Newborn Verification Using Headprint

Shrikant Tiwari, Indian Institute of Technology, Banaras Hindu University, India
Sanjay Kumar Singh, Indian Institute of Technology, Banaras Hindu University, India

ABSTRACT

Missing, swapping, mixing, and illegal adoption of newborns is a worldwide challenge and research done to resolve this issue is minimal and least reported in the literature. Most of the biometric systems developed are for adults and very few of them address the issue of newborn identification. The headprint of a newborn is an important source of data for passive recognition, as they are non-cooperative users of biometries. The objective of this paper is to demonstrate the concept of using headprint recognition for verification of newborns. The main contributions of the research are: (1) The preparation of headprint biometric database of newborn and (2) Performance and analysis of the appearance and texture based algorithm for verification of 200 newborn.

Keywords: Biometric Systems, Headprint, Newborn, Newborn Headprint Database, Recognition

INTRODUCTION

The problem of missing children is a very serious issue throughout the world and seeing the importance of this issue, May 25 is observed as National Missing Children's Day. Dependability and efficiency for newborn recognition are key to the rigorous security essentials to control mixing, swapping, kidnapping and illegal adoption of newborns. The level of security is very essential issue in maternity ward and the problem of missing and swapping of newborns is of prime concern to the persons involved and affected.

There is a common perception in the society that they can do nothing to forbid this inauspicious event. In comparison to developed nations the developing countries are cladding more challenges because of overcrowding and scarcity of medical facilities in the hospital. Every year around 1,00,000 to 5,00,000 newborns in United States is exchanged by mistake, or one out of every eight babies born in American hospitals sent home with the wrong parents (http://www.amfor.net/stolenbabies.html).

According to study, out of 34 newborns that are admitted to a neonatal intensive care unit there are 50% probabilities of incorrect newborns identification only in a single day (http://www.ncmec.org/en_US/documents/InfantAbductionStats.pdf; Gray, Suresh, Ursprung, Edwards, Nickerson, & Shinno, 2006). These are the number of cases that have been accounted, but there may be many more cases that are unviewed or the parents and the children never come to know about this inauspicious
incident. The prime concern is that how the parents can be ascertained that their newborns will not be mixed up in hospital. The proficiency of the identification process explained to identify newborn, hangs the peace of mind of the parents until such time as the newborns shows unmistakable attest of its ancestry.

Hospitals have devised different operations to check that babies are correctly recognized and one of the popular methods is the use of ID bracelets. Soon after the birth ID bracelets are put on babies hands/legs, but this has not been able to provide enough level of security for newborn. The medical technique like Deoxyribonucleic Acid (DNA) typing and Human Leukocyte Antigen (HLA) typing are very effective and precise methods for verifying the individuality of babies but due to the amount of time it takes to process a DNA or HLA sample and the cost associated with it, these methods for verification are not feasible for every newborn. Another method recommended by Federal Bureau of Investigation is foot and finger printing of the child and mother (Stapleton, 1999).

According to survey report 90% of the hospitals in United States perform foot printing of the babies within 2 hours of their birth and hospitals maintain newborn identification form on which footprint of the child and fingerprint of the mother are collected. The prints are broadly collected using ink based methods and then printed on the identification form. Medical and computer scientist have explored the efficiency and authenticity of using footprints for newborns identification and analysis done by Shepard, Erickson, and Fromm (1966) using footprints of 51 newborns was examined by fingerprint experts and they were able to identify only 10 newborn (Thompson, Clark, Salisbury, & Cahill, 1981).

Pela, Mamede, and Tavares (1975) conducted the study on 1917 footprints collected by trained staff of hospital in Brazil. Most of the images picked up provided deficient information for identification of newborns. The American Academy of Pediatrics and others concluded that individual hospitals may continue the practice of foot printing or fingerprinting, but universal application of this practice is not recommended. After footprint, researchers explored the applicability of other biometric modalities such as fingerprint, palm print and ear for verifying the identity of newborn babies (Galton, 1899). Although fingerprint and palm print recognition are well established modalities to recognize adults (over the age of 5 years), they did not achieve good results in identifying newborns. Weingaertner, Bellon, Cat, and Silva (2008) developed a new high resolution sensor for capturing the foot and palm prints of babies. Two images of 106 newborns were collected: one within 24 hours of birth and another at around 48 hours. Fingerprint experts analyzed the data and the recognition accuracy of 67.7% and 83% were obtained using foot prints and palm prints respectively. However, multiple studies have quoted that capturing finger/palm/footprint of newborns is very challenging as it is difficult to hold their hands and legs still. Fields, Hugh, Warren, and Zimberoff (1960) have studied the feasibility of ear recognition on a database of 206% newborns. They manually analyzed the samples and concluded that visually ears can be used to distinguish between two children. In all the methods for identifying newborns, no research has evaluated the performance of automatic identification or verification.

Other biometric modalities that have been extensively studied for adults are face (Li & Jain, 2004) and iris (Daugman, 2007) recognition. Although iris recognition for adults yields very high accuracy (Daugman, 2007), for newborns, it is very difficult to capture iris patterns. The work done on face recognition of newborn reports the accuracy of 86.9% on the database of 34 babies also suffers from facial expression of newborn as the face database consist of crying or sleeping face because it is very difficult to get the normal face (Bharadwaj, Bhatt, Singh, Vatsa, & Singh, 2010). The work done by Lemes, Bellon, Silva, and Jain (2011) demonstrate the use of palmprint using high resolution scanner on the database of 250 newborn has the limitation of good quality image and high cost recognition. Recently Tiwari, Singh, and Singh (2011) tested the identification
Enhanced Knowledge Warehouse
[www.igi-global.com/chapter/enhanced-knowledge-warehouse/14386?camid=4v1a](www.igi-global.com/chapter/enhanced-knowledge-warehouse/14386?camid=4v1a)

Bridging the Industry-University Gap through Action Research
[www.igi-global.com/chapter/bridging-industry-university-gap-through/14252?camid=4v1a](www.igi-global.com/chapter/bridging-industry-university-gap-through/14252?camid=4v1a)