DEVELOPMENT OF AN INTELLIGENT SYSTEM TO DIAGNOSE HUMAN DISEASES USING SOFT COMPUTING TECHNIQUES

Dissertation submitted in fulfilment of the requirements for the Degree of

MASTER OF TECHNOLOGY

IN

INFORMATION TECHNOLOGY

By

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11610323

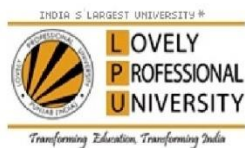Supervisor

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TOPIC APPROVAL PERFORMA

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Qualitative Assessment of Proposed Topic by PAC		
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1	Project Novelty: Potential of the project to create new knowledge	7.00
2	Project Feasibility: Project can be timely carried out in-house with low-cost and available resources in the University by the students.	7.25
3	Project Academic Inputs: Project topic is relevant and makes extensive use of academic inputs in UG program and serves as a culminating effort for core study area of the degree program.	7.25
4	Project Supervision: Project supervisor's is technically competent to guide students, resolve any issues, and impart necessary skills.	7.50
5	Social Applicability: Project work intends to solve a practical problem.	7.50
6	Future Scope: Project has potential to become basis of future research work, publication or patent.	7.50

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Final Topic Approved by PAC: Development of an intelligent system to diagnose Human diseases using soft computing techniques

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ABSTRACT

Now days peoples are taking medication for the symptom unable to know real diseases behind them. Every year lots of diseases are increasing, to diagnose them, there is lack of expert doctors. To overcome this problem, I am going to develop an Expert system that will help to diagnose the diseases. This system will diagnose the 5 diseases Malaria, Dengue, Tuberculosis(TB), Chikungunya, Elephantiasis. These 5 diseases are the National Issue in the India. By using symptoms as inputs, the expert system is going to predict the possibility of the disease. According to world health organization malaria has taken more lives than any other disease in human history. In Expert system the fuzzy based technique is used because of its ability to handle the uncertainty in the data. Expert systems can provide advice for physicians and patients to facilitate the diagnosis and recommend treatment of patients.

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Finally, I am thankful to the Almighty God who had given me the power, good sense and confidence to complete my project successfully. I also thank my parents who were a constant source of encouragement. Their moral was indispensable.

DECLARATION STATEMENT

I hereby declare that the research work reported in the dissertation/dissertation proposal entitled " **Development of an intelligent system to diagnose Human diseases using soft computing techniques**" in partial fulfilment of the requirement for the award of Degree for Master of Technology in Computer Science and Engineering at Lovely Professional University, Phagwara, Punjab is an authentic work carried out under supervision of my research supervisor Mrs. Vishu. I have not submitted this work elsewhere for any degree or diploma.

I understand that the work presented herewith is in direct compliance with Lovely Professional University's Policy on plagiarism, intellectual property rights, and highest standards of moral and ethical conduct. Therefore, to the best of my knowledge, the content of this dissertation represents authentic and honest research effort conducted, in its entirety, by me. I am fully responsible for the contents of my dissertation work.

Signature of Candidate

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SUPERVISOR'S CERTIFICATE

This is to certify that the work reported in the M. Tech Dissertation/dissertation proposal entitled "**Development of an intelligent system to diagnose Human diseases using soft computing techniques**", submitted by **Sandeep Kumar** at **Lovely Professional University, Phagwara, India** is a bonafide record of his / her original work carried out under my supervision. This work has not been submitted elsewhere for any other degree.

Signature of Supervisor

(Vishu Madaan)

Date:

Counter Signed by:

1) **Concerned HOD:**

   HoD's Signature: _____

   HoD Name: _____

   Date: _____

2) **Neutral Examiners:**

   External Examiner

   Signature: _____

   Name: _____

   Affiliation: _____

   Date: _____

   Internal Examiner

   Signature: _____

   Name: _____

   Date: _____

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Introduction

With the advancement in technology, life has become comfort and easy. Due to emerging of new techniques in the medical field, all of the health systems are improving. but as new technology gives the luxurious things to human, there are also bad effect are there on human health like increasing pollution and using of electronic gadgets causes lots of health issues. There is still need of improvement in the medical field. There are some problems those has proper treatment but still diagnosing them is the main problem. According to World Health Organization 61% deaths causes due the non-communicable diseases. According to National Vector Borne Disease Control Programme, 3148 people die in last 5 year in India due to dengue and malaria. And around 11000 cases are increasing every year in India. With the increase of cases the death rate is also increasing. These diseases have the proper treatment, but still deaths are increase due to the disease. The reason is lack of expert doctors to provide the correct treatment. To control these case and death government are taking the many steps. With the growth of technology in computer science allot of applications has developed to help diagnose the diseases. Expert system is the one of the application of artificial intelligent the help diagnoses the disease where is the lack of expert doctors.

