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Efficient Child Nutrition status Detection System through Machine Learning

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ABSTRACT*:* Nutrition of a child is one of the most essential aspects as it is one of the formative years of an individual. The paradigm of anthropometric indices is one of the leading procedures for the measurement of the nutrition status of a child. The measurements need to be evaluated and compared to realize the nutritional status of the child. For this purpose, a collection of researches has been performed to design a system. Most of the prevalent researches for the prediction of the nutritional status has some trade-offs that have been identified and appropriate implementations have been made in this publication. To streamline the process of child nutritional status prediction, machine learning approaches have been utilized. These approaches have been instrumental in overcoming the limitations of the conventional researches performed in this regard. The proposed methodology utilizes the K-Nearest Neighbor, Fuzzy C Means and Linear Clustering for the clustering purposes and Pearson correlation along with the use of Artificial Neural Networks and Decision tree. The presented technique has been subjected to scrutiny through the use of extensive experiments. The experimental tests reveal the effectiveness of the methodology proposed in this publication.

KEYWORDS: K-Nearest Neighbor, Fuzzy C Means, Linear Clustering Pearson Correlation, Artificial Neural network, Decision tree, and Nutritional Status.

I. INTRODUCTION

The nutrition has an important role in the determination of various different factors that are the determining factors for the evaluation of the quality of human resources. Nutrition is one of the principal components for the purpose of leading a fulfilling and resourceful life for a human being. The impact of nutrition is not just on the health of the individual but also on various other factors are governed by nutrition, such as environmental issues, education, parenting, cultural, economic, and social issues. All of these factors are dynamically linked towards the paradigm of nutrition. Therefore, it can be understood that the dimensions of the nutrition paradigm are broad and have a large number of fields where the impact of this approach can be identified and quantified in detail.

The health is one of the most important aspects of human life that need to be maintained to achieve a valuable life and a good health of the citizens contributes productively to the nation or the country in achieving their goals and increase the productivity. The nations have a responsibility to ensure that the health of the citizens is developed through the use of the various components of a healthy lifestyle. The main aim for the nations is to increase the degree of public health through the ability to improve the nutrition of the citizens as the productivity and health status is directly linked to the person's nutrition. Therefore, the nutritional balance must be achieved to get a performance boost for the various citizens for increased willingness and awareness that can be highly helpful.

The nutritional balance should be maintained not only to provide significant improvements in the productivity but also prevent the contraction of various diseases that can lead to the disturbance of the daily routine. This is referred to as malnutrition, which is the improper balance of nutrients in the body that is caused due to the deficiency or an abundance or excess of a nutrient in the body. Malnutrition is one of the most debilitating scenarios that is being largely increasing all over the globe. This is due to the imbalance that is being introduced in the modern diets that are not being able to provide effective and complete nutrition to the individuals. There are also misconceptions and other defining factors that are contributing to this problem negatively. This in turn affects the various other parameters such as life expectancy and the incidence of epidemics all over the world which can be reduced significantly.

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There are various indicators of malnutrition or nutritional capabilities of a region or a country, such as, nutritional status of a community, morbidity rate, mortality rate and the life expectancy of the individual. These indicators are largely responsible for the assessment or the evaluation of the nutritional status or the metrics of a country. Severe malnutrition can be highly fatal and can also lead to a lot of problems and spread of diseases in the future. Malnutrition can be reversed but there is small window that is considered for this reversal. Malnutrition should be eradicated slowly and steadily and there is evidence that the nutritional status of an individual can be improved progressively over a period of time. But this is an extremely difficult endeavor. Mostly when the malnutrition is started from the toddler stages of the individual.

A toddler is an individual that is less than 5 years of age. The most critical of the phases that are highly dependent of the nutrition that is provided in these formative years of the individual. As the children are growing they need an abundance of nutrients on the balanced diet that replenish the growing body periodically. There is a need for the maintenance of the nutrients and provide a healthy diet to this individual as malnutrition in such a young age can have lasting impacts. There is evidence of stunted growth and other problems that are noticed in children that are malnourished from the get go in their early stages of development and growth. The under nutrition is one of the most common effects that are noticed in the children of this age residing it eh impoverished and developing nations.

