International Journal on Recent and Innovation Trends in Computing and Communication ISSN: 2321-8169
Volume: 3 Issue: 5 3099 – 3103

Genetic Algorithm Based for Identification of Heart Disease Risk Factors

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***Abstract*—** The purpose of this thesis was to examine heart disease Angina risk factors. In particular, this Thesis was organized around the central theme of adiposity, which is a prevalent Complication following SCI. Study focused on understanding the relationships between activities of daily living (ADL) and risk factors including central adiposity, lipoproteins, and triglycerides. Using genetic algorithm, while controlling for pertinent covariates such as sex, age, and leisure time physical activity (LTPA), it was found that Mobility ADL (wheeling and transferring) were negatively associated with total and LDL-cholesterol. Study also examined whether individuals who considered themselves to be overweight subsequently had less favorable subjective well-being, and were more likely to report specific secondary complications than individuals who did not consider themselves to be overweight. In summary, the findings suggest that a) participation in specific types of ADL (i.e. Mobility ADL) are associated with a lower risk and should be further explored) elevated perceived adiposity is associated with specific secondary complications and lower subjective well-being. Overall thesis findings support the overwhelming evidence of the benefits of daily physical activity and maintaining a healthy bodyweight in the SCI population

***Keywords*—** *LTPA, SCI, ADL, Data mining, CBR*

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I. INTRODUCTION

Data Mining

How does it work in medical systems?
Data Mining is the process of analyzing data from different perspectives and summarizing it into useful information - information that can be used to increase revenue, cuts costs, or both. Data Mining is the process of finding correlations or patterns among dozens of fields in large relational databases. In biomedical field data mining plays an essential role for prediction of diseases. Data mining tools help us to predict behavior and future trends, allowing to make proactive, knowledge-driven decisions. it simply means to extract data from huge amount of data for the simplification of the processes to make the processes easier several types of analytical software's are available like neural networks, machine learning, artificial intelligence. Statistics and database system. Four types of relationships found in such systems are:
Classes – using the stored information to access the data for determining a need. For example if a GARMENT shopkeeper wants to increase his sales he can use the predetermined data to study the consumer pattern.
Clusters: Data grouped to a particular set of consumers. For example, data can be mined to determine the pattern of female customers visiting a store to buy a particular product.
Associations: we find link between the data when mining, to find associations among them.
Sequential pattern: we can determine trends and patterns to anticipate behavior of consumers. We can determine the household purchases of a particular family for a month basis.
Major elements in data mining are as follows:

- We first extract information, then transform it and load the required data into the warehouse.
- Secondly we store and manage the data in multidimensional system.
- We provide access to technology professionals and business analyst's
- Data can now be analyzed using various application software.
- At the last stage we can present the data in a useful manner which may contain charts, graphs and tables.

In Medical Fields

With advancement in technology several methods are available to computerize the process of medical diagnosis. It includes programs that employs probabilistic, statistical methods, knowledge-based systems that use artificial intelligence methods. Variety of people at various premier institutes like MIT and the New England Medical Center used this approach to diagnose and treat people based on the theories of probability and utility. Their main aim was to build systems that could give optimal medical solutions. Rule-based expert systems gained more popularity with changes in the medical field. CASEY is a real world application based on Cased Based Reckoning (CBR) methodology to give a diagnosis for the heart disorders. It functions as a digital therapy advisor. MYCIN (with 450 rules) was developed to diagnose blood infections by Buchanan, Feigenbaum and Shortliff. Other scientists like Phan and Chen designated the use of logic to healthcare diagnostic systems. With the help of a set of sensors the system could monitor the heart rate, blood pressure and body temperature.

Using logic in medical diagnosis is a hopeful technique that could easily capture the necessary medical information and come up with sound diagnosis solutions catering to the needs of the consumers. The present work launch a simple and effective methodology to develop specialist systems for medical diagnosis. The methodology is extensive and can be used in diagnosing a overall of diseases. However to embellish the concept we consider in this paper a set of eight upper respiratory contamination to develop a prototype computer program that can infer proper diagnosis resolution based on patient data.

