International Journal of Scientific Research and Engineering Development-– Volume 4 Issue 3, May- June 2021
Available at www.ijsred.com

RESEARCH ARTICLE OPEN ACCESS

An In-depth Review on Blood Donation Interval Intimation Systems

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***Abstract* — Blood donation is one of the noblest tasks that can be performed by an individual in good health. The donation of blood can save a lot of lives of individuals such as patients, trauma, and accidental victims. These individuals are either going through a complex surgery or have been through the trauma which leads to a lot of blood loss. Blood is always in demand and there is a scarcity of blood every time. This is due to the lack of donors and the low shelf life of blood. There is also a generalized approach that is utilized for the duration between the donations that makes the donors wait for an unnecessarily long time between donations. The process of determination of the donation interval is a highly complex and convoluted process. It is dependent on various attributes and parameters such as the age weight and other health-related aspects of the donor. This cannot be effectively calculated by a medical professional as it would take an inordinate amount of time and resources for this calculation to be performed. Therefore a number of researchers have been effectively identified and studied for the blood donation interval calculation and the implementation of machine learning algorithms has been reached. This approach utilizes K Mean Clustering and Pearson Correlation along with Deep Belief Neural Networks and Decision Tree. The approach will be elaborated further in the upcoming researches on this topic.**

Keywords:*K-Mean Clustering, Pearson Correlation, DBN, Decision Tree*

I INTRODUCTION

Blood is one of the most useful substances in the body of the majority of the organisms on this planet. The various cells in the body are constantly working round the clock to keep the organism alive. These cells are composed of various chemicals and other organic proteins that perform regular maintenance in the form of wear and tear. These cells require constant nourishment with the exact requirements. These requirements are fulfilled by the various processes in the body and these chemicals are produced in the requisite amount. There is a need to transport these chemicals across the body and fulfill the needs of the various organs in the body.

The cells of the body also have the standard requirements to be completed in order to attain the proper functioning of the various organs. These requirements are essential, such as oxygen, transport of the energy, and the waste byproducts of the processes. This is achieved through the realization of the blood which flows through every corner of the body. The blood acts as a carrier of the nutrients and oxygen that is required by all the organs and cells of the body. The blood transports these nutrients from the source and to the destination and forms one of the most effective mechanisms that keep an organism alive.

The blood flows through channels across the whole body. Therefore, any large breach or trauma to any part of the body can quickly create a leak that can drain the life-giving substance to be lost. This is an undesirable circumstance as blood is vital for the survival of the individual. A marginal blood loss is sustainable as the body can replenish small amounts of blood loss effectively in a few days. But large amounts of blood could be problematic to sustain as the blood won't be replenished in time to save the individual from death. This is the reason why accidental victims and other individuals such as the ones going for an extended surgery require additional blood to sustain themselves through the blood loss.

The blood that is provided to these individuals is the blood donated by other healthy individuals that can save a life of a patient or a victim. It has been said that 300 ml of blood has the capability to save the life of 3 individuals. This is a highly noble cause, as the blood loss due to donation will be readily be rejuvenated by the donor's body in a short time. This window is unique to every individual and depends on the various factors and attributes of the individual.

The blood donation interval that is usually followed is a gross generalization of this fact and a duration of 6 months is provided as a safe upper limit and the recommended duration between the donations. This is a long time that takes into account the generalizations that do not affect a healthy

individual and their ability to achieve replenish the donated blood. There is a large gap between the blood requirement on a daily basis and the blood that is available to the individuals. This means that the gap between donations can be effectively personalized to achieve effective improvement in the state of the blood banks across the country.

This a highly complicated task that requires the complex evaluation of the various factors and attributes to achieve the effective realization of a personalized blood donation interval. These donations are essential for the purpose of fulfilling the ever-increasing blood requirements. There have been a large number of researches that have been performed for the purpose of enabling effective blood donation intervals. These approaches have been studied in detail to achieve the realization of our approach that implements machine learning techniques for effective and accurate blood donation intervals.

This literature survey paper dedicates section 2 for analysis of past work as a literature survey, and finally, section 3 concludes the paper with traces of future enhancement.

II RELATED WORKS

Mohamad Darwiche et. al. introduced a method for the forecast of blood transfusion donation. In this blood donation forecast study, a single hidden layer architecture with sigmoid-type activation functions was selected. The neuron numbers in the hidden layer are relevant to the interval [2; 15]. The MLPs are competent in the training phase with the Levenberg-Marquardt algorithm. There are four indices, applied with a PCA in SVM, that could accurately estimate 65.8 percent sensitivity blood transfusion donations and 78.2percent accuracy in a prospective sample of 148 patients theses indices are months after the last donation, total blood donation, total blood donated in c.c., months from the first donation[1]. Besides, the UCI corpus blood transfusion donation was processed differently from the original marketing system. This latest corpus may also provide a new training set for potential research and development in machine learning approaches.

