**ABSTRACT**

Health is a vital topic which is connected with our human lives. Healthcare sectors come under this as it disperses into a broader scale. Information and Communication Technology plays an important role in the healthcare sector because modern technology assists to furnish effective and efficient services. The impact of Information Technology in healthcare is immense. Therefore, we propose an online disease detection system that delivers quick guidance in absence of human expertise. Generally, it interprets the user’s input by natural language processing but some simpler systems search for keywords within the text and then provide a reply based on the matching keywords or certain patterns. The proposed system will have English as the default language as it would increase the scope for the global community to benefit from it. This system will be embedded into a website to maximize its customer outreach and usage. It will also predict lifestyle-based diseases like heart diseases, diabetes and breast-cancer. The initial model of the project will contain a chatbot which will predict the disease according to the symptoms of the patient and recommend a specialized doctor for respective diseases.

**Chapter 1**

**INTRODUCTION**

Science has made great advancements to enhance the interaction between humans and machines by leaps and bounds. An artificial intelligence software that can simulate a conversation with a user in natural language. Smart interactions save the user’s time by helping them to find the right information and address their queries. This technology has made great progress in the healthcare industry. With the help of this algorithm we will be contributing to the betterment of the society. The model is designed to predict the result according to the symptoms with better accuracy. In the initial phase, we are making a chatbot that would diagnose the disease based upon the symptoms exhibited by the patient. The patient would be required to enter the symptoms and the model would accurately predict the disease based upon a dataset that has been prepared carefully from a large number of sources. On the other hand, there has been a drastic increase in the rate of people suffering from lifestyle-based diseases since a decade. Current human lifestyle is the main reason behind growth of diseases like Diabetes, Breast Cancer and Cardiovascular diseases. Diabetes is a common, chronic disease. Prediction of diabetes at an early stage can lead to improved treatment. Data mining techniques are widely used for prediction of disease at an early stage. In this research paper, diabetes is predicted using significant attributes, and the relationship of the differing attributes is also characterized. Various tools are used to determine significant attribute selection, and for clustering, prediction, and association rule mining for diabetes. Breast cancer (BC) is one of the most common cancers among women worldwide, representing the majority of new cancer cases and cancer-related deaths according to global statistics, making it a significant public health problem in today’s society. The early diagnosis of BC can improve the prognosis and chance of survival significantly, as it can promote timely clinical treatment to patients. Further accurate classification of benign tumors can prevent patients undergoing unnecessary treatments. Thus, the correct diagnosis of BC and classification of patients into malignant or benign groups is the subject of much research. Because of its unique advantages in critical features detection from complex BC datasets, machine learning (ML) is widely recognized as the methodology of choice in BC pattern classification and forecast modelling. Heart disease is the major cause of morbidity and mortality globally: it accounts for more deaths annually than any other cause. Of all heart diseases, coronary heart disease (aka heart attack) is by far the most common and the most fatal. The silver lining is that heart attacks are highly preventable and simple lifestyle modifications (such as reducing alcohol and tobacco use; eating healthily and exercising) coupled with early treatment greatly improves its prognosis. It is, however, difficult to identify high risk patients because of the multifactorial nature of several contributory risk factors such as diabetes, high blood pressure, high cholesterol, et cetera. This is where machine learning and data mining come to the rescue. Doctors and scientists alike have turned to machine learning (ML) techniques to develop screening tools and this is because of their superiority in pattern recognition and classification as compared to other traditional statistical approaches. In the current medical diagnosis method, there can be three different types of errors.

1-The false-negative type in which a patient in reality is already a diseased patient but test results tell that the person is not having the disease.

2. The false-positive type. In this type, a patient in reality is not a diseased patient but test reports say that he/she is having the disease.

3. The third type is an unclassifiable type in which a system cannot diagnose a given case. This happens due to insufficient knowledge extraction from past data,

a given patient may get predicted in an unclassified type. Such errors in diagnosis may lead to unnecessary treatments or no treatments at all when required. In order to avoid or reduce severity of such impact, there is a need to create a system using machine learning algorithms and data mining techniques which will provide accurate results and reduce human efforts.