Medical Diagnosis

Medical artificial intelligence is firstly concerned with the establishment of AI programs that perform diagnosis and make therapy recommendations. Unlike medical applications based on another programming method such as purely statistical or probabilistic methods, medical AI programs based on symbolic models of disease and their relationship with patient's factors and clinical exhibitions . Medical expert systems contain medical knowledge, if we enter the particular symptoms referring to a particular disease it will automatically link the patients' data i.e.; the symptoms with the disease . logic is a superset of conventional (Boolean) logic that has been extended to handle the concept of partial truth – truth values between "completely true" and "completely false". It was introduced by Zadeh in 1965 as a means to model the uncertainty of natural language.

In this paper we have developed an expert system that uses a collection of membership functions and rules, instead of Boolean logic to search about data i.e. the patient's symptoms and diseases associated with it. Leung, Lau and Kwong described a general structure of a system that can be used as the core part of the application. The structure can be summarized in the following four steps, carried out in order:

1) **Composition**: all of the subsets assigned to a particular output variable are pooled together to form a single subset for a particular output variable.
2) **Fuzzification**: the membership functions defined on the input variables are applied to their actual values, to determine the degree of truthiness for each rule premise.
3) **Deffuzification:** is an elective step which can be used when it is useful to convert the output set to a crisp number
4) **Inference**: the true value for the premise of each rule is calculated and applied to the conclusion part of each rule. The result of one subset is assigned to each output variable for each rule.

Defuzzification methods are available [9], however two of the more common techniques are the CENTROID (center of area) and the MAXIMUM methods. In the CENTROID method, the crisp value of the output variable is computed by finding the variable value of the center of gravity of the membership function for the value. In the MAXIMUM method, one of the variable values at which the subset has its maximum truth value is chosen as the crisp value for the output variable.

II. LITERATURE REVIEW

1. HEART DISEASE RISK FACTORS IN INDIVIDUALS WITH SPINAL CORD INJURY

It only takes an instant to acquire a spinal cord injury (SCI), yet the devastating effects last a life time.[1] At least some degree of paralysis almost always occurs following a SCI. In addition to paralysis, individuals with SCI also often suffer from a myriad of other SCI related illnesses and comorbidities.[2] Overwhelming evidence suggests that individuals with SCI often have a higher level of adiposityi than able bodied counterparts.[3] This increased level of adiposity combined with lower levels of physical activity place individuals with SCI at an increased risk for comorbidities such as coronary heart disease (CHD) and diabetes. Possible ways to mitigate this elevated risk are greatly needed. Leisure time physical activity (LTPA) has been identified a strategy to lower adiposity and CHD risk[.4],[5] However, the role of other daily activities, particularly activities of daily living (ADL), in decreasing adiposity and CHD risk is unknown.

2. EXPERT SYSTEM FOR SUPPORTING DIAGNOSIS OF HEART DISEASES

Case-Based Reasoning (CBR) is a general artificial intelligence prototype for reasoning from experience. CBR methodology has been investigated in improving human decision-making and has received much attention in developing knowledge-
based systems in medicine [16]. A special issue that includes papers on CBR theory and applications was published [8, 9]. Unlike the traditional rule-based approach in which expert knowledge must be represented in "if-then" rules, a case based approach allows knowledge to be grouped and stored as cases. The development of this approach has surged as a key tool for developing a new generation of expert systems [5]. Following to the CBR approach, when a new problem is introduced to the system, the problem is indexed, and subsequently, the indexes are used to retrieve past cases from case memory. CBR has already been applied in a number of different applications in medicine. CBR is appropriate in medicine for some important reasons; cognitive adequateness, explicit experience, duality of objective and subjective knowledge, automatic acquisition of subjective knowledge, and system integration [3]. Some real CBR-systems are: CASEY that gives a diagnosis for the heart disorders [6], GS.52 which is a diagnostic support system for dysmorphic syndromes, NIMON is a renal function monitoring system, COSYL that gives a consultation for a liver transplanted patient [2] and ICONS that presents a suitable calculated antibiotics therapy advise for intensive care patients [15].