Rohini Patil et. al. proposed a system that facilitates the protection of blood donors against various reactions during donation with the help of data mining techniques. The system categorizes the response into different groups according to response type and symptoms. To date, a consistent donor prevention strategy has been applied in this setting against their response. Often blood donors seek advice from web-based applications that improve security. This system helps blood donors receive information about instant blood donation calls using email [2]. The output of the system will be suggestions for donor feedback. The researcher's goal is to reduce the likelihood of a donor reaction after donating blood. The system includes some methods of an initial investigation, e.g. Donors with anemia are treated with appropriate medication to alleviate their reactions before the donation process.

W.B. Zulfikar et. al. proposed a model that enables the PMI in addressing the issues related to the classification of potential blood donors. The authors suggested a time reduction classification model using both the decision tree and naive bayes classifier. The decision tree can overlap, particularly when the groups and parameters are various, according to the experimental level [3]. The effect is more time and memory required for a decision. In the meantime, naive bayes classifier takes faster time and can be performed in real-time. The naive Bay classifier produces better results than the decision tree in terms of precision.

Lerong Wang et. al. analyzes the impact of cognitive mediation on the blood donation process and find the relationship between blood donation and health status as measured by SF-36. The research found that with the rising of blood donation level the PCS and MCS of donors are also rising and blood donor cognition partly mediates amongst blood donors and outcome of SF-36. The outcome analysis of the mediation impact showed that cognition in blood donation played an intermediate role in the relationship between SF-36 score in both PCS and MSC of blood donors and blood donation [4]. In other words, the cumulative number of blood donations had a direct and indirect impact on the health of blood donors through the recognition of blood donations. The study reinforces the notion that donating blood is good for health.

P. M. Durai Raj Vincent et. al. introduced an automated framework for blood donation to ease the emergency. Some of the scope and benefits of this research work are that the distance between the needy and the donor can be reduced, the possibility of reaching the rare blood groups as well as the previous record can help know the history of the blood donor. To facilitate this, a comparative data set of blood donors was reviewed. The data set was obtained from the "Blood Transfusion Center" in Xin Chu, Taiwan [5]. The dataset in question consists of several attributes, including age in months, frequency as numbers, and cash in a cube. The prediction of the outcome based on other attributes is a requirement that the dataset in question provided along with the details. This allows researcher to train the most effective model that can help in an emergency.

Rehab S. Ali et. al. introduced the "Blood Bag" web application to meet the needs of specific blood groups. In addition, when a new donation is registered in the campaign system and before it reaches their area, donors can save their data to be notified on their mobile phone via SMS. It's about controlling the donation process outside of blood banks [6]. Once the analysis is complete, the blood bank employee downloads the complete report into the system and the donor can log in to explore the report. Therefore, the "Blood Bag" application controls all processes related to blood donation. This ensures the safe and reliable delivery of blood bags to all

patients. The data of all the donors registered in the system are available to all blood banks and campaigns to avoid uncontrolled donation procedures of infected blood donors. The responsible physician should search for donor data using national accredited evidence and audit status (accepted, rejected) before donation.

Kanishk Agarwal et. al. aims to provide an efficient and seamless system for everyone, including blood centers, to simplify blood collection and transfusion to reduce time and effort. Since most blood bank centers are poorly connected and operate simultaneously with each other, this poses a serious problem for a smooth and efficient system. Blood transfusion is a method of injecting blood or blood products through an IV. Transfusions are utilized in various medical settings to replace lost blood components. Data mining techniques such as grouping and classification techniques, decision tree, random forest algorithms are some of the important algorithms that help researchers to sort and classify unclassified data and find patterns and relationships. After applying the GRA, the efficiency of each algorithm has increased [7]. The increase is not very significant, but this is due to a very less correlation between the attributes of the data set. It is proved that the random forest gives significant result in identifying whether a person will donate blood based on past data.

