

Disease Prediction Using Snn over Big Data

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Abstract : *Enormous information and its strategies not just assistance the biomedical and social insurance segments to estimate the illness expectation yet in addition the patients. It is hard to meet the specialist at all the occasions in clinic for minor indications. Enormous information gives fundamental data about the maladies dependent on the indications of the patient. These days' individuals need to find out about their wellbeing, ailments and the related medicines for their advancement. Anyway existing medicinal services framework gives organized info which needs in dependable and exact forecast. Here, Sensational Neural Network (SNN) is proposed which recognizes the most precise malady dependent on patient's input which advantages in early discovery. Electronic Health Record (EHR) keeps up and refreshes persistent wellbeing records which encourage an improved expectation model. Enormous information utilizes both organized and unstructured data sources which result in moment direction to their medical problems. The framework takes contribution from the clients which checks for different illnesses related with the side effects dependent on breaking down an assortment of datasets. In the event that the framework can't give reasonable outcomes, it private the clients to go for Clinical Lab Test (CLT, for example, blood test, x-beam, and sweep so on where the transferred pictures are sent for the successful profound learning forecast. The various parameters incorporated into viable programmed multi ailment forecast incorporate preprocessing, grouping and prescient examination. The principle target of the proposed framework is to distinguish the sicknesses dependent on the manifestations and give legitimate direction for the patients to take treatment rapidly immediately in a helpful and proficient way.*

Key Terms - Big Data, SNN, EHR, Deep Learning Algorithm, CLT.

I. INTRODUCTION

Because of the commitment of web innovation makes our life increasingly advantageous and gives an assortment of data from which one can peruse their ideal needs. Enormous information has indicated dynamic climb change in therapeutic and human services segments [11]. It gives investigative techniques to gathering profitable data, keeps up and refreshes singular wellbeing profile and different forecast models. Through trend setting innovations towards which utilize every single clinical datum and accomplishes better ailment expectation so as to treat different malady and gives clinical choice support[19]. Upset of web assumes a noteworthy job in social insurance data frameworks containing colossal number of therapeutic records are perfect focuses for information mining [18]. However, it can't in any way, shape or form happen that everything can't be readily available. The fundamental test is to give productive and affluent data applicable to the inquiry. The point by point inquires about and factual examination is more than what a human personality can think. It is the reason everybody is moving towards prescient examination [13].

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Foreseeing sickness is fundamental for any restorative associations so as to make the most ideal therapeutic consideration choices result. It hunts through monstrous number of information, and investigate results for clients [17]. It looks information from past outcomes just as most recent headways. Off base choices may cause delays in restorative treatment or even death toll. The principle goal is to anticipate the maladies from the given side effects make and screens a wellbeing profile of each individual patient [7].

With the multiplication of restorative information, gathering electronic wellbeing records (EHR) contains patient's data; test results and patient history. So as to anticipate malady separate elements have been think about, for example, weight list, cholesterol level, glucose, pulse, etc. Conversely, our proposed foresee a precise ailment dependent on different infections that a patient as of now has. One of the advantages of these methodologies is that it very well may be connected to anticipate any disease as opposed to a particular ailment [2]. Existing framework utilizes just organized information so it's hard to anticipate the precise ailment forecast. Huge numbers of the current framework center just on specific illness. So as to beat this issue, the proposed framework propounds an exact programmed multi-ailment forecast in medicinal services utilizing huge information [17].

It makes a programmed framework to analyze the infection dependent on the client side effects and their past wellbeing history. Moreover, contrasts and clinical research facility test report because of higher multifaceted nature. In conclusion choice tree gives a precise outcome. Through this patient can without much of a stretch analyze their illness by simply entering their issues or side effects and gives result about what the individual enduring from [14]. Powerful investigation of a precise programmed multi-malady forecast procedures incorporate like preprocessing, grouping, visit design development calculation, design learning calculation [15], Naive bayes classifier, Profile based examination, electronic wellbeing record, clinical research facility test and choice tree.

The general point of this proposed framework is to make the appropriate treatment rapidly and effectively [18]. The paper is composed as pursues: Chapter II talked about the survey of the writing about this field. Part III gives the proposed technique. Results and its dialogs are introduced in Chapter IV. Ends are given in Chapter V.