By using the artificial intelligent I am going to develop the expert system to help diagnose viral and virus diseases in human. These diseases are Malaria, Dengue, Tuberculosis, Chikungunya, Elephantiasis. These diseases occur when virus or parasite enter the human body. Some people are having high immunity against these virus and parasite some has less. So even if a person has the virus present in body still hard to determine the severity of disease and provide the appropriate treatment. This problem can be solved with the help Expert system that will be developed with the help of expert doctor. The Proposed system is going to be developed as an expert system which helps to diagnose and predict the 5 diseases that are Malaria, Dengue, TB, Chikungunya, Elephantiasis. These diseases are most common diseases that can be occurs to any person if he lives or visit to an area where disease is common. The expert system is developed using fuzzy rule-base technique which takes symptoms as an input and analyze them then provide the output as disease according to inputs. These diseases have very wide range of symptoms that present in the infected person. History of these

diseases in India is very bad there are lots of cases registered in India and many people died because of these diseases.

Malaria: Malaria is disease that occur due to plasmodium parasite. This parasite spread through the mosquito bite. Once the person is infected with the parasite it multiplies in the liver of infected person without doing any damage to red blood cells. According to National Vector Borne Disease Control Programme, 4917394 cases of malaria is reported from 2013 to till now.

 The most common symptoms that presents in infected persons are:

- High Fever
- Shivering
- Headache
- Fatigue
- Body aches
- Yellow Skin (From losing red blood cells)
- kidney failure
- confusion
- Anemia
- sweating
- Diarrhea

Dengue: Dengue is a most common infection caused by a virus transmitted by the mosquito that bite in day light. Dengue virus belongs to Flaviviridae family of viruses. dengue is more common among older children, adolescents and adults. The person who has weak immune system is at even more danger of getting infected by dengue virus. According to National Vector Borne Disease Control Programme, 22, Shamnaath Marg, Delhi, 589209 cases of dengue are registered form 2010 to November 2017 and 1537 died. So, the proper Diagnose of the disease is important.

 Early signs of dengue include:

- high fever
- severe head ache

- joint and muscle pain

- Nausea and vomiting

- skin rashes after 2 to 5 days of fever

- mild bleeding in nose or gums

- sore throat

- Fatigue

- Pain behind the eyes

TB(Tuberculosis): TB occur due to slowly growing bacteria name mycobacterium tuberculosis. These bacteria grow best where lots of blood and oxygen present, especially in lungs. The TB can be either Latent and active. Latent TB means that the person has bacteria present in his body, but his body's defense system is preventing it to turning into active. Active TB means that TB bacteria is growing in the person's body and showing the signs and symptoms. The common symptoms that Tuberculosis disease shows:

- bad cough

- fever

- coughing up blood or sputum

- weakness or fatigue

- weight loss

- Pain in Chest

- chills

- sweating at Hight

- no appetite

Chikungunya: Chikungunya is viral disease that transmitted by mosquito bite. chikungunya virus is alphavirus genus and Togaviridae family. This disease is not life threatening, there is rare chance a person dies because chikungunya. However, the that occur due to chikungunya stays for very long time in some cases. The early symptoms that are shown by the infected persons are:

- Severe Joint pain

- Sudden onset Fever
- Fatigue
- Headache
- Muscle pain
- Rashes
- Joint swelling

Elephantiasis (Lymphatic Filariasis): It is the disease caused by the number of parasitic worms, but commonly by Wuchereriabancrofti. All the parasites are spread through the mosquito bite. It mostly occurs to persons who lives in tropical areas. This disease shows no signs or symptoms in early, but after few months of infection some part of the body starts swelling up like arms, legs, sex organs etc.

Expert System: Expert System is the software which has the data base with expert knowledge. The Knowledge of particular domain is gathered from the expert then stored in the data base of the software. The expert system has 3 major components:

1. **Knowledge Base:** Knowledge base contain the domain specific knowledge of the expert. The knowledge base has two components Knowledge representation and knowledge acquisition. Knowledge representation means formalize the knowledge inside the knowledge base and knowledge acquisition means collecting the complete and accurate information from the expert.
2. **Inference Engine:** In the inference engine manipulation of the knowledge from the knowledge base done to get the result. Inference engine commonly uses forward chaining and backward chaining techniques.
3. **User Interface:** User Interface provide the connection to client with the master framework.