**Chapter 2**

**LITERATURE SURVEY**

[1] Medical ChatBot- “Mrs. Rashmi Dharwadkar1, Dr.Mrs. Neeta A. Deshpande”. International journal of computer trends and technology (IJCTT). According to the author, the paper gives the information regarding products which is useful for consumers to obtain what they want exactly. Question Answering (QA) systems can be identified as information accessing systems which try to answer natural language queries by giving suitable answers making use of attributes available in natural language techniques. The system takes a plain text as input and answering all types of questions output by qualified user is the output. It helps the user to resolve the issue by providing human way interactions using LUIS and cognitive services which is implemented on AWS public cloud. The main of this paper is to provide a generic solution to this problem and build up a system which is useful for medical institutes or hospitals to help the users to freely ask medical dosage related queries by voice.

[2] Early Diagnosis of Human Disease using Artificial Intelligence Anil Kumar and Hemant Kumar Soni The Most common fuzzy methodology i.e. Mamdani Fuzzy Inference model is used in this proposed work. This methodology includes fuzzification of crisp data, inferring using knowledge base and rule base and defuzzification of fuzzy output to obtain crisp values. Fuzzification involves reading crisp data and mapping or translates it into fuzzy data for the use of inference system. Inferring includes reading fuzzy data and processes them on the basis of fuzzy rules and knowledge. The result obtained from inferring shows fuzziness. Thus in defuzzification, the result which is in fuzzy form is again map or translates into crisp values so that it becomes accurate and fruitful. The existing study reveals the importance of artificial intelligence in the diagnosis of human disease. The above literature review envisages the need for an expert system in different disease diagnosis. The accuracy of predictions based on the sample size of a patient’s data poses the challenges in this domain. The use of methodologies under AI which ultimately 9 leads the correct diagnosis motivates us to explore future work in this domain. This study helped us to find the possibilities of the design of Expert System (ES) based on paradigms of AI which would yield better results and accuracy. Although there are different paradigms of AI like Neural Network, Machine Learning, Deep Learning, and Fuzzy Logic the application of Fuzzy logic is versatile and gives the accurate prediction where ever approximation diagnosis is required.

[3] A Tool of Conversation: Chatbot- “M. Dahiya”. Automated Medical Chatbot. SSRN Electronic Journal. A Chatbot is actualized utilizing design looking at, in which the request for the sentence is perceived and a spared reaction design is adjusted to the elite factors of the sentence. Chatbot is relatively new technology. The application of a Chatbot can be seen in various fields in the future. This paper covers the techniques used to design and implement a Chatbot. From the author point of view their Chatbot uses simple pattern matching to represent the input and output whereas other Chatbots use input rules, keyword patterns and output rules to generate a response. Their main aim was to develop a chatbot that is simple, user friendly, must be easily understood and the knowledge base must be compact.

[4]CHATBOT ACCEPTANCE IN HEALTHCARE: EXPLAINING USER ADOPTION OF CONVERSATIONAL AGENTS FOR DISEASE DIAGNOSIS- “Sven Laumer, Christian Maier, Fabian Tobias Gubler”. In Proceedings of the 27th European Conference on Information Systems (ECIS), Stockholm & Uppsala, Sweden, June 8-14, 2019. The author develops a model to introspect whether adoption of conversational agents for disease diagnosis should be promoted or not. The proposed model addressed research gaps in CA research in general, but also in medical health and especially the use of CA in healthcare research in particular. To build the model they used UTAUT2 as a theoretical lens and 35 semi structured interviews with potential users of a CA for disease diagnosis. In their model they revealed that hedonic motivation is not relevant for CA adoption. 10

[5] Chatbot for Disease Prediction and Treatment Recommendation using Machine Learning-“ Rohit Binu Mathew ; Sandra Varghese ; Sera Elsa Joy ; Swanthana Susan Alex. 2019 3rd International Conference on Trends in Electronics and Informatics (ICOEI). Individuals can associate with the chatbot simply as they do with another human and through a progression of questions; chatbot will distinguish the manifestations of the client and consequently, predicts the symptoms and suggests treatment. This framework can be of extraordinary use to individuals in directing every day registration, makes individuals mindful of their well-being status and urges individuals to make legitimate measures to stay sound. According to this research, such a framework isn't broadly utilized and individuals are less mindful of it. Executing this proposed system can assist individuals with dodging the tedious strategy for visiting emergency clinics by utilizing this liberation from cost application at any place.