3. EXPERT KNOWLEDGE AND DATA MINING IN A MEDICAL DIAGNOSIS DOMAIN.

It describes a medical diagnosis system in the field of physiotherapy and, more specifically, muscle function assessment based on isokinetic machine data, using an expert system and data mining techniques[5]. An isokinetic machine can be described as apparatus on which patients perform strength exercises. This machine has the peculiarity of limiting the range of movement and the intensity of effort at a constant speed (which explains the term isokinetic). Data concerning the strength exerted by the patient throughout the exercise are recorded and stored in the machine so that physicians can visually analyze the results using specialized computer software.

4. Research On A Cancer Information System

NCI (The National Cancer Institute) is responsible for managing an immense collection of cancer-related information. Part of that information management responsibility involves finding innovative ways to share information in as timely, efficient, and intuitive manner as possible. NCI has therefore instituted a series of small information-sharing initiatives which are publicly available on-line through various links to their World Wide Web (WWW) pages. NCI also shares its digitized collections in a

variety of formats (including CD-ROM) as test beds for data mining investigations.

Some of NCI's on-line initiatives involving cancer information include:

− **CancerNet** (http://www.nci.nih.gov) – provides information about cancer, including state-of-the-art information on cancer screening, prevention, treatment and supportive care, and summaries of clinical trials.

− **CancerNet for Health Professionals** – includes access to PDQ and related information on: treatments; screening, prevention and genetics; supportive care and advocacy issues; clinical trials; a directory of genetic counselors; CancerLit topic searches; cancer statistics; and the *Journal of the National Cancer Institute*. (http://wwwicic.nci.nih.gov/health.htm);

NCI's International Cancer Information Center (ICIC) clearly considers that it is essential for the cancer information that it manages to be easily accessible to all levels of medical information users from the very naive to the extremely expert. "Other novel channels of information distribution will be explored to bring cancer information to those who require it, whether health professionals, patients, or policy makers. Appropriate choice cannot be made unless the full range of options is available to these decision makers"

III. EXPERIMENTAL COMPUTATION

THE PRESENT WORK INTRODUCES A SIMPLE AND EFFECTIVE PROCEDURE TO DEVELOP EXPERT SYSTEMS FOR MEDICAL DIAGNOSIS. THE METHODOLOGY USED IS GENERAL AND CAN BE USED IN DIAGNOSING A WIDE RANGE OF DISEASES. HOWEVER TO ILLUSTRATE THE CONCEPT, WE HAVE JUST CONSIDERED HEART DISEASES TO DEVELOP A PROTOTYPE COMPUTER PROGRAM THAT CAN DEDUCE PROPER DIAGNOSIS DECISIONS(RISK FACTOR) BASED ON PATIENT'S DATA.

1. Existing Work

Medical diagnostic related expert system is one of the favorite's research areas now-a-days. Lot of work is being done in this field now to find new solutions. Each work has its own level of significance. There are no. of disease with lot of symptoms and the diagnosis of these problems with help of one system is difficult to design. Each disease and its symptoms, diagnosis is itself a research area.

Many researchers by this time have done a lot of work with diseases that can be identified by the human normal behaviors. Such diseases include lung problems, cancer etc. There is a no. of approaches being used with such problems like neural network, fuzzy approach etc.

We are offering a project for the heart disease and we are providing its risk estimation using genetic algorithm.