Capabilities of Expert Systems:

- Able to copy the ability of decision making of an expert

- Advising

- Instructing and assisting humans in decision making

- Predict Result

- Able to handle imperfection in data

- Justify the conclusion

- Diagnosing

Applications of Expert System:

1. **Medical Domain:** In the medical domain there are many expert systems that helps to diagnose the diseases and conduct medical operations on humans.

2. **Design and Manufacturing Domain:** Expert systems helps in designing and manufacturing like camera lens's design, auto mobile design etc.

3. **Monitoring:** Expert systems helps to monitor and compare data continuously with observed data using pre-described behaviours such as leakage of petrol in long petroleum pipelines.

4. **Process control:** Expert system helps to improve the process control in manufacturing operations such as self-tuning controllers, supervisory expert control etc.

5. **Finance and commerce:** Expert systems has many applications in finance and commerce domain such as fraud detection, stock market trading, airline scheduling, evaluating defaulter risk in banking sectors etc.

Fuzzy Expert System: A fuzzy expert System contains membership functions and different types of rules that are used to reason about the data. The fuzzy expert systems help to handle even the uncertainty in the data. Membership functions and rules are used to get the crisp output from the fuzzy data. The Fuzzy expert system is processed on numerical processing. Using fuzzification methods the fuzzy systems translates the input numbers into linguistic terms like mild, moderate and severe or Small, Medium and large. In the Inference Engine Rules base is used to map the linguistic inputs onto similar linguistic terms described in the rule base to get the linguistic output. Finally, the linguistic output is converted into crisp output. As shown in fig 1.1.
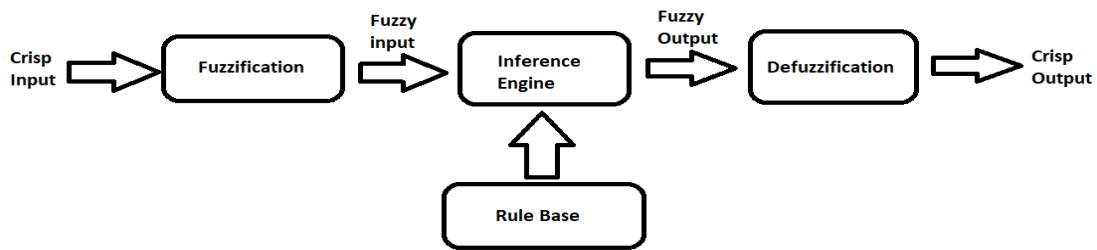
Fig 1.1: Fuzzy Expert System

The crisp value as an input convert into fuzzy value with the help of fuzzification and processing is done on the fuzzy values in inference engine that give fuzzy output then fuzzy output converts into crisp output as a result. The fuzzy expert system contains:

- **Fuzzification:** In the process of Fuzzification inputted crisp value converted into fuzzy values

- **Inference Engine**: In the inference engine the rule base is used to map the input fuzzy values into predefined fuzzy value in the knowledge base to get the output. Commonly forward chaining and backward chaining techniques are used for reasoning.
  1. **Forward chaining:** In forward chaining Inference engine, start with the available data and use the rules of inference to extract more data until a goal is reached.
  2. **Backward chaining:** In backward chaining Inference engine we work backward from the goal.

- **De-fuzzification:** In De-fuzzification process the fuzzy output form the inference engine is converted into the crisp output.

- **Rules Base:** Rule base is connected to the fuzzy inference engine. It contains the IF-THEN rules that are used to get the output.

Components of Fuzzy expert system:

- **User interface:** User Interface is used for communication between users and system.

- **Membership function base:** It contain the membership functions of linguistic variable.

- **Fuzzy rule base:** It contains the Rules that are used to get the output.

- **Fuzzy inference engine:** The fuzzy inference engine is the program that have the ability to match fuzzy rules, fire fuzzy rules and other execution task.

- **Fuzzy Knowledge base:** In the fuzzy knowledge base the knowledge of the expert is stored.

- **Working memory:** working memory is the temporary storage to save inputs and results.

- **Knowledge acquisition facility:** An effective approach to derive rules and membership functions from training instances automatically.