For the purpose of evaluating the growth and the nutritional status of an adolescent or a toddler less than the age of 5, the paradigm of anthropometry is being used. This is the branch of medical sciences that can effectively and approximately measure the growth in the individual children that can be clear indicator of the nutritional status. The anthropometry involves the use of various attributes such as the head circumference, age, height, weight, gender, etc. to measure the nutritional status of the child. For this purpose, this research article presents an innovative technique for the evaluation of the nutrition of children. The presented methodology implements Nearest Neighbor Clustering technique to cluster the dataset. The clustered data is utilized to preprocess and acquire the Pearson correlation which is given as an input to the artificial neural networks. The Artificial neural networks employ the use of machine learning to provide effective nutritional status of the child which is classified effectively using the Decision Tree approach.

Section 2 of this research article is dealing with Literature Review of the past works. Section 3 concentrating on elaborating the proposed technique whereas obtained results is evaluated at section 4. Section 5 finallyconcludes this paper by giving some hints of future scope.

II. LITERATURE REVIEW

This section of the literature survey eventually reveals some facts based on thoughtful analysis of many authors work as follows.

I. Kurniastuti explains that there has been an increased interest in the nutrition of human beings of all ages, especially newborn babies. A baby's nutrition is one of the most essential aspects that govern health and wellbeing directly. The nutritional status of the baby refers to the balance that is achieved through the use of the anthropometry. Anthropometry refers to the utilization of various metrics of the infant such as head circumference, height, weight gender, and age [1]. The authors in this publication defined an approach that utilizes the dataset with the appropriate values for the expected values of the attributes that are being utilized for the anthropometry. The drawback noticed in the proposed methodology is the lack of detailed parameters for the evaluation of the nutrition of the infant.

R. Putri introduces the concept of managing the nutrition of a toddler or a child less than 5 years of age. The toddler period is one of the most crucial moments that determine the health of the individual for a long time in the future. This is the time that is crucial for the newborns as it can determine their health status in the future. Authors in this publication achieve this through the use of anthropometric calculations [2]. These calculations have been certified by various surveys that ensure that the anthropometry can be e highly useful in determining the nutritional growth of toddlers. The researches in this publication utilize the Naïve Bayes algorithm for the classification of the nutritional status according to the anthropometric attributes.

M. Hazman elaborates on the concept of providing a nutritious meal to the children in their growing years. Most of the growth of children is determined at an early age which is highly dependent on the nutritional ability of the food that is being fed to these kids. The nutrition for the children can have a drastic effect on their ability to behave and also to exercise along with their capacity to learn. Nutrition plays an important role in all of these activities which makes it one of the most crucial implementations for a kid's good health [3]. Therefore the authors in this methodology propose

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a healthy nutrition expert system that is specifically designed to cater to children of varying ages and genders. The limitation recognized in this publication is that the authors have not validated the knowledge in the presented methodology.

S. Winiarti narrates that there are a number of regulations that govern the genetically modified organisms for their commercialization. These types of genetically modified food have a lot of potential in generating high nutritional value foods that can be highly useful and providing a nutritional gain for the average human being [4]. Therefore, the authors in this publication utilize the fuzzy c means algorithm to extract the nutritional status of the individual through the use of a smartphone. The major limitation noticed in this proposed methodology is the increase in the computational complexity of the approach.

D. Rubilar discusses that the nutrition of an individual is one of the most useful attributes that are essential for a healthy and good quality of life. Nutrition a person determines a lot of factors in individuals such as their susceptibility to various diseases and immunity against common ailments. A nutritional status is a much-nuanced approach that is highly dependent on the personal characteristics and other parameters of an individual [5]. Thus, this publication presents the utilization of a web application to integrate in-depth knowledge of nutrition for enabling automated menu recommendations to focus on the individual and their clinical nutrition. The main limitation identified in this approach is the increased time complexity of the presented methodology.

R. Putranto explains that the implementation of cloud computing and visualization has been highly beneficial for various applications extending to different fields and Paradigms. The authors in this research also claim that nutrition for infants is one of the most crucial aspects of healthy life for the individual after he or she grows up. Therefore combining these two different aspects and diplomatic and innovative and useful approaches towards infant nutrition through the use of anthropometry is proposed in this publication [6]. The researchers utilized the medical records of the babies and tracked their nutrition through web services and forward chaining along with cloud computing used in the form of the platform as a service or PaaS.