II. LITERATURE REVIEW

Min Chen, et.al [1] proposes AI calculations for viable forecast of chronic disease episode in illness visit networks. Experiment the adjusted forecast models over genuine medical clinic information gathered from focal China in 2013-2015. To defeat the difficulty of deficient data uses an inert factor model to reconstruct the missing information on a territorial constant disease of cerebral dead tissue.

Additionally, various districts display unique characteristics of certain provincial maladies, which may weaken the forecast of ailment outbreaks. Proposes another convolution neural network based multimodal illness hazard expectation (CNN-MDRP) calculation utilizing organized and unstructured information from emergency clinic.

Here focused on the two kinds of organized and unstructured information in the territory of therapeutic enormous information analytics. Compared to a few normal expectation calculations, the prediction accuracy of our proposed calculation achieves 94.8% with convergence speed which is quicker than that of the CNN-based unimodal ailment hazard forecast (CNN-UDRP) calculation. Feixiang Huang, et.al [2] applies the information mining procedure to predict hypertension from patient medicinal records with eight other diseases. An example with the measure of 9862 cases has been studied. The test was extricated from a certifiable Health care Information System database containing 309383 therapeutic records. Here, saw that the circulation of patient infections in the medical database is imbalanced.

Under-examining procedure has been connected to produce preparing informational indexes, and information mining Weka instrument has been utilized to create the Naive Bayesian and J-48 classifiers. Likewise, an outfit of J-48 classifiers was made endeavoring to improve the forecast presentation, and roughest instruments were utilized to lessen the gathering dependent on the thought of second-request estimation. Trial results demonstrated a little improvement of the gathering approach over unadulterated Naïve Bayesian and J-48 in precision, affectability, and F-measure. Sujatha R, et.al [3] upgrades mining in wellbeing area assumes a significant job for revealing new patterns which thus supportive for every one of the gatherings related with this field. It is another incredible innovation which is of high enthusiasm for PC world. It is a sub field of software engineering that utilizations officially existing information in various databases to change it into new explores and results.

It utilizes Artificial Intelligence, Machine Learning and databases the executives to remove new examples from enormous informational collections and the information related with these examples. The real undertaking is to remove information via programmed or self-loader implies. The various parameters incorporated into information mining incorporate grouping, anticipating, way examination and prescient investigation. Pinky Saikia Dutta, et.al [4] depicts about information mining in ailment forecast is a sub field of software engineering that utilizations effectively existing information in various databases to change it into new explores and results. In this data rich world, individuals are coming up short on data. This can involve chance for the individual who needs quick cures with respect to their weakness. To unfurl this obstacle, the idea of information mining is the most appropriate.

Here, the customary methodologies have been supplanted by savvy advancements. The primary reason for information mining application in social insurance framework is to build up a robotized apparatus for recognizing and spreading significant medicinal services data. In this framework, we have displayed an electronic application for Predicting sicknesses dependent on client input indications. It predicts likely infections by mining informational indexes and gives therapeutic answers for

viable treatment. Ravi Aavula, et.al [5] propose e-wellbeing applications in light of the fact that counseling a specialist is a very clear thing in our everyday life, except the accessibility of the specialist amid the season of our necessity is eccentric.

So as to conquer this issue a proposition of android application is made, this keen wellbeing application empowers clients to get moment report on their medical problems through a wise medicinal services application on the web. This e-wellbeing application empowers client to express their side effects and issues. It at that point forms user's issues and manifestations to check for different medical problems that could be related with the side effects given by the client. In the event that the application is unfit to give a specific arrangement, at that point it asks the client to under-go tests like blood test, CITI filter in like manner.

Priyanka Vijay Pawar, et.al [6] portrays about the significance of savvy advances over customary methodologies has been incorporated in each order of science. Here, propounds a technique to anticipate sicknesses dependent on client input manifestations. They have constructed a model to show the productivity of these strategies which will educate clients about the malady they are experiencing. It predicts likely illnesses by mining informational indexes and gives recommended specialists and healing arrangements.