Artificial Neural Network: An Artificial Neural Network is a mathematical representation of the human neural architecture, reflecting its learning and generalization abilities. The structure of a neural network is formed by an input layer, one or more hidden layers, and the output layer [5].
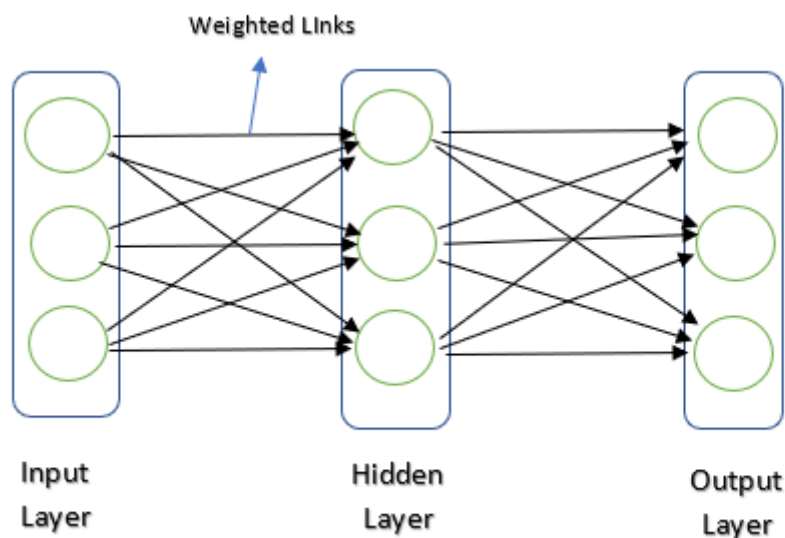

Fig: 1.2 Artificial Neural Network

The neurons in the input layer receive the data and transfer them to neurons in the first hidden layer through the weighted links.

Objective Of study

The Object of the study is the develop the expert system to diagnose the Malaria, Dengue, Tuberculosis(TB), Chikungunya, Elephantiasis. The proposed system is developed by using the different symptoms as inputs like Fever, Headache, body pain and muscle pain etc. On the basis of these symptoms, the output can be predicted. The proposed system: -

- Diagnose the type and Name Of diseases by using the symptoms.
- To find accurate risk factor of having the particular disease by analysing the symptoms and report.
- To calculate the Severity of the diseases to help the provide the treatment.
- Comparison with Existing System.

Scope of Study

The expert system is the system that with the knowledge of an expert of particular field. The expert system in medical field can help the inexpert person to recognize the disease by checking its symptoms and can help diagnose the disease where is no human expert is available.

- It diagnoses one or more diseases and suggests the appropriate therapy.
- It suggests the patient's when visit to a specialist.
- It can diagnose the absence of any of these diseases.
- It can find some symptoms or signs due to any exogenous cause.

These qualities and accuracy of Expert Systems can be Increase by taking more variable as an input and by using a better algorithm for processing the data. The accuracy of the system depends on the knowledge that is in the knowledge base. So, the more Data we add more accurate the system will become.

Literature Review

Jimmy Singla, et.al (2014) the aim is to explain the working of expert system for diagnosis of multiple diseases. The main focus in this paper is how an expert system can be developed using fuzzy logic, neuro-fuzzy and artificial neural network. The development of fuzzy knowledge base is explained using the tuberculosis disease. In end provide the comparison of existing expert system.

Meenakshi Sharma, et.al (2016) uses the K- Nearest Neighbor Technique is used to classify the clinical dataset of cervical cancer to identify the stage of cancer. In This paper the Pap smear images are used for the detection of cervical cancer using. Edge based image segmentation is used on the pap image to separate cell nuclei from cytoplasm. Then some features are extracted from the images, which describe the characteristics of cell nuclei and cytoplasm. The K-Nearest neighbor classification technique is used to classify the cancer based on features extracted from the image. The classification algorithm provides the 82.9% accuracy. By adding more features, the accuracy of classification can be increased.

M. Arabzadeh Ghahazi, et.al (2014) develops a Fuzzy expert system for the diagnosis of Multiple Sclerosis. Multiple Sclerosis is an immune system infection disease that influences the central nervous system. It disturbs the correspondence between the cerebrum and spinal line and different parts of the body. Because of this reason an extensive variety of signs and symptoms appears on person's body. In this expert system the fuzzy rules are used to make a better decision based on symptoms, clinical observation and person's identity. The System provide the ability of modelling fuzzy rules with binary premise and uncertain consequent. The output of the fuzzy system is determined is crisp value, that helps MRI should be taken or not. Expert System's knowledge base is build, basis on direct approach and inference engine uses the forward chaining method. Because of the multiplicity of factors that refers to Multiple Sclerosis.

Jimmy Singla, et.al (2013) proposed a technique for medical expert system is developed to diagnose the lung diseases. Diseases are determined by taking the symptom that can be seen and felt. The lung diseases have many common symptoms and some of them are very much alike. This creates many difficulties for the lungs doctor to reach at a right decision or

diagnosis. This expert system provides the diagnosis for 32 lung diseases. It is successfully implemented in SWI-Prolog and result is taken. It provides the 70% correct result. There are more lung diseases which are not considered in the system's knowledge base. By adding more diseases and symptoms the accuracy of system can be increased.

