

Detection of Bilirubin for Neonates Using LDR with Machine Learning Algorithm

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Abstract— When a baby has jaundice, their skin, eyes, and other tissues turn yellow. The yellow color was caused by the dissolution of the albumin-bound bilirubin pigment. When hemoglobin is broken down too frequently, the liver cannot eliminate all of the bilirubin. If bilirubin levels in infants are excessively high (10mg/dL or higher), it can damage their brains. When bilirubin turned into toxic dice and travelled to the brain, it caused death. The intrusive technique and the non-invasive technique are the two methods used to detect bilirubin. The two approaches differ in that the intrusive technique required more blood to be examined and was more uncomfortable than the non-invasive technique. The blood's bilirubin content might range from 0.3 to 1.9 mg/100 ml. Over 80% of newborns experience the physiological condition known as neonatal jaundice. A newborn's liver has an undeveloped metabolic capacity and is less able to break down high levels of bilirubin. As a result, hyperbilirubinemia develops. Therefore, regular bilirubin monitoring is necessary to spot newborns who need phototherapy and identify those who are at danger. The current bilirubin continuous measurement apparatus is not more accurate and also more expensive. In this study, we develop a low-cost gadget that continuously monitors bilirubin levels while administering phototherapy. Both work together to prevent infants from receiving insufficient phototherapy. For multi-vital sensing, we also implemented oxygen saturation and heart rate monitoring. Additionally, we need a lot of approval before we can test our equipment. We used a machine learning approach (supervised learning), such as a decision tree or random forest, to simplify this process.

Keywords— Infrared-led, light-dependent resistor, Esp8266, spo2, Heart rate monitor, Microprocessor, Phototherapy, Machine learning, Decision tree algorithm.

Date of Submission: 18-01-2023

Date of acceptance: 03-02-2023

I. INTRODUCTION

An infant's newborn skin and other tissues will appear yellow due to neonatal jaundice or neonatal hyperbilirubinemia. A newborn baby or infant has a significant risk of developing health issues. This happens because the organs and metabolism have just recently begun to mature. Jaundice, a disorder caused by an excessive amount of bilirubin serum in the blood, is one of the most prevalent health issues that infants face. It usually appears five days after birth. The immature infant's liver issue causes this ailment to manifest. In neonates, clinical jaundice is defined as a bilirubin level exceeding 85 $\mu\text{mol/l}$ (5 mg/dL), but in adults, a level of 34 $\mu\text{mol/l}$ (2 mg/dL) would be considered icteric. By blanching the skin with digital pressure to disclose the underlying skin and subcutaneous tissue, jaundice in infants can be identified. Newborns with jaundice exhibit a yellowing of the face that extends to the chest and an apparent icteric sclera. When bilirubin levels rise, jaundice in newborns first manifests in the face before spreading to the trunk and eventually the entire body.

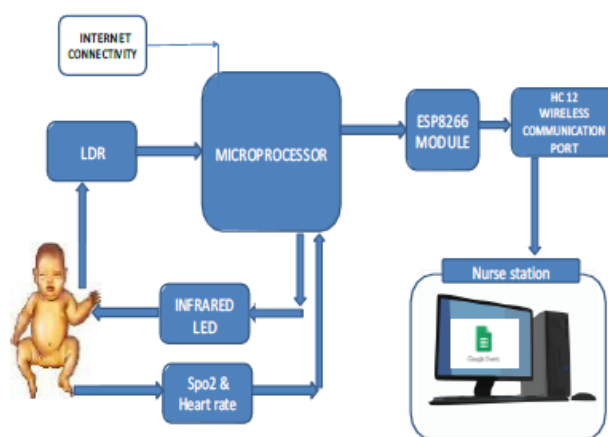
Over half (50–60%) of all neonates experience this syndrome in the first week of life. Jaundice in babies can be identified using invasive or non-invasive techniques. Ingram icterometer and transcutaneous bilirubinometer are used in non-invasive methods. These are the techniques used to gauge the severity of jaundice, though. The processes are manual. By transferring bilirubin from the serum to the skin tissue, transcutaneous bilirubinometry determines the level of bilirubin. Melanin, skin tissue maturity, haemoglobin, and bilirubin all contribute to skin reflectance in babies. The results' quality is also influenced by the measurement that is being done. The best association between measurements of the forehead and sternum and serum bilirubin has been found. Transcutaneous bilirubinometry has the benefit of being non-invasive. Therefore, we anticipate that transcutaneous bilirubin measurement will result in a decrease in consequences such as infections or osteomyelitis.