It will likewise manage the clients by offering tips to carry on with a sound life, some eating regimen tips and furthermore handiness of plants and nourishment things. The creators recognized likelihood of sicknesses utilizing apriori method. Krishnaiah V, et.al [7] represents a diagram of the utilizations of information mining procedures, medicinal, inquire about, and instructive parts of clinical forecasts. In medicinal and social insurance territories, because of guidelines and because of the accessibility of PCs, a lot of information is getting to be accessible. From one perspective, experts are relied upon to utilize this information in their work at the same time; in the meantime, such a lot of information can't be prepared by people in a brief span to make determination, visualization and treatment plans.

A noteworthy goal of this paper is to assess information mining systems in clinical and medicinal services applications to create exact choices. The paper additionally gives a point by point exchange of therapeutic information mining systems can improve different parts of Clinical Predictions. Rawan Ali, et.al [8] makes an online interview venture for wellbeing expectation framework. It enables clients to get moment direction on their medical problems through a savvy medicinal services framework. Through online contains information of different side effects and the sickness/disease related with those side effects. It likewise has a possibility for clients of sharing their manifestations and issues. Information digging system is utilized for expectation for patient ailment and patient can take the drug legitimately from the drug store if specialist can't utilize enormous information in biomedical and human services networks, exact examination of restorative information benefits early infection recognition, tolerant consideration and network administrations.

In any case, the examination exactness is diminished when the nature of medicinal information is fragmented. Besides, various

districts display one of a kind attributes of certain local maladies, which may debilitate the expectation of infection episodes. To conquer the trouble of inadequate information, utilizes an idle factor model to recreate the missing information. A convolution neural system based multimodal illness chance expectation (CNN-MDRP) calculation utilizing organized and unstructured information from medical clinic. As far as we could possibly know, none of the current work concentrated on the two information types in the zone of restorative huge information investigation. Contrasted with a few run of the mill forecast calculations, the expectation precision of our proposed calculation achieves 94.8% with an intermingling speed which is quicker than that of the CNN-based unimodal malady hazard expectation (CNN-UDRP) calculation.

Md. Tahmid Rahman Laskar, et.al [9] proposes ADPS because of fast expansion of web innovation and handheld gadgets has opened up new roads for online social insurance framework. There are examples where online therapeutic assistance or medicinal services counsel is simpler or quicker to get a handle on than genuine assistance. Individuals regularly feel hesitant to go to emergency clinic or doctor on minor manifestations. Be that as it may, much of the time, these minor side effects may trigger significant wellbeing risks.

As online wellbeing exhortation is effectively reachable, it tends to be an incredible head begin for users. Besides, existing on the web social insurance frameworks experience the ill effects of absence of dependability and precision. In this, we propose a mechanized ailment expectation framework (ADPS) that depends on guided client input. The framework takes contribution from the client and gives a rundown of likely infections. The exactness of ADPS has been assessed widely. It guaranteed a normal of 14.35% higher precision in examination with the current arrangement.

II. PROPOSED SYSTEM

Wellbeing is a most significant factor for everybody. Yet, lamentably it has been dismissed today for some reasons. Nonappearance of specialist because of some reason during crisis circumstance may result in death toll. Not just that occasionally understanding regularly feel reluctant to go to clinic for minor side effects. These may provoke into real ailment. Huge information mining empowers appropriated capacity and handling condition is basic to store and process the human services information, which can be gotten to at whenever. With the expansion of innovation in social insurance ends up simpler to finding any sickness. It is connected in medicinal services to recognize the bunches of patients, illnesses and future expectations with the assistance of different AI apparatuses.

In this way, this paper proposed a programmed framework that enables clients to get moment direction in regards to their medical problems. So as to analyze any sickness specialist at first investigations the manifestations of the patient after then last outcome is anticipated. So also, machine determination the ailments dependent on the side effects simply like the specialist does.

The framework is brought with different side effects and their sickness related with it. The client share their indications and issues. The wellbeing information are ascribed as large information, which is characterized by 3Vs

as far as Volume, Velocity and Variety. The gathered patient information are of peta or zeta bytes, which portray the volume. The speed is communicated regarding information landing rate from the patients. Assortment clarifies the expanded informational collections concerning the organized, semi structured and unstructured informational collections, for example, checked pictures, clinical reports, EHRs, and clinical lab test.

