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INTELLIGENT MEDICINE RECOGNITION SYSTEM

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ABSTRACT

An intelligent medicine recognition system based on deep learning techniques, named ST-Med-Box. The proposed system can assist chronic patients in taking multiple medications correctly and avoiding in taking the wrong medications, which may cause drug interactions, and can provide other medication-related functionalities such as reminders to take medications on time, medication information, and chronic patient information management. The proposed system consists of an intelligent medicine recognition device, an app running on an Android-based mobile device, a deep learning training server, and a cloud-based management platform. Currently, eight different medicines can be recognized by the proposed system. The experimental results show that the recognition accuracy reaches 96.6%. Therefore, the proposed system can effectively reduce the problem of drug interactions caused by taking incorrect drugs, thereby reducing the cost of medical treatment and giving patients with chronic diseases a safe medication environment

OVERVIEW

Currently, the world's society is aging. Among the 7.5 billion people in the world, the elderly population accounts for 600 million, including 480 million people with chronic diseases. According to statistics from the World Health Organization (WHO), the average elderly person suffers from 1.4 chronic diseases, and the typical medication dosage of an elderly person is five times that of a younger person. Elderly people are also seven times more likely to take the wrong medicine because of declining physiological functions. The WHO also indicates that one-third of the world's deaths are caused not by diseases themselves but by the incorrect use of drugs, and the costs associated with such improper drug use amount to nearly 28.5 billion U.S. dollars every year. Due to the abovementioned problem of deaths caused by the improper use of drugs, the smart medicine pillboxes available on the market are constantly being updated. For example, the Pill Drill [1], [2], a smart medicine pillbox, can help users conveniently store and distribute medication and has a reminder function to remind users who forget to take their medicine.

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However, a patient cannot know whether the medications he or she has taken are correct. Due to the wide variety of drugs used for patients with chronic diseases, their classification is obviously a complex task, and misidentification of medications caused by negligence may lead to the possibility of taking the wrong medicine. Taking the wrong medicine may result in harmful interactions or offset the intended effects of the drugs, leading to further serious consequences such as acute complications. To address this problem, this paper proposes a deep-learning-based intelligent medicine recognition system, named ST-Med-Box, that can recognize medications and remind patients with chronic diseases when to take their medications. By using the proposed system, patients with chronic diseases can know whether a drug is taken correctly the first time, thus reducing the probability of taking the wrong medicine and the cost of social medical care.

"Prevention is better than cure", is universal truth. In the human life Health is the most important factor. So now a days there is need to do the prediction of diseases. Many researchers have used data mining and machine learning techniques for predicting the diseases based on the medical data or pathological data [1]. These approaches are used for doing the prediction of diseases and reoccurrence of those diseases. Also, some another approaches used to predict the diseases and control the diseases. This approach also controls the progression of particular diseases. The recent success of deep learning in different areas of machine learning has driven a shift towards model of machine learning that can learn hierarchical and rich representations of raw data with the pre-processing and produce more accurate result [1]. Diseases related numbers of papers have been published on several data mining and machine learning techniques. In that various data mining and machine learning techniques are used like Naive Bayes algorithm, neural network, decision Tree algorithm, K-nearest neighbors algorithm bagging algorithm, so on [2].Also Heart related numbers of papers are published using data mining and machine learning techniques [5]. Those techniques such as support vector machine, kernel density, automatically defined of heart groups for showing different levels of accuracy in diseases prediction [20]. Generally Waikato Environment for Knowledge Analysis (WEKA) tool is used in this type of researches. Previously existing systems do the prediction on diseases but cannot predict the subtypes of diseases. Those systems also can't find the diseases which are caused by occurrences of any previously diseases. Those systems fail to predict possible conditions of people. Previous system can handle only structured data but not an unstructured data. In current past, countless disease estimate classifications have been advanced. The standing organizations

