Implementation of Child Healthcare System by Using Machine Learning Techniques

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Article History	Abstract
	The focus of the article was paediatric healthcare for children under the age of five. This approach was designed with the goal of tracking children's development from infancy to age five. The goal of the child healthcare system is to provide treatment for growing children outside of hospitals. Nowadays, because we live in a purely digital age, we can provide parents the ability to monitor their child's development while they remain in their own country. Children's info can be uploaded by their parents. The system can then assess the present development and growth status, spot unhealthy behaviours, anticipate potential chronic diseases, report health-related factors (such as vaccination coverage) that's in the immediate surroundings, and finally offer tailored solutions to avert health hazards as quickly as possible. The studies included in this study concentrate on utilising machine learning algorithms to forecast child healthcare. We put the system into practise using a decision tree for CHS, MySQL for reminders about immunizations, and the K-means Elbow technique for maternal registration and notification.
	***Keywords:** Child Healthcare System, Decision Tree, Disease Health Risk.*

1. INTRODUCTION

The issues with the current healthcare systems are put out in this effort. Motivated by both the poor hospital interventions and the high under-five death rate. In order to assist the current health system, we suggested using computer technology to provide missing health services, such as kid risk query and results. The suggested system will solve the stated issues and accomplish the project's objective.

Diseases are more likely to affect kids below the age of five. According to the WHO, a total of 6.3 million babies died annually, and over half of those deaths are preventable or treatable with access to low-cost, straightforward therapies. These children's parents typically have a large family but little spare time, energy, money, or risk tolerance [1]. Despite the fact that the majority of families are responsible, they struggle to get their kids to the doctor on a regular basis. Due to a lack of available professional knowledge, local health communities might not be able to provide effective therapy. While the capital hospital often requests that parents await for a consultation due to comparatively insufficient medical resources in comparison to a high patient volume [2]. They cannot anticipate receiving sufficient justification during the medical checkup or a prompt study of the child's behaviours when they see the doctor. Because the specialists do not have adequate information about the child's medical history, they are only able to offer advice on present diseases rather than latent disorders [3]. Along with internal health risks and lifestyle choices, the outside environment also contributes to a child's risk factors in

several ways. Additionally, a simple physical examination and hospital-based illness diagnosis are insufficient for protecting youngsters. These simple tests for eyesight, teeth, the spine, height, and weight only provide a string of data that are challenging for parents to understand [4]. Test findings require immediate evaluation and individual interpretation. In terms of diagnosing diseases, it can be effective after overt symptoms show up, but young patients may already be experiencing severe symptoms [5, 6, 7, 8, 9, 10].

Additionally, after reviewing the development chart as well as the clinical record[11], most professionals won't warn parents about hidden hazards unless there is strong support or a need[12,13]. This may cause a delay in child treatment [14] and prevention [15]. In addition, a lot of severe chronic illnesses begin in childhood. Therefore, developing methods for identifying growth-related issues and predicting chronic diseases is worthwhile [16]. In addition to the direct dangers to children, environmental issues, particularly infectious illnesses, are a major cause of death. However, the majority of parents are unaware of the environmental hazards and risk of infectious diseases in their neighborhood and at their trip locations [17, 18]. Existing work also does not offer such a environmental and infection risk retrieval function based on addresses. Besides, most online expert's point out that lifestyle change is a practical way to tackle health problems, but their advice is too general to follow. Parents expect personalized solutions based on age [19], gender [20], location [21], etc. After all, children's diet, activity and sleeping time vary considerably with age and gender [22]. Advice needs to be personalized to take account of this individual variability. Although many programmers are established for saving children and mortality and leading causes are published to public, it is still hard to take advantage of health care resource [23]. Recently computer technology as a persuasive tool makes accessible and affordable health service available. Typically, Personal Health Record offers alerts, notifications, reminders, personalized health guidance and decision support for diseases to assist the user to manage their health record and interact with health-care providers. However, these web-based health care systems have limited risk alert and representation along with personalized solution for children under age of five [24, 25, 26, 27].