MapReduce structure gathers information which are changed into significant bits of knowledge. By utilizing insightful information mining systems assesses the different ailment related with it and anticipate most exact infection. The framework ought to react like a specialist. The proposed framework not plans to supplant the specialist rather it predicts the illness and get appropriate medicinal help from the pro. Alongside the side effects given by the patients the proposed framework additionally utilizing patient's history to improve our outcomes.

The proposed framework utilizes SNN information mining calculation to make these expectations practically impeccable. The SNN calculation is to discover illnesses dependent on the information side effects through therapeutic information mining. This calculation is utilized to discover restorative datasets from which affiliation guidelines can be produced. The point is to discover suitable and visit infections from the medicinal dataset. According to SNN subject of a continuous itemset ought to likewise be a regular itemset.

The shortlisted infection has been get from ANN (Artificial Neural system) calculation. After this procedure, the patient information are joined with Electronic Health Record (EHR) to give reports to better proposals and choices utilizing SNN calculation. EHR incorporates specialist remedy, clinical reports and any past clinical history of the patients. Indeed, the current models can't bolster both examination and preparing for the huge volume of multi-organized social insurance information. SNN mean to improve ailment treatment and furthermore its conclusion in beginning times for a quicker and better treatment. Along these lines, any NBNs endeavor to make a quicker and increasingly exact illness forecast and help the doctors for settling on a solid choice. Give D a chance to be a preparation set of database. Every database is spoken to by a n-dimensional trait vector. y incorporates „n“ autonomous traits (y1, y2, ... , yn). Assume there are „m“ classes, for example, c1, c2, ... , cm, at that point order is to determine the maximal p(c_i | y). This can be gotten from Bayes' hypothesis as condition (1),

$$p(c_i|y) = p(y|c_i) \cdot \frac{p(c_i)}{p(y)} \quad (1)$$

P(y) needs to be maximized because it has equal value for all classes as equation(2)

$$p(c_i|y) = p(y|c_i) \cdot p(c_i) \quad (2)$$

An easy NBN is that the attributes are conditionally independent. So, the assignments of this test samples are according to equations (3) and (4).

$$p(c_i|y) = \prod_{k=1}^n p\left(\frac{y_k}{c_i}\right) \quad (3)$$

$$\arg \max C_i \{p(y|C_i) \cdot p(C_i)\} \quad (4)$$

SNN rationale can demonstrate the aftereffect of a patient's

test, to anticipate or decide the opportunity of finding an illness. Neural systems hypothesis infers that a standard for construing or refreshing the measure of „belief“ in the light of new data. Neural systems can be viewed as a substitute for strategic relapse models that can figure reliance or independency of factors. Profile based analytic infection approach in medicinal field proposes dependent on their profile and prescripts as per client is an issue. Henceforth, important parameters, for example, age, weight file, so on and considering current body state of the patient and other fundamental subtleties will improve in taking choice in ideal way. It prompts builds the nature of administration gave to the patients and diminishes the medicinal expenses. If there should be an occurrence of high complex sickness recognized, the framework can't give exact outcomes, it urges clients to go for Clinical Laboratory Test (CLT) or whichever report it feels user's side effects are related with. The vast majority of the current framework not concentrated on unstructured information. By utilizing SNN, both organized and unstructured information can be assessed, for example, blood test, x-beam or any output. At long last, by utilizing choice tree gives a most exact outcome to the individual client/quiet.

SNN utilizes a prescient model which maps sees about a thing to finishes up about the thing's objective esteem. It is one of the prescient demonstrating methodologies utilized in insights, information mining and AI. In these tree structures, leaves speak to class names and branches speak to conjunctions of highlights that lead to those class names. In choice investigation, a choice tree can be utilized to outwardly and unequivocally speak to choices and basic leadership. The proposed framework predicts the precise infection dependent on the indications and entered by the client. By considering user's past therapeutic history and profile based examination to anticipate the most conceivable ailment.

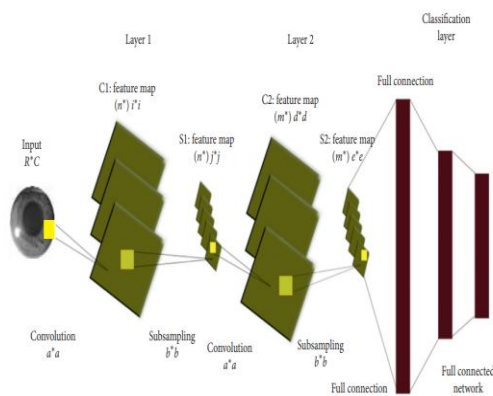


Fig 1: SNN working Flow

The pseudocode rule for SNN is given below.