[6] Manish Bali , Samahit Mohanty, Subarna Chatterjee, Manash Sarma,Rajesh Puravankara have proposed their work on Diabot: A Predictive Medical Chatbot using ensemble learning. They have combined various machine learning algorithms and text pre-processing techniques in a voting ensemble. The advantage of using this is that they have a high performance framework for future disease specific chatbot designs and they combine all the weak classifiers with quantitative performance using meta classifiers. Diagnosis decisions based on the classification result alone will be very weak. Disadvantage of this model is that ensemble learning is very weak in terms of accuracy. As a part of future work we can concentrate on the ingesting patient directly into the diabot server using IOT sensors and build a recommendation engine.

[7] Josip Bozic,Oliver A.Tazl,Franz Wotava have proposed the Chatbot Testing Using AI Planning. This is based on AI where each action is considered to be a question to the chatbot.The disadvantage of this model is that the chatbot remains in the mode even if the user responds in an unexpected way. They use a planning based test approach where they create a model which serves as a test case generation. The model of SUT is extracted which is used to 11 plan specifications. Advantage of using this is that when multiple information is being submitted at once it doesn't influence the order. As a future work they can be used for other functional and non-functional testing.

[8] Deepika Joshi, Renu Kant and Sachin Shakya have proposed their work on Disease prediction using machine learning in a chatbot. This paper consists of various ML algorithms to predict the disease symptoms along with their diabetics status through the information given by patients. The advantage of this method is that with the help of the modules the bot can predict the disease using a decision tree algorithm as they are proven to give better accuracy.The disadvantage can be mentioned as the computational power of the bot where every time the response time decreases.

[9] Gajendra Prasad K.C, Tathgat Ankit, Satvik Ranjan and Vivek kumar have proposed their work on A Personalised Medical Assistant Chatbot: Medibot. The algorithms used here are Sequence to Sequence Model, Apriori which is used in finding the frequent item set in the given dataset. So a chatbot is used to analyse the self-diagnosis. This helps the individual to keep track of the field of medical science for early and faster detection of diseases. The disadvantage is that the lack of correct and accurate medical dataset also in the seq2seq model is very time consuming during the training phase using the hardware which is not capable of handling it.also in the model accurate heart rate,BMI can be given as input to the system and the disease prediction also can be improved.

[10] Flora Amato, Stefano Marrone and Vincenzo Moscato have proposed their work on Chatbots meet eHealth: automatisation healthcare. The aim of this work is to showcase the effectiveness of the human intervention paradigms. The biggest challenge is that for modern eHealth applications is to provide intelligent recommender systems which leverage different kinds of available data. The design allows us to adapt it to different clinical scenarios and medical tasks. They implemented various techniques which plan on spreading HOLMeS in different countries for helping the medical knowledge sharing. When interaction requires 12 elaborating machine learning algorithms of accessing the data storage the core system contacts the cluster for accomplishing the specific tasks.

[11]An Advanced Conceptual Diagnostic Healthcare Framework for Diabetes and Cardiovascular Disorders M. Sharma,1 \*,G. Singh2 and R. Singh A hybrid artificial intelligent and smart framework based upon Data Mining, IoT, chatbots, contextual entity search, sentiment analysis and granular computing has been proposed.Therefore, here, a smart data mining and IoT (SMDIoT)based progressed medicinal services framework for capable diabetes and cardiovascular maladies have been proposed. The hybridization of information mining and IoT strategies should give a viable and affordable answer for diabetes and cardiac patients. With the utilization of SMDIoT, fundamental clinical assets and labor will be better used; subsequently, the patient consideration will be additionally upgraded. Notwithstanding social insurance, it will significantly decrease financial misfortunes of diabetes and cardiac patients by limiting different verifiable and express clinical costs.