When bilirubin levels in a baby's blood reach risky levels, bilirubin may transfer to the brain and result in either temporary harm (known as early acute bilirubin encephalopathy) or permanent damage (called kernicterus). Severe hyperbilirubinemia can be avoided by regularly checking on newborns who are at high risk for jaundice and by treating them early. Thus, the purpose of this essay is to advocate for infant jaundice monitoring as a new first aid. The experimental findings show that the suggested strategy can reduce morbidity and death more than the established method.

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II. FRAME WORK



IV. METHODOLOGY

Babies are occasionally born abnormally or unwell for a variety of reasons. In many nations, a test known as the newborn screening (NBS) test can be used to identify certain conditions. Newborn screening (NBS) is the procedure used to check newborns for metabolic problems, genetic illnesses, endocrine, treatable genetic, hematologic, or blood conditions. It is also known as the Guthrie Test, the Neonatal Screening Test, and the Infant Screening Test. Jaundice is one of more than 30 uncommon illnesses that can be identified through testing. There are several techniques for spotting jaundice. The continuous monitoring of neonatal bilirubin levels is the proposed methodology. We put up the device with a LDR and an infrared led to provide a good set of findings (IR). Blood testing are another technique that yields precise and encouraging results. There are guidelines and measures to follow in this test. In this study, the second stage of testing— after centrifugation—used an IR sensor to detect bilirubin to separate the baby's blood's corpuscles and serum. An infrared sensor that receives the light reflected from the sample serves as the raspberry pi's input. To ensure light persistence, light is delivered through the sample that was obtained.

Light intensity is measured using a Light Dependent Resistor (LDR). If a fast rising bilirubin is anticipated and jaundice has been present for less than 24 hours, phototherapy should be started right away.

Phototherapy using light-emitting diode (LED) light sources reduces serum total bilirubin levels as effectively as phototherapy using conventional light sources like halogen or compact fluorescent lamp (CFL). We can manually adjust (raise or reduce) the light intensity using a potentiometer in accordance with the severity of the condition as determined by the doctor's diagnosis. A potentiometer regulates the current that flows through the LEDs, which in turn affects how intense they are. The LDR can quickly measure the IR sensor's light output's intensity.

We have built this system with associated devices for measuring basic parameters like spo2 and heart rate to lessen the workload of the nurses. Here, the data are kept in a Google sheet for both future reference and constant measurement (to cut down on insufficient phototherapy). In order to detect the method, such as the amount of time needed for the treatment and the wavelength needed for the progression of outcomes, we applied machine learning technology, or the decision tree algorithm. Following diagnosis, the observed data findings that reveal the disease's state will be displayed on an LCD display.

V. LITERATURE REVIEW

1. Vinod K Bhutani¹, Ann R Stark, Laura C Lazzeroni, Ronald Poland, Glenn R Gourley, Steve Kazmierczak, Linda Meloy, Anthony E Burgos, Judith Y Hall, David K Stevenson developed Initial Clinical Testing Evaluation and Risk Assessment for Universal Screening for Hyperbilirubinemia Study Group is Predischarge screening for severe neonatal hyperbilirubinemia identifies infants who need phototherapy. The proposed system is to test whether the combined use of total plasma/serum bilirubin (TSB) levels and clinical risk factors more accurately identifies infants who receive phototherapy than does the use of either method alone. The system is invasive method used to identify the total plasma/serum bilirubin and also predict the other clinical factors accurately and has less prediction. The results shows that of 1157 infants, 1060 (92%) completed follow-up, and 982(85%) had complete datasets for analysis.