- (i) Network initialization: every which way opt for the initial weights
- (ii) Select RST coaching combine
- (iii) Forward computation that features the subsequent steps:
 - a. Apply the inputs to the network
 - b. Calculate the output for each vegetative cell from the input layer, through the hidden layer(s), to the output layer
 - c. Calculate the error at the outputs
- (iv) Backward computation

- a. Use the output error to reckon error signals for pre-output layers
- b. Use the error signals to reckon weight changes
- c. Apply the load changes
- (v) Repeat Forward and Backward computations for alternative coaching pairs.
- (vi) Periodically value the network performance. Repeat Forward and Backward computations till the network converges on the target output.

III. RESULTS AND DISCUSSION

The aftereffect of trial investigation in recognizing significant examples for anticipating different maladies is exhibited. The framework is preprocessed adequately by expelling related records and given that missing quality. The polite OWL dataset, coming about because of preprocessing, ANN, SNN is then created by Deep learning. The exhibition examination was assessed by utilizing execution files, for example, affectability, explicitness, PTR, NTR, and exactness for 3 patients. A portion of the fundamental details is as per the following: Accuracy: The exactness speaks to the all-out precision rate of characterizing each subject into the right gathering. This file not just speaks to the likelihood of precisely ordering the subject as sound or not, yet in addition accurately characterizing every patient into the right illness gathering

$$\text{Precision} = \frac{(TP+TN)}{(TP+FP+TN+FN)} * 100 \%$$

Where TP is True Positive, TN is True Negative, FP is False Positive, FN is False Negative,

Table 1: Performance Analysis for Various Patients

| Metrics | Patient A | Patient B | Patient C |
|-------------|-----------|-----------|-----------|
| Accuracy | 94.65 | 96.06 | 96.51 |
| Sensitivity | 95.75 | 96.42 | 96.06 |
| Specificity | 92.62 | 95.13 | 97.23 |

Affectability: The likelihood of accurately distinguishing that the subject experiences the malady. A higher affectability implies that the prescient model can without much of a stretch distinguish the sickness.

$$\text{Affectability} = \frac{TP}{(TP + FN)} * 100 \%$$

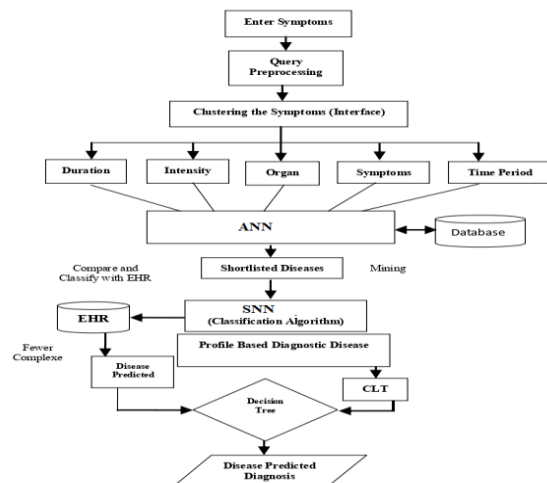


Fig 2: Flow chart of the proposed model

Particularity: Compared to affectability, explicitness speaks to the likelihood of accurately discovering that the subject does not experience the ill effects of the infection.

$$\text{Particularity} = \text{TN}/(\text{FP} + \text{TN}) * 100 \%$$

Table 2: Performance comparison

| Performance Index | Dataset 1 | Dataset 2 |
|----------------------|-----------|-----------|
| Accuracy | 96.06 | 97.73 |
| Sensitivity | 95.52 | 97.32 |
| Specificity | 96.81 | 98.48 |
| Positive Test Result | 97.75 | 98.67 |
| Negative Test Result | 92.88 | 96.04 |

Figure 3 demonstrates the presence of the proposed procedure regarding precision, affectability, and explicitness. From the resultant information, it is discovered that the proposed procedure gives a limit of 96.51% exactness, 96.42% of affectability and 97.23% of explicitness. It is presumed that the proposed procedure proficiently anticipate the illnesses with deference the side effects of the patients.

