2019). The condition of the cry such as wet diaper, hunger, burp, pain further can be exploited to evaluate the level of risk of neonates, high level/ low- level risk at NICU.

The fundamental acoustical properties of the neonatal cry and its corresponding cepstral analysis can be well investigated to distinguish the low-risk and high-risk preterm neonates and to improve the wellbeing of newborns. This specific study suggests an automated mechanism to recognize the low-risk and high-risk preterm neonates in NICU by considering the variants of cry patterns. Four selected clinical conditions Appropriate Gestation Age (AGA), Intrauterine Growth Restriction