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Computer Vision for Jaundice

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Annotation: Physiological jaundice occurs in the first week of life in newborns due to the increase in bilirubin level which leads to yellowish discoloration of skin and sclera. Sever jaundice and toxic level of bilirubin can cause brain damage as bilirubin exists in the central nervous systems.

Invasive detection can cause blood loss and leads to anemia, especially when repeated blood tests are required. Blood tests put the infant at risk of infection. The proposed system uses the mobile camera as a color-based screening tool because it is affordable, objective, ubiquitous, and less painful for infants. Based on the color analysis obtained from the captured images, jaundice was detected.

Keywords: Physiological jaundice, Blood tests, jaundice.

Chapter One

Introduction

Jaundice refers to a yellowing of skin or the whites of the the eyes. This condition is very common among newborns due to the inefficiency of the immature liver in metabolizing bilirubin. Bilirubin is produced when old red blood cells are broken down. In fact, the human body is constantly producing new red blood cellsRBCs in an adult last about 120 days, but in newborns they last for a much shorter period. Thus, newborns have higher than normal red blood cell counts, which leads to higher levels of bilirubin as more red blood cells are broken down.

There are different methods for diagnosing jaundice: the most ideal way to determine the level of hyperbilirubine- mia is to measure total serum bilirubin (TSB), which is performed by taking blood samples .And there are non-invasive methods: One example of a non-invasive method is the determination of bilirubin in the blood based on appearance.

Diagnosis

There are different methods for diagnosing jaundice:

1. Invasave method (TSB): Measurement of Total Serum Bilirubin Levels The TSB is measured using a micro blood sample which is based on spectrophotometry. It's particularly useful in neonates because bilirubin is mostly unconjugated. Since repeated blood sampling can cause anemia, pain, it is discomfort, stressful for parent and time-consuming.
2. Non invasive (TCB): The TCB is a convenient alternative to TSB estimation, and it can cut blood sampling by nearly 30%. However, TCB systems are costly, and the consumables such as disposable tips and other products have a large recurring expense. The TCB test can be done on infants that are 35 weeks or more of gestation after 24 hours. TCB is ineffective in babies born before 35 weeks of gestation and in the first 24 hours after birth.

Treatment

1. Phototherapy: One of the most effective treatments for neonatal jaundice is phototherapy. More than 20 years earlier The key justification for using phototherapy is to avoid needing to use exchange transfusions. one could now assume that phototherapy is the main treatment process . The ultimate purpose of phototherapy is to lower or stop the current level of circulating bilirubin from increasing. This can be accomplished by using light energy to alter the form and structure of bilirubin, allowing it to be transformed into molecules that can be excreted even when regular conjugation is inadequate . Light absorption by dermal and subcutaneous bilirubin causes a fraction of the pigment to undergo a series of photochemical reactions, each of which occurs at a different rate .
2. Blood transfusion: When severe jaundice does not respond to other treatments, the child needs to replace his blood with a transfusion of new blood.

Chapter two

Literature Review

In this section, we provide a summary of some of the research focused on the diagnosis of jaundice in neonates.

Penhaker etal. proposed the design of a cost-effective electronic instrument that measures bilirubin level .The proposed design uses light transmission through the skin of infants.

a new technique for screening neonatal jaundice by Mreihil etal. based on solid images was proposed. The technology uses a camera ,Captured images were analyzed using MATLAB and a custom color chart was used as reference.

Another study by Ali et al. presented an algorithm for diagnosing the inherited condition of constitutional jaundice. The algorithm has two parts, using the Wavelet transform to analyze the images is the first part, and calculating the percentage of gray scales for each image across the histogram is the second part.

Chapter Three

Materials and Methods

Introduction

This chapter introduces hardware and software that is used in jaundice detection systems in terms of auto -mated skin detection and real-time implementation.

1-Hardware

a-The Arduino used in the practical part of the project, it is the Uno type.