2. Problem Definition

The present work presents a simple and operational methodology for medical diagnosis. Diagnosis of upper respiratory infections is considered here as a vehicle to demonstrate the concept, however the developed methodology is much more suitable for application to a wider range of diseases. We define a set of features *F* relevant to the set of considered diseases *D taken by us for sampling*. The input case to be diagnosed is termed by assigning a value to each feature of the set *F*. Each disease of the set *D* is indicated by its profile in the form of a table obtained by consulting an expert physician. The inference is applied to obtain a decision set for each measured disease, and crunchy decision values are obtained to state the certainty of presence for each disease.

Risk Factor = (no_of_factor_selected/total_factor)*100

3. **Risk factors:** Various risk factors causing heart diseases are as follows:-

In the United States, the main cause of death of men and women is heart problems .Risk factors affecting it includes:

- Age
- Family history
- High blood pressure
- High cholesterol
- Smoking and drinking habits
- Lack of balanced diet
- Obesity
- Inactivity (sedentary lifestyle)
- Other health related problems
- Lack of proper exercising

IV. RESULTS & DISCUSSION

Many links in Heart Disease information system:

Various links in **Heart Disease information system** is used to provide various information. Like patient link contain information about patients, information about a patient can be added, deleted, and can be searched. Similarly Doctor Link contains the information that a doctor has in his mind (database).

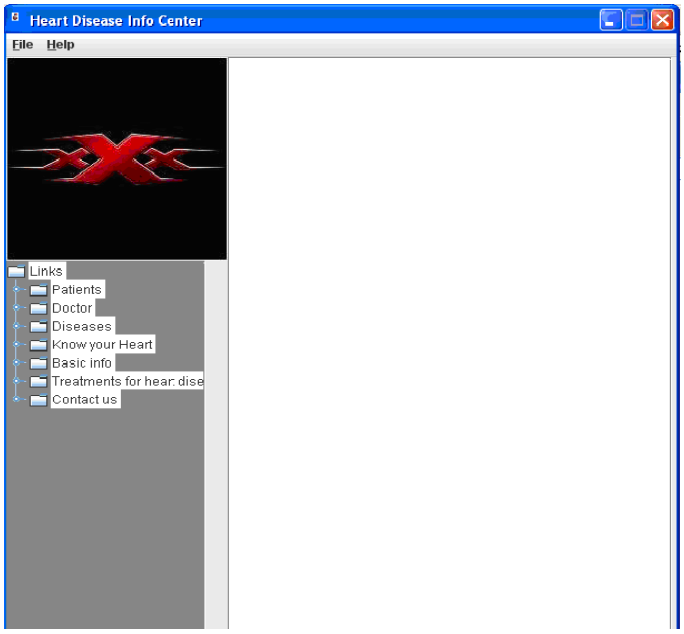

Fig.1

Insertion of Patient Details:

Patient link contains further insertion part in which we have various fields. Information of the patient is added here that gets saved in the database of the system and helps in easy retrieval of data at a later stage.

ISSN: 2321-8169
3099 – 3103

Fig. 2

patient : Table

patient_id	name	sex	age	contact	history
P	1	Male	11-20	adf	sdf
P-0123	lala	Female	21-30	012-3456789	very sick...dyin
P-101	sss	Male	11-20	asdf	asdf
P-102	asdf	Female	21-30	asdf	asdf
P-asa	as	Male	0-10	as	as
P-asrar	Asrar Ahmed M	Male	21-30	no 11 Jln Belimi	1. Aortic Aneury
P-asrar1	Asrar Ahmed M	Male	21-30	no 11 Jln Belimi	1. Aortic Aneury

Table 1

Calculate Your Risk factor:

The implementation of **Genetic algorithm** is stated here. Given a specific problem, the input to the GA(**Genetic algorithm)** is a set of potential solutions to the problem that is encoded in some fashion, and a metric called a ***fitness function*** which allows each candidate to be quantitatively evaluated.

Inputs to the GA are:

Various Risk factors for heart disease includes:

Sex, Age, Family history (background of any heart disease in the family), High blood pressure, High cholesterol, Smoking and drinking habits, Poor diet, Excess weight (because of sedentary lifestyle) as shown in picture.