1. Nienke Bosschaart¹, Joke H Kok, Astrid M Newsum, Dagmar M Ouweneel, Rosaline Mentink, Ton G van Leeuwen, Maurice C G Aalders proposed the Limitations and opportunities of transcutaneous bilirubin measurements. Transcutaneous bilirubin bilirubinometry defines the amount of bilirubin by transferring from serum to the skin tissue. In infants, melanin, maturity of skin tissue, hemoglobin, and bilirubin is used in the skin reflectance. The measurement taking place also reflects in the quality of the results. Measurements taken on foreheads and sternum have proved the best correlation with serum bilirubin. The advantage of the transcutaneous bilirubinometry is its non-invasive. Therefore, we expect that the measuring of transcutaneous bilirubin is result in reducing the complications such as infections or osteomyelitis. Although transcutaneous bilirubinometers have existed for over 30 years, the clinical utility of the technique is limited to a screening method for hyperbilirubinemia, rather than a replacement for invasive blood sampling. In this study, they investigate the reason for this limited clinical value and address possibilities for improvement. The results shoes the TcB correlated well with the total serum bilirubin concentration (TSB) ($r = 0.88$) with an uncertainty of 55 $\mu\text{mol/L}$. The BVF in the measured skin volume ranged between 0.1% and 0.75%. thus, The limited clinical value of current bilirubinometers can be explained by the low BVF in the skin volume that is probed by these devices. Because the TcB depends for over 99% on the contribution of extravascular bilirubin, it is a physiologically different parameter from the TSB.

2. Ichiro Morioka introduced Hyperbilirubinemia in preterm infants in Japan: New treatment criteria. The paper has the three revised points areas follows: (i) newborns are classified under gestational age at birth or corrected gestational age, not birth weight;(ii) three treatment options were created: standard phototherapy, intensive phototherapy, and albumin therapy and/or exchange blood transfusion; and (iii) initiation of standard phototherapy, intensive phototherapy, and albumin therapy and/or exchange blood transfusion is decided based on the total serum bilirubin and serum unbound bilirubin reference values for gestational weeks at birth at <7 days of age, and on the reference values for corrected gestational age at ≥ 7 days of age. Studies are needed to establish whether chronic bilirubin encephalopathy can be pre-vented using the 2017 revised Kobe University treatment criteria for preterm infants in Japan.

3. Onishi S, Isobe K, Itoh S, Manabe M, Sasaki K, Fukuzaki R, Yamakawa T developed metabolic bilirubin and its photoisomers in the biological fluids of a hyperbilirubinaemic newborn infant before and during phototherapy were analyzed by a recently improved HPLC method. In the serum, the percentages of (EZ)- and (ZE)- bilirubin in the total bilirubin concentration before phototherapy were approximately 10% and on average increased over 1.5-fold at 2 h after initiation of phototherapy. The percentage of the (EZ)-cyclobilirubin in the serum bilirubin was under 1%. In the bile, the mean concentration of (ZZ)-bilirubin, derived mainly from (ZE)-bilirubin, nearly tripled during phototherapy. The (EZ)-cyclobilirubin concentration in the bile was very low before phototherapy, increased nearly ten-fold at 3 h after initiation of phototherapy, and was 5- to 6-fold as high as that of (ZZ)-bilirubin. In the urine, upon exposure to light, the urinary concentration of (EZ)-cyclobilirubin is apparently equivalent to half of the biliary concentration of (ZZ)-bilirubin and one-fifth of that of (EZ)-cyclobilirubin. It was concluded that during phototherapy of neonatal hyperbilirubinaemia the structural photoisomer [(EZ)-cyclobilirubin] predominates considerably over the geometric photoisomer [(ZE)-bilirubin].

4. Vinod K. Bhutani, MD; Glenn R. Gourley, MD; Saul Adler, MD; Bill Kreamer, BS; Chris Dalin, MTASCP; Lois H. Johnson, MD Noninvasive Measurement of Total Serum Bilirubin in a Multiracial Predischarge Newborn Population to Assess the Risk of Severe Hyperbilirubinemia demonstrates that Non-invasive measurement of total serum bilirubin in a multiracial predischarge new borne population to assess therisk of severe hyperbilirubinemia In this paper, The data demonstrate the accuracy and reproducibility of the predischarge Bili Check measurements in term and near-term newborn infants of diverse races and ethnicities. Infants with predischarge Bili Check values above the 75th percentile of hour-specific TSB values on the bilirubin nomogram may be considered to be at high risk for subsequent excessive hyperbilirubinemia. Further studies are needed to assess the efficacy of this technique in preterm infants, those undergoing phototherapy, and those with TSB values of ≥ 15 mg/dL ($\geq 256 \mu\text{mol/L}$). 75% of an hour specific should be considered at high risk for developing excessive hyperbilirubinemia. It uses multiwavelength spectral analysis. This method is not much efficacy for preterm infants and difficult for preterm infants to

undergo phototherapy.