Filippo Amato, et.al (2013) In this paper the capability and development of Medical Expert system using artificial neural network is discussed in detail. The working of artificial neural network is explained, and diagnosis of Cardiovascular diseases, cancer and Diabetes is explained using artificial neural network. Artificial neural network represents a powerful tool to help physicians perform diagnosis and other enforcements. In this regard, artificial neural network has several advantages including the ability to process large amount of data, reduced likelihood of overlooking relevant information, reduction of diagnosis time. [5]

Ranjit Kaur, et.al (2016) In this paper the fuzzy expert system is introduced to calculate the Immunity of the human body to provide the appropriate dose of medicines. As in Ayurveda knowing the strength of human body is important before starting the treatment. To calculate the strength of human body the quality of the Blood, Muscle, Lymph, Fat Tissues, Bone, Reproductive tissues, Bone Marrow, and Mind of the person is calculated. On the bases of these parameters the Total Strength of a person is computed that allow the Ayurvedic Physician to give the appropriate dose of medicines. [6]

QeetharaKadhim Al-Shayea, et al (2011) In this paper the evaluation of artificial neural network done in disease diagnosis. In this paper evaluate on the bases of two type of disease cases are studied. The first case is acute nephritis disease and the second is heart disease. For nephritis disease data is symptoms and for heart disease data is cardiac SPECT (Single Proton Emission Computed Tomography) Images. Each patient is classified into infected or disinfected category. The feedforward back propagation neural network model is used to classify the patients. In acute nephritis disease diagnosis, the accuracy was 99% correct and in heart diseases case it classifies 95% correctly. Artificial neural networks showed significant results in dealing with data represented in symptoms and images. Results showed that the proposed diagnosis neural network could be useful for identifying the infected person. [7]

Kaur Ranjit, et.al (2016) In this paper the fuzzy logic-based expert system is designed to calculate the physical constituent of human body. In Ayurveda every human has different

physical constituent value. The physical constituents are vatt: combination of space and air, pitt: combination of water and fire and kaph: combination of water and earth. The factors that are taken to calculate the constituent are Intellectual Traits (Grasping power, intelligence, memory, concentration), Behavioral Traits (Temper, activities, Jealous, Friendship, Patience), Homeostatic traits (Thirst, sweating, sleep, immunity, Energy), Physiological traits (Stool, appetite, walk, eating habit, sexual activities speech), Anatomical Traits (Complexion, eyes, skin, Hair, Tendons & veins). These factors are categorized into values of vatt, pitt and kaph and using those values the final result is calculate. [8]

Ebenezer ObaloluwaOlaniyi, et.al (2015) In this research work, causes of heart diseases, the complications and the remedies for the diseases have been considered. An intelligent system which can diagnose heart diseases has been implemented. The researcher provides the new algorithm, Support Vector Machine algorithm that is better than the previous Backpropagation. The Backpropagation Neural Network which gives the 85% accuracy, and the Support Vector Machine algorithm which gives the 87.5% accuracy. The new designed algorithm that is based on machine learning technique Support vector machine that provide the 2.5% more accuracy than the previous algorithm. [9]

Mohammad Reza Heidari Iman, et.al (2015) presented in this paper that there is an increase in demand of the non-functional requirements by the users with the growth in software technologies over the years. Usability is one of the non-functional requirements. Higher quality of interface is very important when considering that there will be direct user interaction and the user has to be satisfied. Thus, a suitable usability is required for software user interface. In order to evaluate the software usability, various actions have been performed. However, there are numerous challenges faced while providing the quantitative evaluation of the qualitative concepts which might help in providing software usability. In order to avoid facing such challenges, a fuzzy expert system is proposed in this paper which also helps in identifying higher number of problems and the deficiencies present in the design of interface. With the application of this method, the users can easily identify their problems and remove them which can help them develop a better interface [10].

Dian SaadillahMaylawati, et.al (2017) stated a study based on the pregnancy which is an important part of human lives. Most of the cases that involve miscarriage are caused due to the fact that the women do not know about their pregnancy at early stages. Any abnormalities are good to be warned at the early stage of pregnancy to avoid later mis-happenings also.

Numerous disorders have been known within the pregnancies which need to be avoided. In order to predict the pregnancy disorders at early stages, an expert system is generated in this paper with the help of Artificial Neural Network (ANN) and the Back-Propagation algorithm. A dataset of various pregnancy records was generated and used in order to conduct an experiment here. As per the various simulation results achieved it was seen that there was higher accuracy of results achieved with the application of ANN based technique [11].