W. Fahrozi introduces the fact that nutrition is one of the most important parts of a human being. Nutrition plays an important role in providing sustenance to the physical body of the human. With the right nutrition in the human body can work at a peak potential that can be very rewarding in the long run [7]. Keeping these factors in mind, the authors of this publication proposed the creation of an expert system. The expert system provides diagnosis through the utilization of the Dempster-Shafer method for impaired nutrition the thin body patients.

D. Ferreira elaborates on the increase in the recognition that has been noticed for various technological advancements such as data mining and machine learning. These technological advances have been critical in achieving an increased amount of success in various different fields. The machine learning and data mining approaches have been exponentially useful for the purpose of extracting increased efficiency from an already existing system effectively [8]. The authors in this publication utilize data mining for the purpose of extracting nutrition therapy for the purpose of prediction through the WEKA framework.

A. Martinez-Millana explores the various risks and other factors that are caused due to malnutrition or having reduced nutritional status of an individual that is elderly. Nutrition of every human being is one of the most important aspects that are essential for their survival. The good nutritional status of an individual determines their resilience towards disease and other ailments [9]. This is especially true in the case of elderly individuals that are not as scheme towards nourishment through high nutritional value items. Authors have designed a mobile application that utilizes questionnaires for the assessment of elderly individuals in an elderly housing facility. The experimental results concluded that the proposed methodology has been implemented successfully.

Z. Momand evaluates the various parameters and components that are essential for the development growth and survival of children in an environment. Children require a lot more nutrition than their adult counterparts due to their active lifestyle and the developmental nature of their physiology. Therefore it is essential to monitor the nutritional status of children under 5 years of age especially in countries that are developing [10]. Therefore the author has utilized data mining for the purpose of prediction of multiplication in Afghani children. The drawback of this publication is that the authors have not effectively utilized the anthropometric parameters for the determination of the nutritional status of the children.

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G. Agapito explains that there are a lot of different smartphone applications that are used for the management of diet and individual weight. There are a plethora of these applications that are hosted in various different app stores which claim to provide accurate and highly context laden advice to their users. The researches in this publication have determined that a lot of these apps are not based on the clinical context. Therefore the authors have provided an application in this research article that utilizes medical evidence to provide a recommendation for personalized food and suggestion for adaptive diet monitoring [11]. The limitation faced in this approach is that the authors have not provided recipes according to the health status of the individual.

A. Miller presents the various findings that have been researched by the World Health Organization on the topic of fatality in developing countries of young children due to undernutrition. The authors claim that there are a lot of debts that are caused due to undernutrition which can account for the majority of deaths that happened to children. Therefore it is highly crucial for the monitoring of neonates for their nutritional status as it can cause a lot of long-term health problems such as hypertension, cardiovascular disease, and obesity [12]. For this purpose, the researchers in this approach have defined the utilization of near-infrared Spectroscopy to determine the body fat percentage and the nutritional status of neonates.

D. Wulandari states that there are a lot of issues that are present in child nutrition even today that can see the impact the potential of a nation in the future significantly. Therefore it is imperative to conduct a periodic evaluation and monitoring the nutritional status of children at regular intervals. For this purpose, various systems utilize the anthropometric measurements for benchmarking the nutritional status of the children [13]. This is usually achieved through the utilization of fuzzy inference systems. The authors in this publication compare the Tsukamoto and Mamdani methods that are used in these inference systems. The experimental results conclude that the Tsukamoto approach is highly accurate in comparison to the Mamdani technique.

Z. Valero-Ramon elaborates on multiplication as it is a state where a human body has reduced nutritional intake due to loss of balance between the various different nutrients such as protein and carbohydrates in their daily intake. This is highly detrimental to the individual as it can cause a lot of problems such as the increased risk of cardiovascular diseases and other hormonal imbalances in the body that could be eventually fatal. Therefore malnutrition should be combated significantly to reduce fatality and increase the health of the individuals to provide them a good quality of life. For this purpose, the authors have utilized anthropometric measurements through static variables and implemented a dynamic behavior approach that utilizes process mining for the nutritional assessment [14]. The most obvious drawback that is noticed in this approach is that the authors have not utilized a larger period of time for their analysis also large sample for their calculations.