5. Mansor, M. N. 1, Yaacob, S. I. 1, Hariharan, M. 1, Basah, S. N. 1, Ahmad Jamil, S. H. F. S. 2, Mohd Khidir, M.

L. 2, Rejab, M. N. 2, Ku Ibrahim, K. M. Y. 2, Ahmad Jamil,

A. H. F. S. 2, Junoh, A. K. I. 1, Saad, S. A. I. developed Jaundice in Newborn Monitoring using Color Detection Method. This paper the development of a jaundice-detection system involves the following three tasks: (a) the extraction of skin feature information from video recordings of infants monitored for jaundice, (b) the selection of quantitative features that convey some unique behavioral characteristics of neonatal jaundice such as mean, standard deviation, skewness, kurtosis, energy and entropy and (c) validation test to distinguish between jaundice and normal newborn infant. The long-term goal of this research is the development of a stand-alone automated system that could be used as a supplement in the NICU to provide 24-h/day noninvasive. The goals of this paper are to promote a new first aid of jaundice newborn monitoring. A simple color detection method was employed to study the behavior of the infant. The experimental results reveal that the proposed method can minimize the morbidity and mortality than the conventional method.

6. Peter Szabo, Martin Wolf, Hans Ulrich Bucher Jean, Claude Fauchere, Daniel Hanensee Romaine Arlettaz proposed the Detection of hyperbilirubinemia in jaundiced full-term neonates by eye or by bilirubinometer. The aim of this study was to compare predictions of hyperbilirubinaemia by eye, performed by trained physicians and nurses, with predictions obtained using two commercial bilirubinometers. Hyperbilirubinemia defined as a serum bilirubin concentration $>250 \text{ Lmol/l}$, is a frequent problem in neonates. As a consequence, serum bilirubin measurements are the standard method to assess jaundiced neonates. It is unfortunately invasive, painful and costly. To overcome these drawbacks non-invasive methods of bilirubin measurements have been proposed.

7. Mohd Azrul Hisham Mohd Adib, Mohd Hanafi Abdul Rahim, Nur Hazreen Mohd Hasni, introduced The Development of bilirubin jaundice (Bili dice) device for neonates. In this paper, the bilirubin jaundice so-called BiliDice device is proposed. The device consists of three main components: RGB colour sensor, microcontroller, and LCD display. The advantage of this prototype is affordable and portable. This device is simple, easy to handle, fast and accurate readings for the bilirubin level of the newborn. In this study, the BiliDice device is successfully developed by using the non-invasive method as shown in Figure 2. The infected area is irradiated with light of specific wavelength and change in properties of light after reflection from the skin is noted. In order to detect neonatal jaundice, Light Emitting Diodes (LED) of a specific wavelength is employed as a source of light, which is an occurrence on baby skin. The light is reflected back and absorbed by photo-detector. However, this BiliDice device is still in the early development with positive progress. The device is also simple, and easy to use.

8. Nurashlida Ali, Siti Zarina Mohd Muji, Zuhairiah Zainal Abidin proposed A Review of Non – Invasive Jaundice detection using Optical Technique in Neonates. In this paper non-invasive technique of bilirubin detector proposed. This non-invasive technique will be less painful, reduce turnaround time and easy to handle. The non-invasive bilirubin detection using optical technique is a better solution to eliminate the baby trauma in the process of jaundice detection. The purpose of this project is to improve and adapt methodology of continuous diagnostic for newborn and accuracy of early detection bilirubin. The automated systems enable detection of sensor, measurement concentration bilirubin and alarm for home monitoring.

9. L. C. Ku, N. S. M. Lazim introduced Direct Photometry Non Invasive Bilirubin Device. In this paper detection of jaundice in early stage can be predicted by using invasive method. Due to demand in our latest technology and without painful, a new device is designed to determine jaundice by using direct photometry. Non-invasive bilirubin device which is more preferable and painless for testing to the baby. By using this non-invasive bilirubin device, it can save time, user friendly, affordable, painless and can make a harmony situation without any pricking needle is needed to determine the level or readings of the jaundice among baby. A system is developed in designation of spectrophotometer sensor by building two different wavelengths which are 455 nm and 575 nm. The device can indicate the three conditions of jaundice: normal, mild and critical level with LED light. This new technology of product can enlighten the effort of Pediatrics Units.