Mina Asadi Sanjani, (2015) presented in this paper that the prediction of electric load is very important within the power systems as there is higher time consumed while making decisions and also the costs are relatively higher. The occurred electric load prediction is an important concern here which is to be based on the country's electric import and export as well as the load peak of the annual electric utilization. The overall electric cost can be calculated with the help of this statistical information achieved related to the load peak utilized, the import as well as the export of electric power over the years. On the basis of various comparisons, the increment and decrement of cost over the years can be computed easily. With the help of receiver operating characteristic curve, the evaluation of performance of fuzzy expert system was done. It was seen that the level of accuracy was higher within this approach. The analysis of receiver operating characteristic curves was utilized for testing the correctness of the system function [12].

Angbera et.al (2016) the main aim is to design the fuzzy based expert system for Tuberculosis diagnosis and Treatment. The system has several input fields and different outputs field. Input fields are Chest pain, cough duration, fever duration, night sweats, weight loss, loss of appetite, change in bowel habits, variations in mental behaviour, masses along the neck, draining sinus, coma, stiff Neck, headache, abdominal Pain, painful or uncomfortable urination, hemopysis, fatigue and blood present in urine. The output fields predict that what type tuberculosis disease of the patient. The system uses the concept of Mamdani inference method. The results obtained from designed system is correct when compared with the data in the database and observed results. Fuzzy based system was designed with different technologies like Java, Microsoft visual, MySQL workbench, MySQL, Java Server Pages(JSP) and XHML. [13]

Subhagata Chattopadhyay, et.al (2015) This paper proposed an expert system on the base of Genetic Neuro Fuzzy hybrid system for the intelligent diagnosis of tuberculosis. The Genetic Neuro Fuzzy system takes input from two type of examination physical examination

in which swollen lymph nodes, blood pressure, rale breathe, abnormal breast sound is checked and medical in which the symptoms such as loss of appetite, confusion, cough, fever, chest pain, weight loss, night sweat, fatigue. The system provides the Result as a person is infected with the TB disease or not as its output. The proposed system provides the result with 61% accuracy. [14]

Feng Zheng, et.al (2017) presented in this paper the new product design process using the fuzzy TOPSIS which has linguistic assessments that will help in establishing the relationship amongst the product form and the requirements of the consumers. Here, there is a subjective and imprecise expression of the choices of the consumer. A fuzzy TOPSIS expert system is built in this paper which uses the neural network model for providing help to the product designers to choose an appropriate combination of the design of the new product. Due to the huge variety of experiences, the fragrance bottle form design is selected. Around 20 thousand of different combinations of the fragrance bottle form can be designed with the utilization of soft, classical and fashionable image values provided. This helps in creating an expert system. A set of desirable image values can be specified by the product designers in order to design a new fragrance bottle. The optimal combination of design form elements can be attained with the help of an expert system [15].

Subhagata Chattopadhyay, et.al (2017) In this paper a neuro fuzzy expert system is proposed for help diagnose the depression in adult person. Total 14 Symptoms are taken whose load and severity is measured by the psychiatrists. Using these symptoms as an input a neuro fuzzy expert system is developed that provide the output as depression grade with the accuracy of 95.50%. In the neuro fuzzy approach, the Mamdani fuzzy logic controller is used with backpropagation algorithm. This system provides the more accuracy than the previous systems that the build using fuzzy and neuro fuzzy technique. [16]

X. Y. Djam, et.al (2014) This paper proposed a fuzzy based expert system for providing the decision support platform to malaria researcher and physicians. In this System the Root Sum Square Inference system is used with the triangular membership functions. The Center of Gravity technique is used of the DE fuzzification. The proposed system takes 11 symptoms like Fever, Head ache, Nausea and Vomiting, Enlarge Liver, body weakness, Dizziness, Loss of appetite etc, as an input and provide the result as risk factor of malaria like mild, moderate, severe, very severe. This system provides the physician to help determine which malaria patient need the emergency treatment with more accurately. [17]

Varinder Pabbi, et.al (2012) This paper proposed the Fuzzy based expert system to help diagnose and predict the risk factor of Dengue. In the paper the dengue symptoms and clinical symptoms are taken to get better identification of dengue fever. The inputs are such as Age, TLC, SGOT/SGPT, PLATELETS COUNT and BP are taken to provide the dengue as an output. The triangular membership functions are used in system. The system provides the 95% accurate output, when tested with actual data. [18]

Putu Manik Prihatini, et.al (2012) In this paper a fuzzy Knowledge based expert system is proposed for diagnose of 7 tropical infection diseases like Typhoid Fever, chikungunya and dengue fever. Total 22 symptoms are taken to from which 6 symptoms are taken from the clinical examination. The system provides the result that has 91.07% similarity with the expert. A web based platform is used to receive the inputs which are physical symptoms and complete examination of laboratory. [19]