The rest of this paper is made up of a related work, methodology & experimental setup that has been conducted, a discussion of the outcomes, and important conclusions.

Related Work

Purvi et al [19], work titled Decision tree-based classification algorithms: research and evaluation Machine learning {ML) is the process of teaching a mainframe new abilities based on a variety of testing & training datasets and predicting outcomes under diverse circumstances deprived of unequivocal programming. A Decision Tree is one of ML approaches. These algorithms could be used to extract text, discover data in sectors that need medical certification, substitute statistical techniques, search engines. Various decision tree algorithms are being developed, respectively based on accuracy and costeffectiveness of method. Significant how to employ the optimal algorithm in each decision-making scenario becomes crucial. Three alternative Decision Tree algorithms, ID3, C4.5, and CART, are included in this work.

Khirade et al [20] proposed Image processing for the detection of plant diseases. Identification for plant diseases is a crucial step in mitigating decreases in agricultural output production and quantity. The study of patterns on plants that are visible to the naked eye is referred to as "plant disease research." Plant disease detection and condition monitoring are vital for agricultural sustainability. Plant disease tracking manually is quite difficult. It demands a significant quantity of effort, expertise in plant diseases, and protracted processing durations. Consequently, plant disease detection uses image processing. Image capture, image pre-processing, feature extraction, segmentation, and classification are the processes in diseases detection process. The article discussed methods for diagnosing plant illnesses using images of their leaves. This research also covers the segmentation and feature extraction methods used to identify plant illnesses.

The objective of face recognition was intensively investigated in recent years, according to Ahmed et al [21]. This report is an overview of recent major research on human facial recognition. We start by giving a broad overview of recognition of faces and its uses. The literature is then evaluated to include most effective facial recognition techniques. The face datasets that are used to assess the effectiveness

of these algorithms for recognising faces are described, along with their flaws. There is also a quick synopsis of the results on the face recognition vendor test (FRVT) 2002, a thorough assessment of automatic face recognition technologies. We conclude by summarising the findings of the study.

The contributors of [22] created a model of forecasting for the categorization of diabetes data using the logistic regression (LR) classification technique. The dataset's sample data is made up of 459 patients, while the testing data is made up of 128 occurrences. The prediction accuracy of the LR technique was 92%. Because these researchers failed to assess the model against existing diabetes prediction algorithms, this study's main flaw was that their model can't be validated.

By kazi [23, 24], who uses IoT to study COVID patient health. A person that has been quarantined inside has to have someone watch over him or her. Measurements of body temperature, sweat production, oxygen saturation, respiration, heartrate, and other variables are needed to design a ventilation system for those individuals or persons. The respiratory sensor observers breathing, the cardiopulmonary sensor searches for heart attacks or uneasiness in the chest, O_2 sensor gauges the body's O_2 saturation levels, and the body's temperature sensor searches for fever. The recommended approach saves track of breathing rate, pulse rate, body temperature, and saturating O_2 levels. Received information is electronically sent to a COVID hospital or facility nearby.

2. METHODOLOGY

Child healthcare system is a web based application which is developed under the 3-tier architecture[28]. This can be very helpful to enhance the future work of the system. Following are the some important implementations are explained in detail.

A. Virtual system:

Connecting with end-user is completely based on the digitally virtual workstations.
End-user can get the knowledge of Growth and Development Risk Module focuses on evaluating the results of physical measurements, including head circumference, arm circumference, height, weight, BMI. For example, if the child's height is close to the average height coming from WHO, the child is developing well. Otherwise, he or she grows faster or slower than most children of the same age. This module includes arm, head, height, weight[29].