Hunor Hegedüs et. al. presented a framework known as Blood Notes to facilitate and promote the blood donation process. It provides a mobile application for donors to enter their blood donation, accesses useful information related to the donation process, and receive notifications. It also provides web applications to employees of blood donation centers for data management and information dissemination. The software system can be categorized into three main components: a mobile app for donors, which runs on iOS and Android platforms; A web application developed in React.js for employees of blood donation centers; The .NET Core Server that connects the first two components, respectively, supplies and maintains data. All of these main components have multilayer architectures [8]. The server communicates with the MySQL database and the Firebase Cloud Message (FCM) platform. FCM is used to broadcast server notifications to mobile clients. The web clients communicate between the server and mobile, respectively, based on the HTTP protocol (Hypertext Transfer Protocol), which conforms to REST conventions (representative state transfers). Communication with the MySQL database is implemented using the Entity Framework.

Giridhar Maji et. al. presented an integrated framework for end-to-end blood management is designed with front-end web modules and back-end databases. Special attention has been paid to the management of local blood donation campaigns. The authors proposed a data warehouse to store past blood donation camp data so that future camp locations and timings can be determined depending on concrete analysis rather than political revenge. Donor referral, registration, and schedule times are very user-friendly and convenient [9]. Also, node offices can use analytics reports to pre-estimate staffing requirements, pre-volume, and other infrastructure requirements. A new Charity League (PL) has been proposed to depend on a new measure of humanity and PS values called the Charity Score (PS). In all humanitarian missions, citizens earn PS and are placed in different PLs accordingly. People with high PL can get priority and additional benefits by using various government services and benefits. It will encourage citizens to engage in more and more human activities.

Pinar Kirci et. al. presented a data-based system to monitor and estimate potential blood donors. In the blood transfusion dataset, it is aimed to estimate whether a donor has donated blood in March 2007 according to the parameters in the data set and compare the performance criteria for the estimated results of the models created. As a result, it is determined that which one of the machine learning algorithms is more successful in the blood transfusion data set [10]. While the diagnosis made by a doctor in medicine is very valuable, the diagnosis and prediction of diseases become much safer with data science. With this study, the people who will donate blood can find out in advance and thanks to this information, the need for blood can be prevented. This research aims to perform data set analysis with machine learning methods. The data set used is an open-source data set published in the UCI machine learning warehouse.

Fawaz Alharbi et. al. introduced a central blood system that involving several stages of the blood donation cycle. The main contribution of this research is the integration of different systems and services into a centralized and integrated system. Various modules and components have also been highlighted to develop this type of system. The proposed system can reduce the time it takes to donate blood and improve performance in many ways. Repeated donors do not need to enter their basic information when donating blood [11]. Alliances with other systems can also improve performance, as certain types of information can be imported for verification purposes.

Fauwzziyyah O. Umar et. al. [12] proposed and implemented a working system for blood banking services that give patients instant access to all types of blood donors, whether they are voluntary donors, alternative donors (family or friends), or compensation donors. In both cases, mutual interests are protected. The system employs unstructured supplementary service data or USSD code, short message service (SMS), and free toll lines, so it grows in very remote areas and is suitable for men and women of all ages. The presented system is easily accessible to online and offline database questions. Furthermore, the system also ensures the availability of services throughout Nigeria through which a dynamic web application and remote central database interface can be provided via USSD and SMS codes, and finally Voice.

Lucian Evdochim et. al. identifies a PPG-dependent methodology for estimating blood supply. A picture of variations in blood supply in the human body is a photoplethymogram, abbreviated as PPG. This is not a direct form signal, but it has at least six main parameters that are beneficial for other signals. PPG has been used for the past decade to provide more useful physiological parameter information [13]. The authors identify the potential possibilities for blood flowing through a tube and model the actual donation process.

III CONCLUSION AND FUTURE SCOPE

The methodology for an effective and useful blood donation intimation system has been elaborated on in this survey article. Blood donation is a highly noble cause that requires a lot of effective donations from a number of individuals to save countless lives. This is due to the fact that the blood cannot be stored for a large period of time and there is a set amount of time after which it cannot be used to transfer use another patient or victim. This is highly problematic as there is always a shortage of blood of all groups and types across various Nations and blood banks. This is further exacerbated by the fact that the donation intervals are extremely long and individuals have to wait for a large time before they can donate again. This donation interval has been set by doctors and individuals for the generalized public taking into account the maximum amount of time it takes for the blood to be replenished in their system. Therefore there is a need for an extensive system that can effectively perform accurate and personalized blood donation intervals for individuals to achieve higher efficiency and fulfill the goals of the blood bank requirements. A number of researchers have been performed for this purpose which has been elaborated in this research article effectively. The approach for an effective blood donation intimation system will be elaborated in further detail in the upcoming editions of this research.

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