The exhibition measurements are assessed in two distinct information tests. Figure 4 demonstrates the aftereffect of execution measurements of two informational indexes. From Figure 4, it is inferred that the proposed technique gives the most extreme exactness of 98.67 in PTR measure.

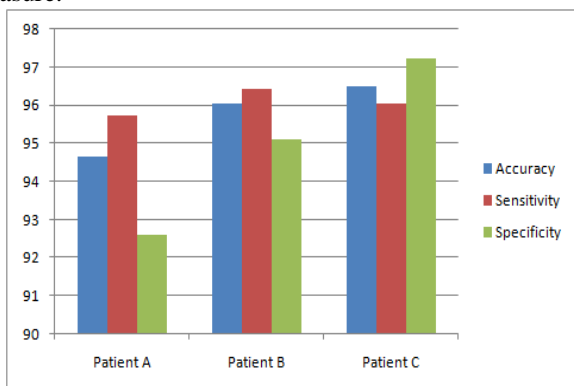


Figure 3: Performance Analysis for various Patient

PTR: It is the extent of positive test outcomes that are genuine positives, for example, right findings. It is a basic proportion of the presentation of an indicative technique, as it mirrors the likelihood that a positive test mirrors the hidden condition being tried for.

$$\text{PTR} = \text{TP}/(\text{TP} + \text{FP}) * 100 \%$$

NTR: It depicts the exhibition of an analytic testing system. It is characterized as the extent of subjects with a negative test outcome who are effectively analyzed. A high NPV for a given test implies that when the test yields a negative outcome, it is in all likelihood right in its evaluation.

$$\text{NTR} = \text{TN}/(\text{TN} + \text{FN}) * 100 \%$$

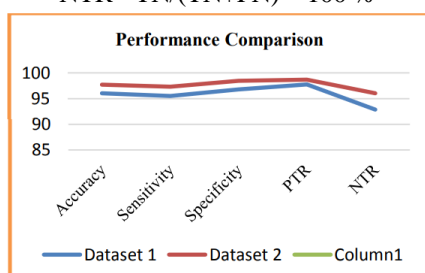


Figure 4: Performance Comparison

The genuine positive rate speaks to the division of positive cases that are effectively ordered by the model. The bogus positive rate speaks to the portion of negative cases that are inaccurately delegated positive. Hence, it gives an exchange off among affectability and particularity.

IV. CONCLUSION

Social insurance assumes a noteworthy job with the advantage of data innovation. The malady determination utilizing mining is trying because of its high hazard, monstrous data, immaterial and loud information. The proposed programmed ailment forecast framework has investigate learning utilizing enormous information strategies and gives extraordinary potential to defeat those issues and improves clinical expectation practically flawless. Here info side effects are given which concentrates helpful and pertinent data from the database through ANN. Alongside the manifestations by applying SNN calculation, patient's history from EHR has been assessed to improve our outcomes. In spite of the fact that this model could precisely anticipate a few sicknesses, it is still hard for some different ailments, particularly those faces intricacy in analysis. Thus, it urges them to gathers the past wellbeing records, doctor's remedy, and lab test esteems to improve the presentation of the patient and delivers subjectively results and gives precise and effective outcomes, which will enable patients to get finding in a flash. The framework lessens the human exertion, cost and time requirement and increment the analytic exactness. The general mission of framework advancement is to make the essential treatment rapidly and effectively with the utilization of innovation. As it is said anticipation is superior to anything fix so the framework will assist the patient with letting them realize what they are experiencing till the specialist responds to it. In future paramedical proposal and online meeting with the specialists can be made for more comfort.