B. Growth and Development Risk Module:

Growth and Development Risk Module focuses on evaluating the results of physical measurements, including head circumference, arm circumference, height, weight, BMI. For example, if the child's height is close to the average height coming from WHO, the child is developing well. Otherwise, he or she grows faster or slower than most children of the same age[30].

i. Arm:

If the child's arm's circumference is close to the average arm's circumference coming from WHO, the child is developing well. Otherwise, he or she grows faster or slower than most children of the same age. According to the difference between the user input and the average, result is calculated. Such a kind of result visualization is easier to understand than an informative growth chart.

ii. Head:

If the child's head circumference is close to the average head circumference coming from WHO, the child is developing well. Otherwise, he or she grows faster or slower than most children of the same age. According to the difference between the user input and the average, result is calculated.

iii. Height:

If the child's height is close to the average height coming from WHO, the child is developing well. Otherwise, he or she grows faster or slower than most children of the same age. According to the difference between the user input and the average, result is calculated.

C. Environmental Risk Module:

The environmental risk module aims at evaluating the environment related risk of under-five child mortality and infection rate. Infectious diseases usually cause more deaths in a short period than common environment-related problem. For example, the SARS epidemic had the potential to overwhelm health services. Most governments try to control the outbreak of infectious disease. In an

outbreak, often children suffer most because they have relatively unprepared immune systems. We cannot always stop epidemics in a short time, but we can protect children with vaccination and parental awareness. Infection rate retrieval is such a function that attempts to improve parental awareness by showing the incidence and vaccination coverage rate at different locations[31,32].

D.   Clinical Risk Module:

In this module decision tree algorithm is implemented. A decision tree is an aid to decision-making that uses a tree-like structure or model to describe decisions along with all possible outcomes, including utility, resource costs, and consequences of random occurrences[33]. This is one way to demonstrate an approach that only employs statements of conditional control. This module lets parents select symptoms using this symptom as training data and using previously trained model of future probable diseases are carried out.
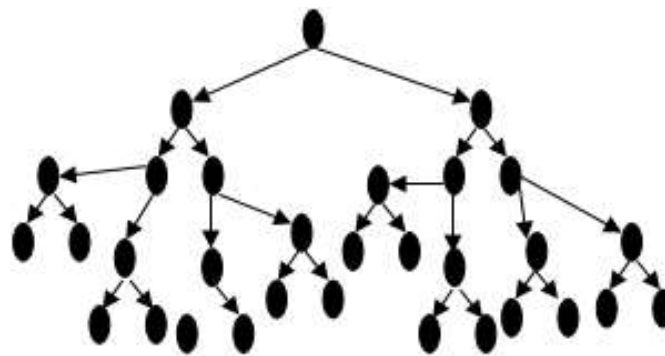

Figure 1 Structure of the decision tree.

The figure 1 represents the structure of the decision tree method used for the Machine learning[34] for prediction of the child health risk module. In this diagram the left node represent the symptoms to be matched as 1 for specific disease whereas left node represent as 0 for that disease not has specified symptoms. As like all possible disease are been represented in this diagram.

Experimental Setup

This research proposes the problems in existing health systems. Inspired by these inadequate interventions at hospital as well as high mortality of under-five children. We proposed use of computer technology to offer missing health services, like child risk query and results to support modern health system. The proposed system will address the proposed problems and achieve the goal of this research. Design and implement a new web based child health risk prediction system for children under five years old that predict health risks and will give preventive solutions. To speed up the process of identifying the proper collection of symptoms and to more precisely forecast the illness with the purpose of helping children with autism receive a diagnosis. To generate a deep architecture-compatible incremental learning method that is entirely automated.