10. Fahmi Akmal Dzulkifli, Mohd Yusoff Mashor and Karniza Khalid developed Methods for Determining Bilirubin Level in Neonatal Jaundice Screening and Monitoring: A Literature Review. In this paper This paper aimed to provide a comprehensive review of various methods of non-invasive screening and monitoring of neonatal jaundice which includes the light wavelength absorption or reflectance technique, optical technique, electronic equipment and image processing technique. Despite the TSB invasive technique, it is the gold standard diagnostic and monitoring method for bilirubin measurement. TcB is a non-invasive measurement method requiring a specialized meter. The spectrum of optical signal reflected from the newborn's subcutaneous tissues is analysed by a specialised meter analyses. This technique differentiates the yellow discoloration on a blanched skin as an estimate of jaundice, as compared to the direct quantification in the TSB method [31]. The TcB technique aimed to reduce the frequency of invasive procedures for bilirubin

determination in the clinical setting, which can be distressing to the newborn and the parents. A technology that is more reliable, safe and accurate in measuring the serum bilirubin in the newborn is possible with the thriving development of electronic gadget and technological advancement. The trend of health sensing through smartphones has received growing attention among the community of researchers as a medium to screen diseases. The existence of Internet of Things (IoT) in the medical field advocates a smart healthcare system in monitoring and tracking individual health status. It is hoped that in the near future, the development of an accurate and feasibly cost-effective, non-invasive device applying the use of smartphones may be developed as a superior technique to the current, routine, invasive methods in the clinical setting in the management of neonatal jaundice.

11. Hongyu Chen Mengru Xue, Zhenning Mei, Sidarto Bambang Oetomo and Wei Chen proposed A Review of Wearable Sensor Systems for Monitoring Body Movements of Neonates. Characteristics of physical movements are indicative of infants' neuro-motor development and brain dysfunction. For instance, infant seizure, a clinical signal of brain dysfunction, could be identified and predicted by monitoring its physical movements. With the advance of wearable sensor technology, including the miniaturization of sensors, and the increasing broad application of micro- and nanotechnology, and smart fabrics in wearable sensor systems, it is now possible to collect, store, and process multimodal signal data of infant movements in a more efficient, more comfortable, and non-intrusive way. This review aims to depict the state-of-the-art of wearable sensor systems for infant movement monitoring. In this review they focus on infant's movement monitoring. Thus, mobility characteristics include position, motion, posture, activity, motor behavior, moving, eye deviation, fixed open stare, blinking, apnea, cycling, boxing, stepping, swimming movement of limbs, mouthing, chewing, and lip smacking. With the development of sensor technology and wireless communication technology, the research on movement monitoring with wearable sensor systems for infants has made a lot of progress. Wearable sensor systems are becoming smaller, more intelligent, and many of them are commercially available. With the development of sensor technology and wireless communication technology, the research on movement monitoring with wearable sensor systems for infants has made a lot of progress. Wearable sensor systems are becoming smaller, more intelligent, and many of them are commercially available.

12. Hashim, W.; Al-Naji, A.; Al-Rayahi, I.A.; Alkhaleel, M.; Chahl, J. Neonatal Jaundice Detection Using a Computer Vision System implies In this paper, a developed system based on a digital camera was proposed to diagnose and treat jaundice in newborns. The system detects jaundice and determines if the neonate needs treatment based on the analysis obtained from the real-time captured images. The treatment was achieved by using an Arduino Uno microcontroller to drive phototherapy lighting, which has proven to be an efficient treatment method for jaundice. In addition, the proposed system has the ability to send the diagnostic results to the mobile phone of the care provider. The obtained results from 20 infants inside the intensive care unit showed that the proposed system was accurate in terms of detecting jaundice, easy to implement, and affordable. The proposed system decides efficiently whether the neonate has jaundice or not. If jaundice is detected, the system starts the phototherapy by switching a blue LED light ON. The functionality and reliability of the proposed system were investigated and tested in three different scenarios. Moreover, the effect of skin color, camera distance, and ambient lighting on the system's performance was also considered. The proposed system has several advantages over the other proposed system found in literature, including that it is effective in detecting jaundice at a TSB level of 14 mg/dL and above, the detection time is only 1 s, and it can be used in hospitals and medical centers where laboratory facilities and trained medical staff are not available, due to its low cost.