[12] A PAPER ON CHATBOT FOR MEDICAL DIAGNOSIS ANKIT GARG RAJAT JINDAL SUNNY ASHISH The suggested Medical Chatbot can interconnect with users and gives them the same virtual realistic experience of visiting a Medical Professional. This Chatbot firstly uses the text classification to detect the intent of the user also known as intent classification and then detects the pattern of the response by the user using AIML (Artificial Intelligence Markup Language) technology. AIML is the markup language which is based on XML. AIML is used to build AI applications. AIML first reduces the message to the few keywords in that message. It retrieves them from the initial messages and then know about the possible health issue/problems that unconfirmed patients might be having, based on the symptoms shown by the user. 13

[13] Machine Learning and Artificial Intelligence based Diabetes Mellitus Detec- tion and Self-Management: A Systematic Review Jyotismita Chaki, S. Thillai Ganesh, S.K Cidham, S. Ananda Theertan This paper gave an exhaustive investigation of programmed diabetic location and determination procedures. The fundamental articles are gathered from Scopus and PubMed logical archives. After an exhaustive screening measure, 107 examinations are picked for this investigation. Each exploration is tended to in this investigation from the perspective of four explicit viewpoints, including information bases, ML-based arrangement, and indicative strategies, AI-based wise collaborators for patients with DM, and execution measurements. A few freely open information bases with explicit qualities have been depicted and archived in this investigation. Among these datasets, Pima Indians Diabetes Dataset, DIARETDB1, DIARETDB0, Kaggle, STARE, and Messidor are most generally used for DM identification. Text, shape, and surface element created better results. In ML calculations, the majority of the investigations expressed that Deep Neural Network and Support Vector Machine conveys better order results followed by random forest and Ensemble Classifier. CNN is fundamentally utilized in profound figuring out how to naturally recover and distinguish DM information. Numerous analysts have created diverse astute colleagues like chatbots and robots which can be utilized to upholds the day by day DM the executives cycles of patients like insulin management, diet checking, and so forth. Regarding performance assessment, most of the researchers used the accuracy, specificity, sensitivity, and AUC as indicators.

[14] Symptom Based Health Prediction using Data Mining Vijaya Shetty S Department of Computer Science and Engineering Nitte Meenakshi Institute Of Technology Bengaluru,India Karthik G A Department of Computer Science and Engineering Nitte Meenakshi Institute Of Technology Bengaluru,India M Ashwin Department of Computer Science and Engineering Nitte Meenakshi Institute Of Technology Bengaluru,India The proposed model utilizes the capability of different Machine learning algorithms combined with text processing to achieve accurate prediction. Text processing has been implemented using Tokenization and, is combined with various algorithms to test the similarities and the outputs. In the health industry, it provides several benefits such as pre-emptive detection of diseases, faster

14 diagnosis, medical history for review of patients, etc. The dataset used had a lot of cleaning and preprocessing needed to be done. The first step was to transpose the datasets into a form with diseases as the target column and each of the symptoms as dummy variables for the diseases, on which models were to be trained. For the study, three different sets of algorithms were used for mapping symptoms into diseases: Decision Trees, Random Forest, and Naïve Bayes. The model trained for predicting diseases gives a very good result for the given dataset. The algorithms used are very efficient and accurate. This model can be integrated with chatbot models such as DialogFlow from Google to add some more interactions.

[15]Fitriyani, N. L., Syafrudin, M., Alfian, G., & Rhee, J. (2020). HDPM: An Effective Heart Disease Prediction Model for a Clinical Decision Support System. IEEE Access, 8, 133034-133050. The system proposed system here uses Density-Based Spatial Clustering of Applications with Noise (DBSCAN) to detect and eliminate the outliers, a hybrid Synthetic Minority Over-sampling Technique-Edited Nearest Neighbour (SMOTE-ENN) to balance the training data distribution and XGBoost to predict heart disease. On comparison with other well-known machine learning algorithms, the proposed system outperformed them on the grounds of accuracy, precision and speed..