REFERENCES

1. Min Chen, Yixue Hao, Kai Hwang, Lu Wang, and Lin Wang, "Disease Prediction by Machine Learning over Big Data from Healthcare Communities", IEEE. 2169-3536, 2017.
2. Feixiang Huang, Shengyong Wang, and Chien-Chung Chan, "Predicting Disease By Using Data Mining Basedon Healthcare Information System", IEEE International Conference on Granular Computing, 978-1-4673-2311-6, 2012.
3. SujathaR ,Sumathy R and Anitha Nithya R, "A Survey of Health Care Prediction Using Data Mining", International Journal of Innovative Research in Science, Engineering and Technology, Vol. 5, Issue 8, 2016.
4. Pinky Saikia Dutta, Shrabani Medhi, Sunayana Dutta, Tridisha Das and Sweety Buragohain, "Smart Health Care Using Data Mining", International Journal of Current Engineering And Scientific Research, ISSN : 2393-8374, Vol.-4, Issue-8,2017.
5. Ravi Aavula, M.Kruthini, N.Raviteja and K.Shashank, "Smart Health Consulting Android System", International Journal of Innovative Research in Science, Engineering and Technology, Vol. 6, Issue 3, 2017.
6. Priyanka Vijay Pawar, MeghaSakharamWalunj and PallaviChitte, "Estimation based on Data Mining Approach for Health Analysis", International Journal on Recent and Innovation Trends in Computing and Communication, Volume: 4 , 2017.
7. Krishnaiah, G. Narsimha and N. SubhashChandra, "A Study On Clinical Prediction Using Data Mining Techniques", International Journal of Computer Science Engineering and Information Technology Research (IJCSEITR), Vol. 3, Issue 1, 2013.

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8. Rawan Ali AL-jraib, Wafamoqhas, Huda Saeed Salman, AmeeraMohyAdden and Mona Mohmmad, "Biohouse Journal of Computer Science", International Journal Series, ISSN 2379- 1500, 2017.
9. Md. Tahmid Rahman Laskar, Md. Tahmid Hossain, Abu RaihanMostofa Kamal and NafiuRashid, "Automated Disease Prediction System (ADPS): A User Input-based Reliable Architecture for Disease Prediction", International Journal of Computer Applications (0975 – 8887), Vol. 133 – No.15, 2016.
10. Aditya Tomar, "An Approach to Devise an Interactive Software Solution for Smart Health Prediction using Data Mining", International Journal of Advanced Research in Computer and Communication Engineering Vol. 5, Issue 7, 2016.
11. VidyaZope, PoojaGhatge, Aaron Cherian, PiyushMantri and KartikJadhav, "Smart Health Prediction using Machine Learning", IJSRD - International Journal for Scientific Research & Development| Vol. 4, Issue 12, 2017.
12. AakashKhatavkar, PiyushPotpose and PankajkumarPandey, "Smart Health Prediction System", IJSRD - International Journal for Scientific Research & Development Vol. 5, Issue 02, 2017.
13. Prashant Tiwari, AmanJaiswal, NarendraVishwakarm and PushpanjaliPatel, "Smart Health Care - An Android App To Predict Disease On The Basis Of Symptoms", International Research Journal of Engineering and Technology (IRJET), Vol.: 04 Issue: 04, 2017.
14. EvaK.Lee and Tsung-LinWu, "Classification and disease prediction via mathematical programming", American Institute of Physics, AIP Conference Proceedings, doi: 10.1063/1.2817343, 2007.
15. Riccardo Miotto, Li Li, Brian A. Kidd and Joel T. Dudley, "Deep Patient: An Unsupervised Representation to Predict the Future of Patients from the Electronic Health Records", DOI: 10.1038 / srep26094, 2016.
16. Prasan Kumar Sahoo, Suvendu Kumar Mohapatra and Shih-Lin Wu, "Analyzing Healthcare Big Data with Prediction for Future Health Condition", IEEE OI 10.1109/ACCESS.2016.2647619, 2016.
17. Cheng-HsiungWeng, Tony Cheng-Kui Huang and Ruo-Ping Han, "Disease prediction with different types of neural network Classifiers", Elsevier Ltd. <http://dx.doi.org/10.1016/j.tele.2015.08.006>, 2016.
18. Xianglin Yang, Yunhai Ton, XiangfengMeng, Shuai Zhao, ZhiXu, YanjunLi,Guozhen Liu and Shaohua Tan, "Online Adaptive Method for Disease Prediction Based on Big Data of Clinical Laboratory Test", IEEE978-1-4673-994-3, 2016.
19. AjinkyaKunjir, HarshalSawant, NuzhatF.Shaikh, "Data Mining and Visualization for Prediction of Multiple Diseases in Health Care", IEEE 978-1-5090 -6399-4,