13. Zulfadhli Osman, Afandi Ahmad and Azlan Muharam implemented Rapid prototyping of neonatal jaundice detector using skin optics theory. This project concerns with the quantification of neonatal jaundice level using Simulink model-based design. It is important to address that the proposed method is non-invasive, hence suitable for infants. In this project, the concentration level of bilirubin in dermis layer of skin has been detected using skin optic theory with light emitting diode (LED) and photodiode as a detector. To evaluate the proposed system, a mock skin soaking is used to replace the real infant's skin. At the system level, Arduino Uno has been used as a hardware platform, whilst MATLAB and Simulink have been fully utilised to implement the system's architecture. An evaluation of the proposed systems reveals its capability to detect, process and display real-time results with three (3) levels of jaundice, including normal, mild and critical. It is also important to address that the proposed prototype was non-invasive, hence relevant for new born baby.

14. S, B. N., & T. S., S. A. (2022). Detection and Classification of Neonatal Jaundice Using Color Card Techniques. This paper reviews the most recent suggestions to determine and medicate neonatal jaundice. The scope of the study includes exploring various techniques for skin detection, feature extraction, image fusion, feature selection, and classifier construction. Several challenges, such as handling large amounts of data, data and image integration, and image mining with the clinical system, are being addressed. Enhancement of medical data mining will be the objective of many research societies. The feature selection method from

computer vision plays an important role in the image of medical data. It includes feature extraction, feature selection, and classification by machine learning. Some of the image preprocessing techniques are implemented on image data before applying machine learning methods to reduce the complexity and make the computation fast, easy, and simple. Therefore, the implementation of computer vision techniques and machine learning methods on medical data helps to provide early prediction and classification. The diagnosis of the disease using these methodologies will boost the accuracy.

15. Dissaneevate, Supaporn & Wongsirichot, Thakerng & Siriwat, Pittaya & Jintanapanya, Nutchaya & Boonyakarn, Uakarn & Janjindamai, Waricha & Thatrimontrichai, Anucha & Maneenil, Gunlawadee. (2022). A Mobile Computer-Aided Diagnosis of Neonatal Hyperbilirubinemia using Digital Image Processing and Machine Learning Techniques. The propose a Mobile Computer-Aided Diagnosis (mCADx) tool to identify the Neonatal Hyperbilirubinemia symptom using advanced digital image processing and data mining techniques. The mCADx was developed in a cross-platform environment. The mCADx works with smart devices run on either iOS or Android operating systems. With ethical committee approval, we collected and studied image data of 178 infant subjects with different jaundice severity levels. The severity of the disease was examined from blood test results, which were annotated by medical specialists. Data mining techniques included Decision Trees, k Nearest Neighbor, and the Conventional Neural Network was investigated in the dataset. An in-depth comparison between techniques was performed and discussed. The classification results in CNN gained the highest accuracy at 0.8099, 0.9251, 0.8086. This novel work can assist in identifying Neonatal Hyperbilirubinemia in newborns after discharging from the hospital.

16. Johanna Viau Colindres , Corey Rountree, Marie André Destarac, Yiwen Cui, Manuel Pérez Valdez, Mario Herrera Castellanos, Yvette Mirabal, Garrett Spiegel, Rebecca Richards-Kortum, Maria Oden A prospective randomized controlled study comparing low-cost LED and conventional phototherapy for the treatment of neonatal hyperbilirubinemia. In this paper the objective was to carry out a prospective, randomized, single-blind study to evaluate whether light emitting diode (LED) phototherapy using a low-cost set of lights is as effective as conventional photo-therapy in treating hyperbilirubinemia in neonates. The study included 45 pre- term neonates requiring phototherapy as per American Academy of Pediatrics guidelines; participants were randomized to receive phototherapy using LED-based lights, conventional fluorescent blue lights or conventional halo-gen lights. There were no statistically significant differences in the average bilirubin levels at the onset, at the maximum and at the end of treatment, nor in the duration of phototherapy treatment and the rate of decrease in bilirubin levels in the neonates receiving conventional fluorescent blue light, conventional halogen light and LED phototherapy. In this pilot study, LED phototherapy using a simple, low-cost set of lights was as effective as conventional phototherapy in the treatment of neonatal hyperbilirubinemia. such lights may enable phototherapy to be safely and reliably delivered in low- resource settings.