Kantesh Kumar, et.al (2014) this paper an Expert System is proposed for predict the risk factors of heart disease specifically cardiovascular disease. A fuzzy rule based, and data mining technique is used for system development. The system takes 6 inputs and give the result as an output of risk factor of the cardiovascular disease. [20]

Antika Thapar, et.al (2016) proposed in this paper the designing of a fuzzy expert system that helped in identifying whether an infant was suffering from malnutrition or not. It also helped in identifying the severity or extent to which the malnutrition had spread. The thirteen different input variables were utilized here within this technique on the basis of which the computations were made. These included the family size, protein intake, energy intake, mother's education level and many other factors. With respect to some specific categories, the presence of malnutrition and its severity were identified. Not only under nutrition is in the category of mal nutrition, but over nutrition also its part. The Mamdani inference technique was utilized by the design expert system. It is seen through the achieved results that the level of nourishment can be detected here in accurate level and can help in providing benefits to the users which can help prevent it [21].

Tarig Faisal, et al (2012) proposed an adaptive neuro fuzzy Expert system that diagnose the risk factors in dengue patients. The system uses the symptoms, signs and bioelectrical impedance Analysis measurement as inputs. These inputs are incorporated with ANFIS tool to construct models. Two models are constructed using symptoms, signs and bioelectrical

impedance. By systematically optimize the initial parameters of ANFIS tool the first model is constructed and in second model the subtractive clustering technique is used. Both proposed systems provide the overall accuracy of 86.13% and 87.5%. [22]

Dimple Sethi, et al (2016) The author represents the fuzzy based expert system to diagnose the Tumors in the field of gynaecology. The fuzzy expert system Diagnose the five types of tumor in women are Carcinoma, Adenomyosis, Myoma, Endometrial, Sacroma of uterus, Choriocarcinoma of vagina. which contain the vague values for the symptoms, especially in the field of gynecology. The system will help various physicians and gynecologists in the process to diagnose the disease. The author used the inbuild fuzzy tool in the Matlab toolbox to design the system. [23]

Parteek Aggarwal, et al (2015) proposed a Fuzzy rule-based medical Expert system to identify the disorder in the eyes, ear, nose, throat and liver. The author develops 3 different system one for eyes, one for ear-nose-throat and one liver disease diagnosis. In all the systems fuzzy based technique is used. Matlab inbuilt fuzzy toolbox is used to design the system. [24]

Research Methodology

The proposed System is going to develop by using the fuzzy rules. There are 19 inputs like headache, temperature, skin rash, muscle pain, body pain, bleeding in gums, fatigue, shivering, nausea and vomiting and based onthe symptoms fuzzy rules are made. The risk factor of getting a particular disease gets as output through fuzzy rules.
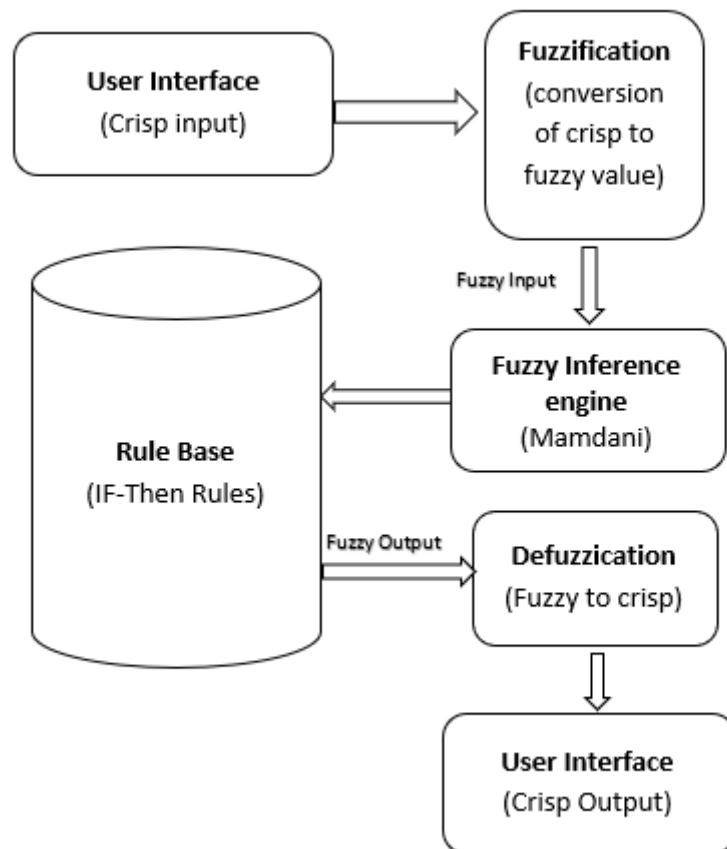
Flow chart:

Fig 2: Flow Chart

In the upper diagram the flow chart of the expert system is shown. In This diagram start is the initial interface for the system where the inputs are going to be entered. Then they are analyzed by the fuzzy system and the output will be shown on the interface.