Function/formula for the Risk factor used in GA is:

Risk Factor = (no_of_factor_selected/total_factor)*100

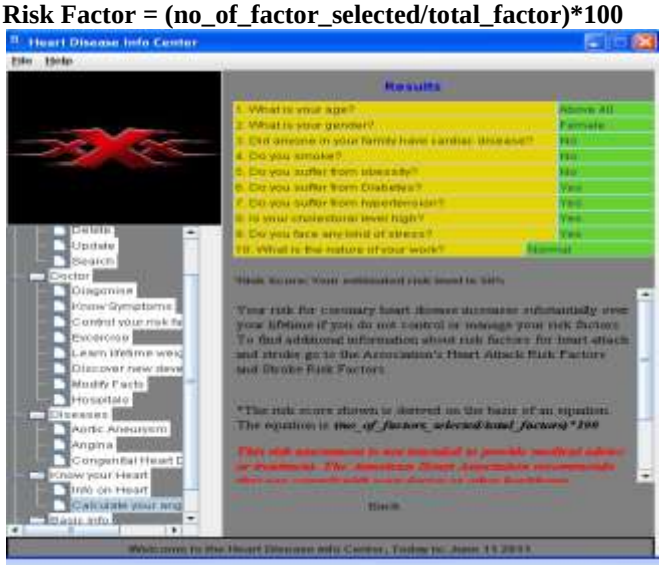

Fig. 3

Various results /output are:

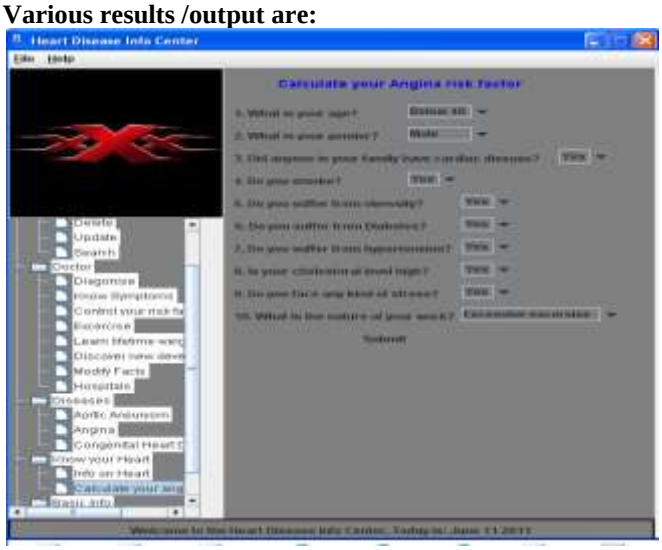

Fig. 4

V. CONCLUSION & FUTURE WORK

The Proposed System is a simple and effective technique that can be beneficial for the medical diagnosis of a wide range of diseases. in this study, a methodology is made to capture the experiences of various expert physicians and store them in form of tables to represent various disease profiles. Inference techniques can be used to provide sound diagnosis results. A case study is provided to demonstrate the eminence of results obtained for a typical input case. Complete agreement with the diagnosis of human expert physicians has been obtained in many experiments with different input symptoms in each case study.

In this paper, a genetic algorithm based on medical expert system that supports identification of heart diseases is developed. Knowledge structures are represented via a formalism of various risk factors. The system uses different technique for the retrieval of data from the system; genetic algorithm based on ANN technique is used for calculation of risk factor for an input case. It has all the information about heart, risk factors, various risk factors affecting the heart, causes of various risk factors and what is the prevention of these diseases. In the front end java is being used for design purpose.

For future work, we have estimated risk factors for a few heart diseases. We can enlarge the same application by including more diseases and more symptoms in it. We can use clustering algorithms to accumulate all the related disease as a group and categorize it on several basis. Further more to get more accuracy and the efficiency We can also use the quantum approach. Ultimately, the results of these experiments will be used to help patients to decide, what the chances of heart diseases are.

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