We construct the system utilising Decision Trees to determine the sickness of the kid from the child's symptoms and send the doctor information about the condition for the parent of the kid in question. We use MySQL to create a framework for immunising children, and our system will send the parents a message. MySQL is utilised to do this. The suggested strategy for prediction in paediatric healthcare is depicted in Figure 2 below.
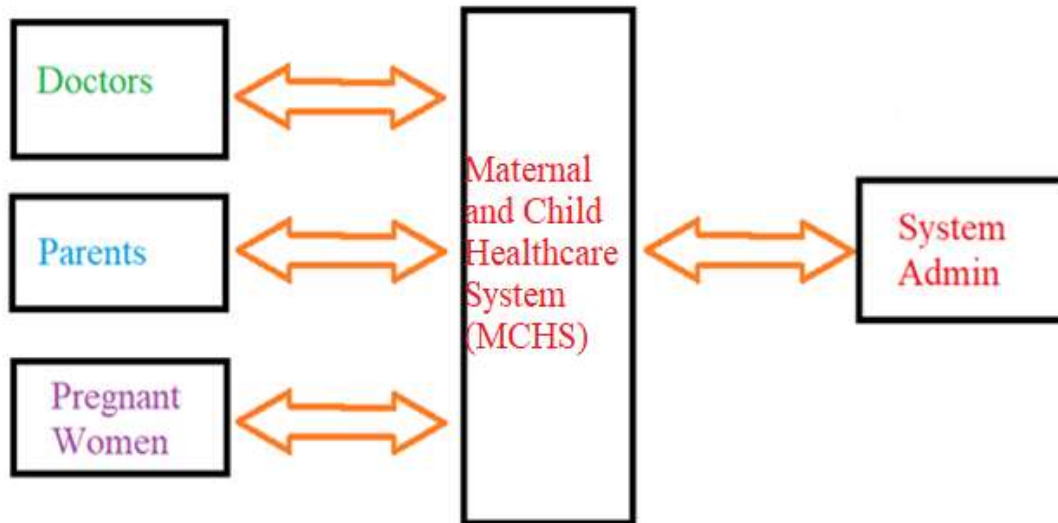
Figure 2- Proposed method

In this work, we used the Decision Tree technique to more accurately forecast the span of a newborn infant's illness according to its given or determined symptoms. The illness and its related symptoms are represented by two nodes in this dataset.

E.   Implementation:
1.   Requirements:
i.Software Requirements:
*   Anaconda Spyder
*   XAMPP server
*   MySQL Database
*   Python
*   Flask Web Application Framework
ii.Hardware Requirement:
*   20 GB HDD
*   4GB RAM
*   Minimum Core i3 processor
2.   Technology Stack:
*   Python
*   Flask Web Application Framework
*   Decision Tree method of Machine Learning
*   MySQL Database
*   Pandas for Train and Test CSV Data.
*   HTML, CSS, JavaScript for UI/UX.

F.   Machine Learning Method(Decision Tree):
By supplying computers with data and knowledge in a manner of observations and interactions with people in the real world, machine learning(ML) [35]involves a way of making computers learn and behave like humans do. The following list of machine learning techniques is provided:
• Representation (a collection of classifiers or a computer language)
• Evaluation (also known as an objective or scoring system)
• Optimisation (search technique; frequently the classifier with the highest score, for instance; both commercially available and specialised optimisation techniques are employed)

Decision Tree: Classification problems are where this type of supervised learning approach is most typically used. Unexpectedly, it works with both categorical and continuous dependent variables. Let's

use this method to split a population into more than two homogeneous groupings (Figure 3). It is carried out based on the most significant characteristics/independent variables in order to generate as many distinct groups as possible. It has been discovered that the under "Complex Layer" query delivers results containing more pertinent information from social networks, as well as from articles and blogs. The is less comprehensive than books and other publications, and there is hardly any information on the products.
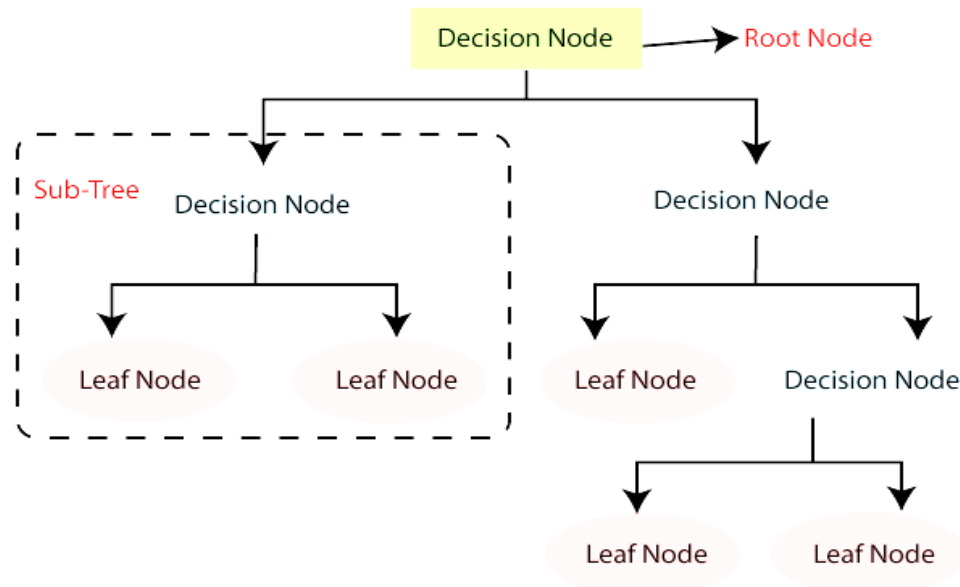