V. Ayma explains that the nutrition of a child is one of the most important as the first five years of a child can determine the future aspects of the individual. Malnutrition in children is a very debilitating problem that can have long-lasting effects if not treated urgently. The World Health Organization classified as if as one of the significant associations that can increase the mortality rate for children by a large margin. Therefore the nutritional status of neonates should be monitored regularly for effective and timely remedies. The paradigm of anthropology is utilized to determine the nutritional status of children under 5 years of age. The authors in this approach implemented image processing techniques for performing the nutritional assessment of the children [15]. The experimental results concluded that the proposed methodology achieves highly accurate results through the anthropometric estimations.

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III PROPOSED METHODOLOGY

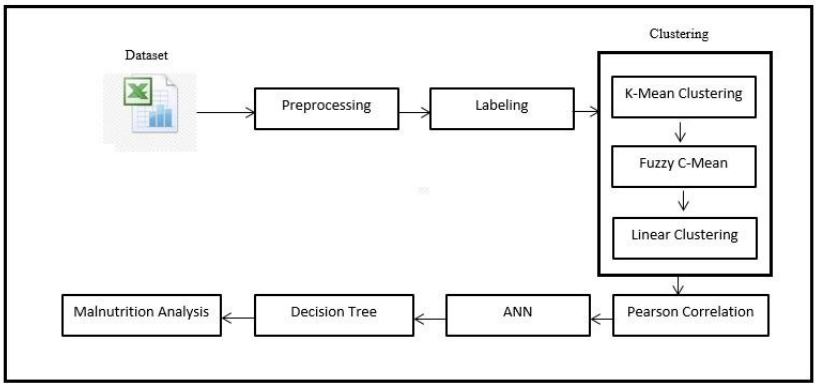

Figure 1: System Overview

The Proposed methodology overview for Nutrition deficiency estimation through Artificial intelligence system is depicted in the figure 1. And the steps that are carried out to accomplish this process are detailed in the below mentioned steps.

Step 1: Input Attributes and Data Preprocessing- This is the initial step of the proposed model, Here a data set has been collected from the URL https://dhsprogram.com/data/dataset/India_Standard-DHS_2015.cfm?flag=1 for the Child nutrition status prediction. The Collected Dataset is stored in MS Excel sheet which contain 50 Attributes. These attributes are read into a double dimension list and then subjected to the process of pre-Preprocessing.

Preprocessing is a task of removing the redundant data from the original list. Here in this process only required attributes are kept and the remaining is vomited. The attributes which are retained are child sex, child age in months, Months of breast feeding, Ever had vaccination, Drug for intestinal parasite in last 6 months, Does not use tobacco, Drinks Alcohol, Child's Weight in Kilogram , Child's height in centimeter and finally child's hemoglobin level.

All these attributes are collected in a separate double dimension list to call is as Pre-Processed list. This pre-processed list along with the user's input for the selected attributes of Pre-processing are collected and then they are fed to the K- Nearest neighbor algorithm.

Step 2: K-nearest Neighbor clustering- Here in this step of clustering a distance is evaluated in between the User input attributes and with the every row of the dataset using the Euclidean distance as mentioned in the equation 1.

$$ED=\sum_{k=0}^{n}\sqrt{(x1-x2)^2+(y1-y2)^2} \quad \text{___(1)}$$

Where ED- Euclidean Distance
x1,y1- Attributes by the user
X2,y2- Attributes from the dataset.

The obtained distance is appended to the each of the rows and then they are sorted in the ascending order. Once they rows are sorted then their mid-range value is composed by evaluating the minimum and maximum distance. This mid-range value is utilized to form two clusters like nearer and farer as mentioned in the below algorithm 1.