The Arduino Nan is a complete and breadboard-friendly device based on ATmega328P

microcontroller that is used in many medical applications due to its availability, small size, low cost,

efficient interrupt structure and ease to programming with an open-source software using an integrated

development environment (IDE) . The Arduino Nano microcontroller has 8 analogue input pins

with a resolution of 10 bits, 14 digital I/O pins and 6 pulse width modulation (PWM) pins with the clock frequency of 16MHz. This microcontroller can be easily linked with the Matlab brogram via Mini- USB serial cable.

b- blue led light According to the hardware design of the proposed system, a 5 V blue LED light that is supplied with power and controlled by the Arduino was used. According to the neonate condition, the blue LED turns ON if the neonate is detected with jaundice, and turns OFF otherwise.

c- Jumper Wires and USB cable to connect Arduino with computer.

2-SoftWare:

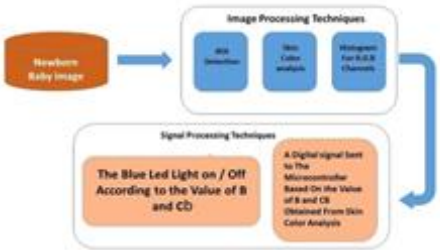
a-Matlab This section explains how the proposed jaundice detection system could be used to determine whether

the infant requires UV therapy or not based on skin color analysis. The selected ranges for jaundice

and non-jaundice skin were used by the MATLAB 2020a environment and determined the skin state and sending a digital output (1 or 0) to the microcontroller circuit that

controls the blue LED light. The proposed MATLAB GUI panel was carried under the Microsoft

Windows 10 operating system with user (doctor or nurse) to load infant image samples, manually select ROI and execute the algorithm to determine the skin state and whether it requires UV therapy or not.



Block Diagram showing how to detect jaundice

b-Arduino software The IDE is open-source software that is used to write codes and upload them to the Arduino board. The environment is programmed easily using the C or C++ language and it runs on Windows, Mac OS X, and Linux, the IDE software was used to program the Arduino UNO that controls the blue LED light .

Chapter Four

Result

Introduction

This chapter discusses the practical results of the proposed detection system. These results were obtained using infant's photos downloaded from the internet.

Experimental results of jaundice detection After download the image of baby from dataset we determine the ROI manually, the matlab analyze the skin color, RGB and Cb then the results of the skin color analysis, the histogram, the diagnosis result, the need for phototherapy, and the state of the blue LED light information are all displayed on the GUI. The system starts downloading

It will compare the result of the analysis of the blue and Cb color with threshold that is specified by the user(100).If the percentage is less than 100,it will be detected that the child.

Has jaundice (run The blue LED that represents phototharepy) and if it is more than100, then the detection is normal and the child not need phototherapy.

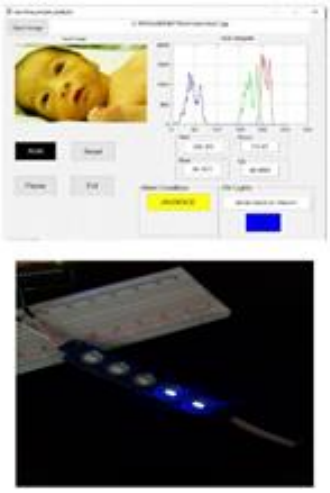


Fig 1.The result when the child with jaundice

a) the GUI result

b) The BLUE LED ON

Fig 2. The result when the child without jaundice

Discussion

Jaundice is one of the common diseases among children in the first day of birth, since the examination process is a painful process for a child that causes blood losses, a system was proposed to detect jaundice using computer vision using the matlab program. Through the implementation of the system, good results were obtained for the proposed system without need of blood analysis. The propsed system easy to apply, inexpensive and comfortable for the child.

Chapter five

Conclusion

Infant jaundice is a yellow discoloration of the skin and eyes of a newborn baby. Infant jaundice occurs because a baby's blood contains an excess of bilirubin, a yellow pigment from red blood cells after using the system,we concluded that the system works well.If the child has jaundice,the infection is detected and the automatic treatment unit is activated.

Development

there are several suggestions or ideas for developing the system, for example, determining the area of interest(ROI) automatically, and photographing the child through

direct imaging technology at the moment of examination and the use of Wi-Fi technologhy to send a medical diagnosis of a child to the attending physician, or to send a child’s case to the parents so that thay are informed of the results of the examination .

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