Step 1: In the inputs part the symptoms values are going to enter according to its range. once the inputs are entered then the inputs will go the fuzzy system where inputs are going to be processed.

Step 2: In the analyze part the fuzzy processing of the system is done. In which the Fuzzification of inputs, then the inference engine processing and then the de-fuzzification is done. The trapezoidal membership functions will be used in fuzzy system.

Step 3: The output of the system will be shown back to interface as a disease and its risk factor.

Inputs and its range:

SR. NO.	Name	Value
1	Fever	97 - 105 F
2	Fatigue	1-10
3	Head ache	1-10
4	Muscle pain	1-10
5	Body pain	1-10
6	Joint pain	1-10
7	Shivering	Yes or No
8	Thickening of Skin	Yes or No
9	Anemia	Yes or No
10	Nausea and vomiting	1-5
11	Skin rashes	Yes or No
12	Bleeding in gums or nose	Yes Or NO
13	Diarrhea	Yes Or NO
14	Area of living	Village, city, tropical
15	Pain in chest	1-10
16	Sputum with cough	1-10
17	Weight loss	Yes or NO
18	No appetite	Yes or NO
19	Joint swelling	Yes or NO

Explanation:

Fever: Fever is the starting symptom that patient feel in all the upper diseases. The fever varies according to disease like in dengue the patient suddenly gets high fever like 104 F after the infected with dengue virus and in malaria the fever low in starting but it increases as time passes and in TB also the fever is low depend on the severity of disease.

	Low	97-99.5 F
Fever	**Moderate**	**99 -101 F**
	High	**101-105 F**

Table2: Temperature values

Fatigue: Fatigue is state when person feel tiredness and exhausted. In all the disease the patient feels fatigue and like in malaria and dengue because low red blood cells patient feels more tiredness.

	Low	0-4
Fatigue	**Moderate**	**3-7**
	High	**6-10**

Headache: Headache is symptom of pain in the head. The headache occurs in many diseases can be vary according to disease like mild, moderate, severe.

Body pain and muscle pain: Body and muscle pain is symptom of pain that can be occur due to high fever. In cases of malaria and Dengue patient feels severe body and muscle pain.

Skin rash: The skin rashes occur due the itching or due to a disease. In case of dengue the patient gets red skin rashes with itching.

Shivering: shivering is the state when person shake slightly and uncontrollably due to cold, frightened and excited. The symptom shivering varies according to disease like in malaria and dengue patient feels shaking chills.

Anemia: Anemia is the state in which the person's red blood cells are low then the normal person. Because of less red blood cells patient's skin color can be start turning into yellows.

Joint Pain: Joint pain is pain the joint of the body like in ankle, shoulders, knees etc. In case of chikungunya the patient feels severe joint pain that can last up to many months.

Nausea and Vomiting: Nausea means discomfort in stomach that urge to vomiting. In some case the dengue and malaria patient feel nausea and some patients gets vomiting.

Bleeding in Gums and Nose: In case of Dengue people gets mild bleeding in gums and nose. But some cases there is only mild pain in gums.

Diarrhea: In some cases of malaria the person gets diarrhea which is loose watery and frequent bowl movement.

Pain in Chest: When a person breathe sneeze and cough feels sharp pain in the chest. In case of Tuberculosis(TB) the person can have severe pain in the chest.

Sputum with cough: sputum is the liquid that comes from respiratory tract when cough. In case of Tb the patent can have mild, moderate or high sputum when cough according to the severity of disease.

No Appetite: No appetite means when u don't have the same desire to eat that you used to have. In case of malaria dengue and TB the person occurs with symptom.

Joint Swelling: The swelling in the joint is occurs in case of chikungunya.

Weight Loss: The continuous loss of weight is occurred when the person has TB.

Thickening of skin: In case of Elephantiasis the person's skin slowly starts getting thick.

Area of Living: These diseases depends on the area where the people lives like tropical area has more disease than other advance cities.

Conclusion

General diseases like malaria and dengue takes more life's than other disease. So, these diseases must be treated on the time. The system I propose is going to predict the risk factor of these Diseases in the patients. This system is more reliable as compared to other existing systems and with more accuracy because no system covers these diseases with this much similarity. The proposed system covers more diseases which has the same kind of symptoms which will lead to increase the accuracy of the software.

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