ALGORITHM 1: KNN Cluster Formation

//Input : Distance List D_L, M [M=Mid_range]
//Output: Nearer Cluster List N_L
knnCluster(D_L,M)
1: Start
2: N_L =∅ [N_L=Nearer Cluster List]

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3: ***for*** i=0 to size of D_L
4: ROW=$D_{L[i]}$
5: DIST=$ROW_{[ROW[SIZE-1]]}$
6: ***if***(DIST<=M)
7: $N_{L=}$ N_{L+} ROW
8: ***end if***
9: ***end for***
10: return N_L
11: **Stop**

By doing this the nearest data with respect to the user input is segregated in a list. This is very helpful to realize the correlation between the input data and with all other rows as mentioned in the next step.

Step 3: Fuzzy C Means Clustering –The fuzzy C means clustering is done through the use of fuzzy crisp values. The preprocessed list obtained in the previous step is being used to achieve the maximum and minimum values. These maximum and minimum values are provided to the fuzzy module to derive the fuzzy crisp values. The minimum value is subtracted from the maximum value to get the difference. This difference is divided by 5 to achieve the addup value. This add up value is added to the minimum values 5 times to achieve the 5 crisp values which are stored in a list.

The input preprocessed list obtained previously is subjected to the classification according to the fuzzy crisp values achieved in this step. This results in the creation of 5 clusters which are provided to the next step for the purpose of further processing.

Step 4: Linear Clustering –The preprocessed list obtained previously is used for providing the input in this step of the clustering of the data. The linear clustering approach first extracts the size of the preprocessed list. The resultant size is divided by 5 to get a value of the index. This index value is useful as it would be utilized to cluster the input preprocessed data linearly.

The clustering process defines a variable as count which is initially set as 0. This count is then compared with the index value achieved previously; if the value of index is greater than the count then that row is added to a cluster and the count is increased. This is repeated until the count is greater than the index, when this point is reached the cluster is added and the count is reset to 0 to continue the process again for another cluster. This is repeated until the entire preprocessed list is exhausted and all of the data is clustered. These clusters are then provided to the next step for the processing.

Step 3: Pearson Correlation- Here in this step all the mentioned attributes that are entered by the user are stored in an array to call it as x [ ]. In the same way the attributes of each row of the nearest cluster are also stored in an array called y [ ]. These two arrays are then measured for their correlation using the Pearson correlation equation as mentioned in equation 2.

$$r = \frac{\sum xy - \frac{\sum x \sum y}{n}}{\sqrt{(x^2 - \frac{\sum x^2}{n})}\sqrt{(y^2 - \frac{\sum y^2}{n})}} \quad \text{\_\_\_\_\_(2)}$$

Where
x is the user attribute list
y is the dataset attribute list
n is the array Size
r= correlation value in between -1 to +1.

This equation yields a correlation value in between -1 to 1. The value nearer to 1 represents the highest correlation whereas the value nearer to -1 represents the poor correlation. Then obtained correlation values are appended to the respective rows and then it is forwarded to the next step of artificial neural network.

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Step 4: Artificial neural network- The obtained correlation list is sorted in descending order with respect to the correlation value. Then around 80% of the top rows are considered in the process of neural network. Once this quality data is selected, then their Body mass index (BMI) is estimated to append at the rows and this make a total of 11 attributes. Then, based on BMI a two target values are being assigned to the well nutritioned child and malnutritioned child as Target 1 and target 2.

Here in this process for all the 11 attributes of the rows 121 random weights are assigned such that their average lies in the mid probability of the Neural network i.e 0.5. Then by using the equation 3 and 4 hidden Layer values are estimated.

$$T=\left(\sum_{k=0}^{n} AT * W\right) + B \quad \text{(3)}$$

$$H_{LV}=\frac{1}{(1+\exp(-T))} \quad \text{(4)}$$

Where,
n- Number of attributes
A_T- Attribute Values
W- Random Weight
B- Bias Weight
H_{LV} – Hidden Layer Value

The obtained output layer values are segregated with the target values Target 1 and target 2 to yield the ANN probability score. This score is then appended at the end of the each row to estimate the nutritional status of the child by using the Decision tree of the next step.

Step 5: Decision Tree- Once the ANN probability list is obtained some protocols are being set for the BMI of the child. Then, based on this BMI values IF-THEN rules of decision tree is applied to label each row of the ANN probability list.