[16]Patil, P. B., Shastry, P. M., & Ashok Kumar, P. S. (2020). MACHINE LEARNING BASED ALGORITHM FOR RISK PREDICTION OF CARDIOVASCULAR DISEASE (CVD). Journal of Critical Reviews, 7(9), 836-844. The proposed system uses Naive’ Bayesian classifier, decision tree and k- nearest neighbour algorithm. After the prediction if the accuracy value is above 95%, the disease condition is satisfied. Analysis showed that the proposed neural network model fared better than other deep learning techniques 15 [17]Manogaran, G., Varatharajan, R., & Priyan, M. K. (2018). Hybrid recommendation system for heart disease diagnosis based on multiple kernel learning with adaptive neuro-fuzzy inference system. Multimedia tools and applications, 77(4), 4379-4399. This paper put forth a heart disease diagnosis using Multiple Kernel Learning with Adaptive Neuro-Fuzzy Inference System (MKL with ANFIS) based deep learning method. The results from the proposed MKL with ANFIS method has produced high sensitivity (98%), high specificity (99%) and less Mean Square Error (0.01) for the for the KEGG Metabolic Reaction Network dataset.

[18]Artificial Intelligence–Based Breast Cancer Nodal Metastasis Detection: Insights Into the Black Box for Pathologists Yun Liu, PhD; Timo Kohlberger, PhD; Mohammad Norouzi, PhD; George E. Dahl, PhD; Jenny L. Smith, DO: The authors have proposed a work to evaluate the application and clinical implementation of a state-of-the-art deep learning–based artificial intelligence algorithm (LYmph Node Assistant or LYNA) for detection of metastatic breast cancer in sentinel lymph node biopsies.The main limitation in this proposed method is that LYNA lacks context about the anatomic position of the current field of view and will be unable to automatically make position-dependent determinations such as extranodal extension and lymph-vascular invasion.LYNA achieved a slide-level area under the receiver operating characteristic (AUC) of 99% and a tumor-level sensitivity of 91% at 1 false positive per patient on the Camelyon16 evaluation dataset. 16

[19]Detection of Breast Cancer with Mammography: Effect of an Artificial Intelligence Support System Alejandro Rodríguez-Ruiz, Elizabeth Krupinski, Jan-Jurre Mordang, Kathy Schilling, Sylvia H. Heywang-Köbrunner, Ioannis Sechopoulos, Ritse M. Mann The main of this research is to compare breast cancer detection performance of radiologists reading mammographic examinations unaided versus supported by an artificial intelligence (AI) system.The AI system is trained, validated, and tested by using a database containing more than 9000 mammograms with cancer.Radiologists improved their detection performance when using AI support, with the average AUC increasing from 0.87 to 0.89 (difference, 0.02; P = .002)On average, the AUC was higher with AI support than with unaided reading (0.89 vs 0.87, respectively; P = .002). Sensitivity increased with AI support (86% [86 of 100] vs 83% [83 of 100]; P = .046). [20]Stand-Alone Artificial Intelligence for Breast Cancer Detection in Mammography: Comparison With 101 Radiologists Alejandro Rodriguez-Ruiz, Kristina Lång, Albert Gubern-Merida, Mireille Broeders, Gisella Gennaro, Paola Clauser, Thomas H Helbich,JNCI: Journal of the National Cancer Institute, Volume 111, Issue 9, September 2019. The main aim of the authors in this paper is to compare the stand-alone performance of an AI system to that of radiologists in detecting breast cancer in DM.The performance of the AI system was statistically non inferior to that of the average of the 101 radiologists. The AI system had a 0.840 (95% confidence interval [CI] = 0.820 to 0.860) area under the ROC curve and the average of the radiologists was 0.814 (95% CI = 0.787 to 0.841) (difference 95% CI = −0.003 to 0.055). The AI system had an AUC higher than 61.4% of the radiologists.As a result, the evaluated AI system achieved a cancer detection accuracy comparable to an average breast radiologist in this retrospective setting.