arrange a machine learning algorithms which can predict exact diseases. In the proposed system we use the artificial neural network (ANN) and stochastic gradient algorithm for learning and doing the effective prediction of diseases. This system handles the both structured data and unstructured data with the help of preprocessing. For that we collect the patient previous history like patient diseases details. Also we can collect the various data sets from UCI Repository, Kaggle, dataset data.gov, and Pima datasets. By using that collected data we prepared new dataset. In our project we contain the three diseases like heart, kidney, and diabetics. We collect the all diseases related data. We combined that dataset into one dataset. In that we first take the common attributes from that datasets and also take the some another important attributes related to that three diseases. For that combined dataset we find the all missing values by using the decision tree liner regression method and generate the missing values. Finally we build the proper dataset. By using that dataset we build the model with artificial neural network (ANN) for predicting the decease and do the predictions using proposed model with better accuracy.

1.1. IMPORTANCE OF DISEASES AND ITS TYPES Now a days in world diseases percentage is increased because of the change in the weather, change in human habits' and many more reasons. There is the need for preventing the diseases and also predicting the diseases. In the world every human have some small or big health related problem. So there is needed to take care from those problems. In the world many more diseases are present that cause the human life

Table1. Diseases with attributes

Sr. No	Diseases	Attributes
1.	Heart	Age, Sex, Blood Pressure, Blood Sugar, chest pain, Cholesterol, restecorg (resting electrocardiographic), thalach (maximum heart rate), exang (exercise included by angina)
2.	Kidney	Age, Sex, Blood Pressure, Blood Sugar, sg (specific gravity), al(albumin), rbc (red blood cells), sc(Serum)
3.	Diabetes	Age, Sex, Blood Pressure, Blood Sugar, BMI (Body Mass Index)

In that project we discuss about the few diseases. For that we do the early prediction for avoiding and take caring of that disease. In this project we take the three types of diseases like heart, kidney, and diabetes diseases shown in the Table 1. In that we show the three diseases with its attributes like age, sex, blood pressure, blood sugar, Cholesterol, restecorg, thalach , exang, sg, al, rbc, sc, BMI for the

heart, kidney and diabetes. Now a day's those three diseases are very common in the human life. Many people are dies because the heart and kidney diseases because those diseases treatment are very costly. For that we can build the new model based on the artificial neural network for predicting those diseases early. By predicting diseases early we can gives the good treatment to that particular patient and save the life of that person in less cost

EXISTING SYSTEM

Min Chen et al., [1] developed techniques for predicting the diseases with the help of machine learning. They can propose new techniques based on the machine learning concept with the help of convoluational neural network. They proposed new method as multimodal disease risk prediction (MDRP) for predicting the chronic diseases. By using MDRP methods chronic diseases are effectively predicted .with the help of structured and unstructured data they can predict the diseases. They use machine learning and deep learning algorithms for prediction. In that machine learning algorithm such as k-nearest neighbor, naive Bayesian and decision algorithms and deep learning algorithm convoluational neural network used to predicting the diseases risk. MDRP algorithm process the datasets into two parts as training set and testing set which is train and test the data respectively for better prediction of diseases with good accuracy. By using this technique predict the whether the patient have a chronic diseases or not. The predicting accuracy of proposed algorithm is 94.8% with the high speed of predicting the diseases. But with the help of convoluational neural network it is difficult to determine window size of data and it can't handle the sequential data.

LITERATURE REVIEW

- R.Tamilarasi et al., [2] proposed a system for predicting hearth diseases with the help of data mining techniques. In medical science large amount data is generated from patient clinical reports other patient symptoms. Data mining is used to handle that large amount of data with the help of classification and clustering. They studied different data mining techniques that can useful to predict the heart diseases. Such data mining classifiers technique are used for effective and efficient heart diseases diagnosis. In that they use various attributes and decision tress method for predicting diseases. Data mining techniques are used to analyze the data from different dimension and

identify their relationships. For predicting the diseases they uses data mining algorithms like decision tree algorithm, naive bayes algorithm, neural network algorithm, k- nearest neighbor algorithm with the classification of diseases. This data mining techniques helps to healthcare professional for diagnosis of heart disease with better accuracy. Proposed system accuracy is 85%. But some disadvantages of data mining techniques like they are lazy