Figure 3- Decision Tree

In this project we used Decision Tree method of Machine Learning for provide better outcome of children disease from the given/specified symptoms in system. In this the Dataset is created in two nodes; one is Disease and another one is respective symptoms. The dataset is trained and tested by merging all symptoms in row and activating respective disease symptoms as setting value to 1 rest will remain as 0.

G.   MySQL Database:
A database is a place where information is collected systematically. It could be anything, like a simple shopping list, an image gallery, or the vast amount of information in a corporate network. A database management system, like MySQL Server, must be used to add, access, and manage the data that is stored within. Computers are good at processing enormous amounts of data, thus database management tools—whether implemented as standalone programming or as an element of other programs—are crucial to computing. A database that is relational stores the data in separate tables rather than storing it all in one big warehouse. The database components are among the physical files with performance optimisations. A flexible programming foundation is offered by the logical framework, which includes objects such as databases, graphs, diagrams, columns, and rows. A few instances of rules that one may develop to manage the interconnections among various data sections have one-to-one, one-to-many, unique, required or optional, and "pointers" across different tables. Since well-designed database follows these criteria, the application will never come across inconsistent, duplicate, orphan, out-of-date, or missing data.

3. RESULTS AND DISCUSSIONS
For father enhancement, parents need first register for the service with their kids and provide their parents with basic information. Basic information about the kid and the parent, including a cellphone number, is collected during the registration procedure in order to facilitate future communications and the provision of the necessary data. The registration screen is seen in Figure 4.

Figure 4 – Registration procedure

Train and Test data for Disease: The training and testing dataset gathered for experiment is as shown in figure 5. We collect database related to pregnant women and child's problems like skin rash, weight loss etc. the dataset is generated based on registration and the problems faced by parents.

Figure 5- Train and test data for disease.

After getting all the data from parents, the childern environmental risk is calculated by system. The result of risk is shown in Figure 6.

Here is provides children

Figure 6- Environmental risk.

All patients who have enrolled may offer details regarding the symptoms for illness prediction. The patents for the system need the screen of symptoms, which is then examined by ML-Decision Tree Algorithm and delivers the illness specifics along with the specialist doctor information who are knowledgeable in that area. Figures 7 and 8 depict the information processing.

Figure 7- Symptoms for system

Figure 8- Info about diseases and specialists

4. CONCLUSION

Machine learning (ML), which is employed in areas like surgery and medical imaging, has already enabled robots to carry out important and time-consuming tasks in the medical field. Currently, it is often used to identify ailments and discover new treatments. But the question that is put out here is: What is the reach of ML within the healthcare industry? Concerning ML and DL usage, healthcare data is regarded as the most significant component that goes into healthcare systems. This research proposes the problems in existing health systems. Inspired by these inadequate interventions at hospital as well as high mortality of under-five children. We proposed use of computer technology to offer missing health services, like child risk query and results to support modern health system. The proposed system will address the proposed problems and achieve the goal of this research. Design and implement a new web-based child health risk prediction system for children under five years old that predict health risks and will give preventive solutions.

- To Identification of child disease from given symptoms of child.
- Provide the doctor information details of that disease to the parents of the child.
- To design framework for child vaccination alert system.
- To provide precautionary care taking monthly instructions or alerts to pregnant women.

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