17. Imant Daunhawer, Severin Kasser, Gilbert Koch, Lea Sieber, Hatice Cakal, Janina Tütsch, Marc Pfister, Sven Wellmann and Julia E. Vogt developed Enhanced early prediction of clinically relevant neonatal hyperbilirubinemia with machine learning. In this study, machine learning (ML) is applied to enhance the early detection of clinically relevant hyperbilirubinemia in advance of the first phototherapy treatment. ML shows great potential in clinical applications and in pediatrics it has been successfully applied for an improved early detection of late-onset neonatal sepsis based on medical records, and of neonatal seizures based on EEG data. Hence, the goal is to draw on the predictive power of state-of- the-art ML methods to provide an early identification of neonates at risk of developing clinically relevant hyperbilirubinemia, and thereby enhance the timing of bilirubin measurements and of phototherapy treatment initiation in practice.

18. Duarte Ferreira, Abílio Oliveira and Alberto Freitas proposed Applying data mining techniques to improve diagnosis in neonatal jaundice. This project Hyperbilirubinemia is emerging as an increasingly common problem in newborns due to a decreasing hospital length of stay after birth. Jaundice is the most common disease of the newborn and although being benign in most cases it can lead to severe neurological consequences if poorly evaluated. In different areas of medicine, data mining has contributed to improve the results obtained with other methodologies. Hence, the aim of this study was to improve the diagnosis of neonatal jaundice with the application of data mining techniques. Different attribute subsets were used to train and test classification models using algorithms included in Weka data mining software, such as decision trees (J48) and neural networks (multilayer perceptron). The accuracy results were compared with the traditional methods for prediction of hyperbilirubinemia. the results shows that The application of different classification algorithms to the collected data allowed predicting subsequent hyperbilirubinemia with high accuracy. In particular, at 24 hours of life of newborns, the accuracy for the prediction of hyperbilirubinemia was 89%. The best results were obtained using the following algorithms: naive Bayes, multilayer perceptron and simple logistic. they conclude The findings of our study sustain that, new approaches, such as data mining, may support medical decision, contributing to improved diagnosis in neonatal jaundice.

19. Nahar, Nazmun & Ara, Ferdous. (2018). Liver Disease Prediction by Using Different Decision Tree

Techniques. The objective of this study is liver disease prediction using data mining tool. The main task in this study is: • Various decision tree techniques are used for the Prediction of the liver disease. • Comparing different decision tree techniques. • Finding best decision tree for the liver disease prediction. The study employed some decision tree algorithm such as J48, LMT, Random Forest, Random tree, REPTree, Decision Stump and Hoeffding Tree to predict the liver disease at an earlier stage. These algorithm gives various result based on Accuracy, Mean Absolute Error, Precision, Recall, Kappa statistics and Runtime. These techniques were evaluated and their performance was compared. From the analysis, Decision Stump outperforms well than other algorithms and its achieved accuracy is 70.67%. The application of Decision tree in predicting liver disease will benefit in managing the health of individuals. However, in future, we will collect the very recent data from various regions across the world for liver disease diagnosis. The results of this study will encourage us to continue developing other advanced decision trees such as CART.

VI. APPLICATION

- The application of detection of bilirubin is used in hospitals and research industries, no need of human assistance.
- It is useful for domestic purposes and has a simple mechanism.
- It is useful in remote places can be carried everywhere.
- It's a needleless method can be used every safely and in efficient way.

VII. CONCLUSION

An analytical summary of the technical developments in the field of neonatal jaundice detection and treatment is given in this review article game store. Due to the fact that infant jaundice is a very widespread condition worldwide, more research and innovations have been possible to increase effectiveness. The survey highlights 10 such developments where scientific application of the designs has been researched and improved the effectiveness of infant jaundice detection and treatment. Through the study, technologies including image processing, wsn, artificial neural networks, regression approaches, and data management have once again demonstrated their efficacy. The cost and productivity of the newly developed systems were the main issues during the analysis of these developments. While some of them were able to be made to work quickly, the others appeared to have some cost-effectiveness problems. The examination of these developments has demonstrated another another aspect of the flexibility and changeability of medical technology. When it comes to effective treatment, medical science and technology go hand in hand, with increasingly president using both manpower and machinery.

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