- Darcy A. Davis et al., [3] proposed the method for predicting the diseases which is based on patient medical history. They propose a CARE, collaborative Assessment and Recommendation Engine which depends on the medical history of patient. They use the IDC-9-CM codes to predict the diseases risks. This method is used for predicting the chronic diseases. In that they also describes a Iterative version of CARE, as ICARE which is incorporates ensembles concepts, but those approach did not have positive capacity of prediction. CARE system can do the prediction based on the vector similarity, inverse frequency and clustering with the medical data of patients. In that IDC-9-CM is the 3-digit code, which represents the small group of similar or related diseases of patients. CARE framework is used explore the border history of diseases suggestions related to previous unconsidered concerns about the prevention. But CARE system generates prediction on only feature visits of patients based on medical history.
- Feixiang Huang et al., [4] developed a system for predicting the diseases by using data mining techniques with the healthcare information. For that they apply data mining process which predicts the hypertension of patient by using the patient medical records. In that 9862 sample cases are studied. This sample is extracted from the real word information system databases. That information system databases contain 309383 medical records is used to generate diseases prediction. For that prediction data mining techniques are used such as naive Bayesian and RJ-48 classifiers. In that WEKA data mining tool is used to generate those data mining techniques. Confusion matrix is

used to represent the performance of naive Bayesian algorithm. In that they use a simple approach of considering the present or absents of diseases in medical history of patient. Accuracy of proposed system is 83.5%.

- AbhishekRairikar et al., [5] proposed prediction model for predicting the heart diseases with the data mining techniques. In that they uses a different more numbers of patients attributes, such as gender , blood pressure, cholesterol like other some attributes for predicting the heart diseases. Healthcare industries produce massive volume of data which is forms of numbers, text, images, and charts. Data mining provides the various classification methods like K-nearest neighbor, decision tree, CART, C4.5, J48 and so on. In this system three different data mining classification techniques such as K-nearest neighbor, decision tree and naive bayes are used to analyze the datasets. K-nearest neighbor classification and regression methods are used to pattern reorganization and decision tree are used to build the good decision. But the KNN algorithm is lazy algorithm, where the functions are only locally approximated and also in that need to determine values of parameters of previous neighbor.
- Saurabh Pandey et al., [6] developed efficient way to predicting the diabetes of patient by using the bio medical signal data with the help of artificial intelligence techniques. This system gives brief overview of diagnosis of diabetes using patient medical bio signal data. In that they use the artificial intelligence approach like ANN, Fuzzy for fixing the wide variety of issues in different application of area. They propose the suitable approach for prediction of diseases based on the dietetics bio medical signal data. Workflow of the methodology is like feature selection as symptoms of diseases then building the datasets with data homoscedasticity after that training and testing of datasets are done by using AI techniques. For the simulation result they use the algorithm which is developed by using MATLAB for detection of diabetes. For that datasets are used with the number of input value which is selected by using regression analysis. In that they use the 768 input samples in

diabetes datasets. After that gives the value of regression coefficient which shows the output dependency of every input sample that gives the prediction of diseases. For accurately representing the statistical properties of real time data which is does not possible to predict diseases.

- Dr.B.Srinivasan et al., [7] studied the data mining techniques for efficiently predicting the diseases in healthcare sectors. They can introduce the various data mining techniques which are useful in medical fields for better decision making related to the diseases. In medical filed huge amount of data produced like the patient details, diagnosis history and varies medications, such data is used to predicting the diseases by using data mining approaches. They introduce the data mining knowledge discovery for converting the low level data to high level data knowledge. For that data cleaning, data integration data selection, data transformation pattern evaluation, knowledge representation such steps are required. In that they studied various data mining technique like as, Bayesian classifiers, decision tree, support vector machine and artificial neural networks for predicting diseases. They discussed about various diseases like Eye diseases, Cancer, Heart diseases, Diabetics, etc. Data mining based prediction systems reduce the cost and human effects but they are time consuming and lazy learning methods.
- ParithoshKhubchandani et al., [8] proposed a system based on artificial intelligence and probabilistic model for medical prediction. Prediction is the important factor in the medical domain. In that they can use the artificial intelligence for decision making in medical filed to predicting the diseases. This system can generate the important data for the evolution of diseases diagnosis. Therefore main advantages of artificial intelligence are it creates tools that should better work than human. In that they present the new approach suitable for medical prediction which is based on the probabilistic modeling. When the information is large and complex the system uses this approach. Knowledge based approach cannot handle the large or

complex data, so probabilistic approach is used to medical prediction. The statistical approach associates a probability each output of medical data for that bayes theorem is used for prediction. By using this system physicians can focus on important activities of patients. Some result of technique take more time to evaluation and some computations are complex that is effects on the other factors of prediction.