**Chapter 3**

**PROPOSED METHODOLOGY**

**3.1 DISEASE DETECTION CHATBOT:**

First the data in the dataset is tokenized to word using NLTK module.

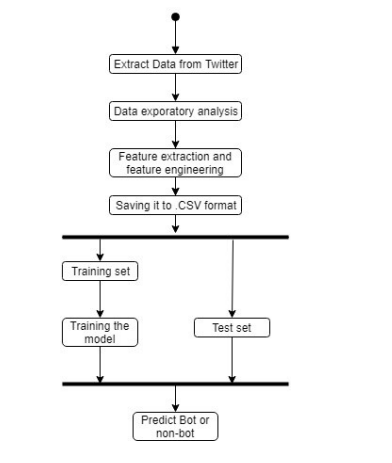


Figure 1:Flow of the Chatbot Each word is appended to the list of words.

After this each word is lemmatized and duplicate words are removed from the list of words. These words are then stored using a pickle file which will be used to predict the data. The input of the training data uses the pattern and the output is the class to which the input pattern belongs to. The data is converted into numbers to be fed to the neural network The model contains 3 layers. First layers contain 128 neurons followed by the second layer containing 64 neurons only. The 3 rd layer, that is the output layer, has a number of neurons equal to the number of intents to predict output intent using softmax. After the model is compiled, Stochastic Gradient Descent Algorithm is used with Nesterov Accelerated Gradient to train the data model. Then the model is fitted and saved. 22 To display the predicted output, the trained model is loaded and a graphical user interface is used. The model just predicts which class the input belongs to. This class is used to retrieve a random response from the list of responses with the help of various functions like bag of words. Tkinter library is used to display the predicted output on the GUI.

**3.2 PREDICTION ANALYSIS:**

● Perform descriptive analysis on heart disease prediction, breast cancer prediction and diabetes prediction using key factors like Glucose levels, Blood Pressure, Skin Thickness, BMI etc.

● Visually explore these variables, you may need to look for the distribution of these variables using histograms. Treat the missing values accordingly.

● We observe integers as well as float data-type of variables in this dataset. Create a count (frequency) plot describing the data types and the count of variables.

● Check the balance of the data by plotting the count of outcomes by their value. Describe your findings and plan future course of actions.

● Create scatter charts between the pair of variables to understand the relationships. Describe your findings.

● Perform correlation analysis. Visually explore it using a heat map.

● Devise strategies for model building. It is important to decide the right validation framework. Express your thought process. Would Cross validation be useful in this scenario? 23

● Apply an appropriate classification algorithm to build a model. Compare various models with the results from KNN.

● Create a classification report by analyzing sensitivity, specificity, AUC (ROC curve) etc.

● Create a dashboard in tableau by choosing appropriate chart types and metrics useful for the business.

The dashboard must entail the following:

a) Pie chart to describe the diabetic/non-diabetic population

b) Scatter charts between relevant variables to analyze the relationships

c) Histogram/frequency charts to analyse the distribution of the data

d) Heatmap of correlation analysis among the relevant variables

e) Create bins of Age values and analyse different variables for these age brackets using a bubble chart. –

**3.3DIABETES PREDICTION ANALYSIS:**

There are 768 rows and 9 columns in this dataset The dataset has nine attributes in which there are eight independent variables (Pregnancies, Glucose, Blood Pressure, Skin Thickness, Insulin, BMI, Diabetes Pedigree Function, Age) and one dependent variable (Outcome). BMI and DiabetesPedigreeFunction are a float data type and rest of the variables are integer data type. The Variables have a lot of zero values which can be represented as missing values The missing values '0' is replaced by mean to explore the dataset. The Outcome variable shows that there are 500 non-diabetic people and 268 diabetic people. It means that 65.1% people are diabetic and 34.9% people are non-diabetic.

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