The applied labels are evaluated and weighed to declare the Nutritional value of the Child in 5 Ranges like VERY LOW, LOW, MEDIUM, HIGH and VERY HIGH. The output obtained is then displayed to the user in a well-designed graphical user interface.

IV. RESULTS AND DISCUSSIONS

The proposed methodology for child nutrition prediction which utilizes the Artificial Neural Networks and Decision Tree has been implemented in the Java programming language through the utilization of the Netbeans Environment. The presented system is realized on a laptop equipped with a standard configuration such as the Intel Core i5 processor assisted by 500GB of HDD and 4GB of physical memory.

An extensive assessment of the performance of the proposed system was performed using evaluation metrics thoroughly. For the measurement of the preciseness of the presented system, the Precision and Recall metric has been utilized which has the potential to extract a thorough evaluation of the performance of the proposed system. The performance metrics are measured extensively to state that the approach for Child nutrition prediction implemented through the Artificial Neural Networks and the Decision Tree framework in this publication have been performing as per the suppositions.

Performance Evaluation based on Precision and Recall

Precision and Recall allow the extraction of in-depth information concerning the performance of the proposed methodology. The precision and recall metrics are exhaustive and perceptive parameters that can evaluate the actual performance of the methodology. Precision in this assessment evaluates the relative accuracy of the proposed technique by approximating the accurate values of the measure of precision accomplished in the presented system.

Precision in this methodology is being assessed as the ratio of the consolidated sum of all the appropriately predicted child nutritional status to the number of incorrectly predicted child nutritional status. Therefore, the evaluation of the values of precision obtained is a meticulous assessment of the accuracy of the defined system.

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The Recall metrics utilized for assessment of the absolute accuracy of the methodology which is significantly unique from the precision metrics. The Recall metrics are calculated by the assessment of the ratio of the number of accurately predicted child nutritional status versus the total number of nutritional status predictions performed. This methodical evaluation provides intuitive knowledge as it measures the unadulterated accuracy of the system. Precision and recall are depicted mathematically in the equations below.

Precision can be mathematically explained as below

- ✓ A = the number of accurately predicted child nutrition status.
- ✓ B= The number of inaccurately predicted child nutrition status
- ✓ C = The number of child nutrition status not predicted.

So, precision can be defined as

Precision = (A / (A+ B)) *100
Recall = (A / (A+ C)) *100

An in-depth evaluation has been performed on the proposed system through the execution of the equations given above. The result obtained from the experimentation is tabulated in Table 1, given below.

Table 1: Precision and Recall Measurement Table

No of Trials	Accurately Predicted Child Nutirion Status (A)	Inaccurately Predicted Child Nutirion Status (B)	Child Nutirion Status Not Predicted (C)	Precision	Recall
39	30	5	4	85.71428571	88.23529412
60	45	8	7	84.90566038	86.53846154
84	67	8	9	89.33333333	88.15789474
121	99	12	10	89.18918919	90.82568807
139	112	13	14	89.6	88.88888889

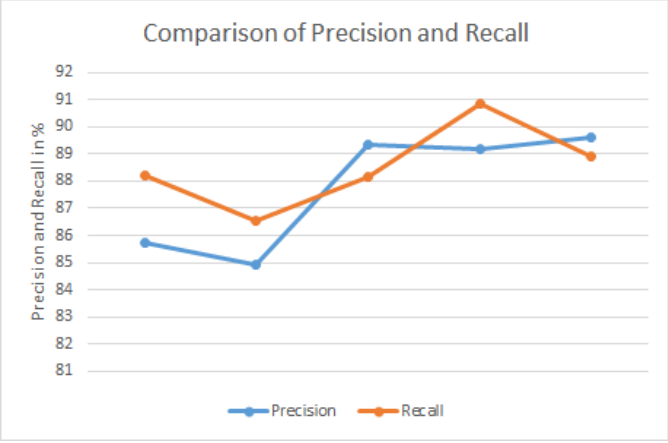

Figure 2: Comparison of Precision and Recall

Figure 2 above exhibits the graphical visualization of the experimental procedures. The fulfillment of the proposed system for accurate child nutrition status prediction achieves unparalleled accuracy which is evident through the precision and recall values attained. The proposed methodology obtained the precision of 87.74% and Recall of 88.52% which is a satisfactory result as the first attempt in the realization of a system for child nutrition prediction using the Artificial Neural Networks and the Decision Tree approach.