- Smita .T et al., [9] developed an efficient algorithm for predicting the diseases with the help of multidimensional data. Main objectives of this system create a easy, fast, effective approach for diseases prediction. They introduced new hybrid algorithm for diseases identification and prediction by using data mining techniques. New algorithm is diseases identification and prediction (DIP) it is combination of decision tree and association rule. This is used for doing prediction of some diseases in particular area. Also it is shows the relationships between the different parameters of diseases. For that they use data mining approach for extracting the information which is previously not known. It also used for analyzing the information for prediction. This research work is based on different data mining approach on the multidirectional data analysis. For that they uses the common data mining models for prediction , such as Association rule, decision tree, clustering, classification rule and various statistical data mining tools. For DIP decision tree and Association rule which construct the Apriori principle. Apply the statistical mining techniques in cluster analysis for extracting the data.DIP predicts the diseases only on multidimensional data. The result is represented in graphical format.
- AnandanadarajahNishanth et al., [10] proposed a new method for early detection of the chronic kidney diseases by identifying the important features from the datasets. Chronic kidney diseases (CKD) are the not know those medical testes of patients are take for the other purposes that is useful for the diseases. In that they use the kidney dataset for identifying and detecting the kidney diseases. In that dataset various attributes are preset like the blood sugar, blood pressure, specific gravity,

Albumin. Serum, blood glucose and so on. In this paper they use the different techniques for the detection like CSP and LDA. CPA is the Common Spatial Pattern and the LDA is the Linear Discriminnant Analysis which is identifies the important attributes and detects the chronic kidney diseases. In this paper classification methods is used for the identifying the attributes of diseases. This analysis contains the albumin, haemoglobin, specific gravity, haemoglobin, with the serum like important features for early detection of kidney diseases. With the Linear Discriminnant Analysis get the 98% accuracy of chronic kidney diseases.

- Fatma Taher et al., [11] proposed a system for detecting the lung cancer by sing artificial neural network and fuzzy clustering method. Lung cancer is the common cause of death of people among the world because its symptoms are appears at only advanced stage. There are many techniques such as x-ray, CT scan, MRI is available for diagnosis of lung cancer but they are very expensive and time consuming. These systems solve the problem effectively with the help of artificial network and fuzzy clustering. For that they use a segmentation process which detects the lung cancer early stage. In that two segmentation techniques are used that is Hopfield Neural Network (HNN) and Fuzzy C-Mean (FCM). Hopfield Neural Network (HNN) it is the one of the artificial neural network which is used for image segmentation. Those propose the segmentation process for both black and white and colour images. HNN can very sensitive and it can detect the overlapping classes of images. Fuzzy C-Mean (FCM) is for fuzzy identification and pattern recognition which is based on the distance criteria. This algorithm contains a predefined numbers of inputs and gives the clusters of outputs. For input they can takes the number of image dataset of diseases and applies the both algorithm and gives the prediction on that image data. But this system is gives the result only on image datasets which requires more numbers of image datasets.
- In the medical field, adverse events (AEs) are the leading cause of morbidity and mortality [3],

according to data from the U.S. Food and Drug Administration (FDA). Since 1997, the number of all AE cases reported by the FDA has increased by nearly a factor of five, and between 2006 and 2014, the number of deaths due to AE cases increased by 232%. To address such problems, many pharmaceutical companies are trying to deal with the increased number of cases by means of manual case records, but this is not a sustainable solution because of the considerable growth in the incidence of AE cases [3]. To address AE-related problems, Dev et al. [4] identified an increasing number of adverse drugs and new drugs. They used deep learning based on a word2vec module for AE case classification. The results showed increased robustness to unseen AE cases and medical words, but due to FDA restrictions, this work lacked interpretability, which led to difficulties in application. With the rapid development of contemporary medicine, one of the key AE-related problems is adverse drug events. To avoid adverse drug events, a high-accuracy automatic medicine recognition system is needed to assist people in recognizing various kinds of drugs. To meet this requirement, many related drug recognition technologies and systems have been addressed, discussed, and developed. To develop pill image recognition techniques, the U.S. National Library of Medicine (NLM) held a challenge competition in 2016. Yaniv et al. [5] reported the results of this challenge competition. Ushizima et al. [6] investigated pill recognition approaches on a new pill image dataset for the NLM competition. They also discussed some data planning strategies for effective content-based image retrieval.

- Ribeiro et al. [7] proposed a medicine box recognition system that adopted a three-stage (barcode recognition, text recognition, and feature matching) approach. Their proposed system used a camera mounted on a device and used an Android system to correctly recognize medicine packages to provide people experiencing difficulties (such as elderly individuals and individuals with visual impairments) with related medication packaging information. Bar code detection and optical

character recognition (OCR) were used to recognize the names on the medicine packages. Their proposed system achieved a recognition success of up to 80%. However, the system had a recognition blind spot in the case of medicine packages bearing the same name but with different contents (number of tablets, dosage, and/or route of administration).

- Wang et al. [8] also presented a deep-learningbased recognition methodology for recognizing drug blister packages.
- Yu et al. [9] presented an accurate and automatic pill recognition system that combined imprint extraction and description to make use of imprint information. Moreover, a loopy-belief-propagation-based image segmentation approach was applied to the imprint on the pill to solve the problem of incoherent and coarse strokes. The experimental results showed that this pill recognition system achieved accuracies of 90.46% on the top rank and 97.16% on the top five ranks.
- Neto et al. [10] proposed a pill feature extractor based on shape and color, called CoforDes. In this work, K-nearest neighbor (K-NN)-, support vector machine (SVM)-,and Bayes-based techniques were adopted to evaluate the extracted features. Moreover, CoforDes can be executed as a part of real-time embedded applications.
- Calix et al. [11] presented a method for medical personnel to use in tracking and monitoring the safe use of drugs, called the Deep Gramulator, which is designed to automatically extract tweets related to personal health experience from social media. In this work, classifiers were built based on a variety of machine learning algorithms, such as deep neural networks (DNNs), to help detect such data. However, when the Deep Gramulator was applied to an independent test set of 3,156 samples, the classifier did not perform well in terms of accuracy. Another important issue is medication adherence. Poor medication adherence can threaten people's health. Hence, many medication adherence monitoring and tracking systems have been proposed [12]–[15].
- Kalantarian et al. [12], [13] proposed a smartwatch-based system in which built-in 3-axial

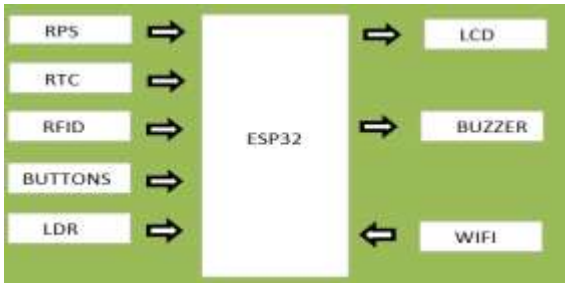
accelerometers and gyroscopes were adopted to recognize several motions for medication adherence detection. Ma et al. [14] also developed a smartwatch-based adherence monitoring system, which used machine learning and distributed computing techniques. Moreover, data were collected from built-in inertial sensors to monitor the sequence of actions occurring during a person's medication intake.