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V. CONCLUSION AND FUTURE SCOPE

The proposed methodology for the prediction of child nutritional status using anthropometric indices has been outlined in this paper. The dataset containing the various attributes for the anthropometric measurements is given as an input to the system. The first step conditions the dataset by preprocessing which removes the redundant data which significantly improves the execution performance of the system. The attributes contain data such as height, weight and other details about the child. The preprocessed data is then clustered using the K-Nearest neighbor, Fuzzy C Means and Linear Clustering based on the user selection. The clustered data is subjected to the correlation estimation based on the Pearson correlation technique. The correlation data is then taken as an input to the Artificial Neural Networks, which generates the neurons and performs an effective prediction of the nutritional state of the child. The prediction results are then provided to the decision tree module. The Decision tree performs the if-then rules to effectively classify the predictions and provide accurate results. The performance of the system is measured through the use of the precision and recall approach which achieves 87.74% of precision and 88.52% of recall.

Future research can focus on the real-time implementation of the presented methodology which can be improved with an interactive interface on a web-based application.

REFERENCES

[1] I. Kurniastuti, "Application of baby's nutrition status using Macromedia Flash", 4th International Conference on Computer Applications and Information Processing Technology (CAIPT), 2017.
[2] R. Putri et al, "Classification of Toddler Nutrition Status with Anthropometry Calculation using Naïve Bayes Algorithm", International Conference on Sustainable Information Engineering and Technology (SIET), 2018.
[3] M. Hazman et al, "A Healthy Nutrition Expert System for Children", The 5th IEEE International Conference on E-Health and Bioengineering – EHB, 2015.
[4] S. Winiarti et al, "Determining the Nutrition of Patient Based on Food Packaging Product Using Fuzzy C Means Algorithm", Proc. EECSI 2017, Yogyakarta, Indonesia, 19-21 September 2017.
[5] D. Rubilar et al, "Automated Menu Recommendation System Focused on Clinical Nutrition", CHILECON, 2019.
[6] R. Putranto et al, "Cloud Computing Medical Record Related Baby Nutrition Status Anthropometry Index during Postpartum", 2nd International Conference on Informatics and Computational Sciences (ICICoS), 2018.
[7] W. Fahrozi et al, "Expert System of Diagnosis Impairment Nutrition the Thin Body by Dempster Shafer Method", 6th International Conference on Cyber and IT Service Management (CITSM), 2018.
[8] D. Ferreira et al, "Predictive Data Mining in Nutrition Therapy", 13th APCA International Conference on Automatic Control and Soft Computing (CONTROLO), June 4-6, 2018.
[9] A. Martinez-Millana et al, "Evaluation of an app-based questionnaire for the nutritional assessment in elderly housing", IEEE 32nd International Symposium on Computer-Based Medical Systems (CBMS), 2019.
[10] Z. Momand et al, "Data Mining Based Prediction of Malnutrition in Afghan Children", 12th International Conference on Knowledge and Smart Technology (KST), 2020.
[11] G. Agapito et al, "DIETOS: a recommender system for adaptive diet monitoring and personalized food suggestion", Fourth International IEEE Workshop on e-Health Pervasive Wireless Applications and Services, 2016.
[12] A. Miller et al, "Near-Infrared Spectroscopy to Monitor Nutritional Status of Neonates: A Review", IEEE Reviews in Biomedical Engineering, 2020.
[13] D. Wulandari et al, "A Comparison Tsukamoto and Mamdani Methods in Fuzzy Inference System for Determining Nutritional Toddlers", The 6th International Conference on Cyber and IT Service Management – CITSM, 2018.
[14] Z. Valero-Ramon et al, "A dynamic behavioral approach to nutritional assessment using process mining", IEEE 32nd International Symposium on Computer-Based Medical Systems (CBMS), 2019.
[15] V. Ayma et al, "Nutritional Assessment of Children under Five based on Anthropometric Measurements with Image Processing Techniques", IEEE ANDESCON, 2016.

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