- Aldeer et al. [15] designed a noninvasive medication adherence monitoring system based on integrated collaborative sensing technology in a wireless sensor network (WSN) environment. Several sensors were mounted on the pill bottle to monitor medication adherence behavior regarding pill intake. Other related issues have also been addressed [16]–[31] in attempts to provide immediate medication records, cloudbased online medicine management systems, and personalized telemedicine services. Given several instances,
- Chen et al. [16] proposed a comprehensive medicine management system that integrated medical information from various sources. The proposed system could automatically detect inappropriate drugs. Moreover, every participant could fully track the patients' most recent medicine use online in real time.
- Kim [17] developed a medication compliance monitoring system for checking medication compliance in clinical trials. The proposed system was composed of a clinical trial database management platform and a PDA with a barcode scanner for each clinical trial participant. Related healthcare ecosystems have also been addressed, discussed and proposed [19]–[31] to enable new personalized, predictive, preemptive, pervasive, and precise e-health services.
- Jiménez-Fernández et al. [32] discussed possible issues of adaptation usability and sensor device interoperability for chronic disease management systems. They noted that a large percentage of chronic patients are also elderly patients. Their experimental results showed that sensor-network-based systems could play an important role in monitoring patients. Hence, the usability of such a sensor-network-based system must be adapted to meet the patients' needs.

- Although many solutions have been published for adverse drug events and systems for providing immediate medication records and personalized services have been developed for patients, their functions are often not comprehensive or easy to use. Therefore, in this paper, we develop an intelligent medicine recognition system based on deep learning technology. The proposed system has many benefits, such as its capabilities of perfect recording and high-precision recognition, its simple operation, and its friendly interface. Compared to other machine learning approaches, deep learning is the most effective recognition approach, achieving high recognition rates [33]. The proposed system incorporates edge computing [34] capabilities to reduce delay and to make the connected application more sensitive, thus enabling realtime computing capabilities and the performance optimization of applications based on artificial intelligence over the Internet of Things (AIoT).
- From the above survey it is observed that Disease prediction was done with traditional models such as machine learning, Data Mining using various algorithms like logistic regression, decision tree and so on. Previously existing techniques do the prediction on diseases but cannot predict the subtypes of diseases. Those systems also can't find the diseases which are caused by occurrences of any previously diseases. That fails to do predictions of all possible conditions of patients. Existing systems can handles the only structured data but ca not handles the unstructured data. Existing systems predicts the particular diseases with the help of data mining techniques which are ambiguous [18]. In the existing systems the datasets size is .small, for the patients and diseases are present some specific conditions and the characteristics are selected from experience. So such a pre selected characteristics are not satisfy the changes in the diseases and its influence factors. Those systems have a lower accuracy of diseases predictions. By using Data mining techniques algorithms such as KNN they consumes more time of prediction because those algorithms are lazy

PROPOSED SYSTEM:

BLOCK DIAGRAM



The proposed system can assist chronic patients in taking multiple medications correctly and in avoiding taking the wrong medications, which may cause drug interactions, and can provide other medication-related functionalities such as reminders to take medications on time, medication information, and chronic patient information management. The proposed system consists of an intelligent medicine recognition device, an app running on an Android-based mobile device, a deep learning training server, and a cloud-based management platform. Currently, eight different medicines can be recognized by the proposed system. The experimental results show that the recognition accuracy reaches 96.6%. Therefore, the proposed system can effectively reduce the problem of drug interactions caused by taking incorrect drugs, thereby reducing the cost of medical treatment and giving patients with chronic diseases a safe medication environment.

CONCLUSION: For home human services different innovation have advanced as audit considered, in this paper medication, its planning has all around centered which is useful to improve productivity of endorsed tranquilize and diminish financial factor. To improve the current home human services method number of checking innovation has seen which prompts home wellbeing observing framework. The checking framework can be actualized with detecting component and remote module which should need to verify so message containing the wellbeing related data ought not be degenerate. IOT (Internet of Things) assume a crucial job in imparting the two gadgets, the utilization of informing standard and correspondence convention we can safely move the significant messages with respect to wellbeing. open source IOT cloud will be powerful for putting away sensors data,the advantage of carefully putting away is the recovering of information is simple and quicker way if there should be an occurrence of crisis for secure wellbeing. For the client individual personality and Encryption/Decryption purposes the RFID will best

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