RESEARCH REVIEW JOURNALS
Volume-03
Issue-10
October-2018

ISSN: 2455-3085 (Online)
RESEARCH REVIEW International Journal of Multidisciplinary
www.rrjournals.com [UGC Listed Journal]

Review of Literature on Design and development of an expert system for diagnosis of Selected cardiac diseases

[*1]Miss.Gath Sulbha & [2]Dr. A. T. Gaikwad

[*1]*Associate Professor, department of Computer Science, DKASC College, Ichalkaranji (India)*
[2]*Associate Professor, department of MCA, Bharati Vidyapeeth Institute of Management, Kolhapur (India)*

ARTICLE DETAILS

Article History
Published Online: 10 October 2018

Keywords
Expert System, Cardiac Diseases, diagnosis, knowledge, Decision making, electrocardiograms

[*]**Corresponding Author**
Email: gathsjj[at]gmail.com

ABSTRACT

Expert System for diagnosis of Selected Cardiac Diseases will be a knowledge-based system capable of making multiple diagnoses for Selected Cardiac Diseases. Expert System for diagnosis of Selected Cardiac Diseases will be designed as an information system as an decision support system application, which will provide assistance in the diagnosis of Cardiac disease and will demonstrate the assistance of a microcomputer-based expert system for medical diagnosis related to Selected Cardiac Diseases.

We have thought of implementing Expert System for diagnosis of some Selected Cardiac Diseases because Heart diseases are the leading cause of death today, and causing about million deaths per year in the Society. The Cardiology has estimates that there is shortage of specialists, and the worrying fact is that the majority of electrocardiograms are analyzed by general practitioners in out-of-hospital environments. By effectively and efficiently decentralizing decision-making by means of a Expert System for diagnosis of Selected Cardiac Diseases will be a solution for effective interaction between patients, general practitioners and cardiologists even will be useful to train junior doctors and will aim to achieve a satisfactory solution to Physicians and General Practitioner's needs.

1. Introduction

"**Expert systems are an automated reasoning system that attempts to mimic the performance of the human expert and performs tasks normally handled by a human being**"

Cardiology is an important medical specialty dealing with disorders of the heart where cardiologists provide diagnosis and treatment of heart failure, congenital heart defects and coronary artery disease. It comprises the study of complex types of heart diseases and procedures.

Complicacy of clinical decisions justifies utilization of information systems such as artificial intelligence to achieve better decisions, We aimed at to review the applications of these systems in the medical domain and specially related to some selected heart diseases.

Following is a brief review of literature of expert systems presented by various researchers, and this is the study of the comparative review of the systems in the terms of number of inputs they have considered, the Research/ Design Methodology, Problem Statement, Objectives of Study, Hypothesis that was considered and Expected Outcome of their research and finally from this study we have tried to find out the Research Gaps.

2. Techniques used in Implementing expert system

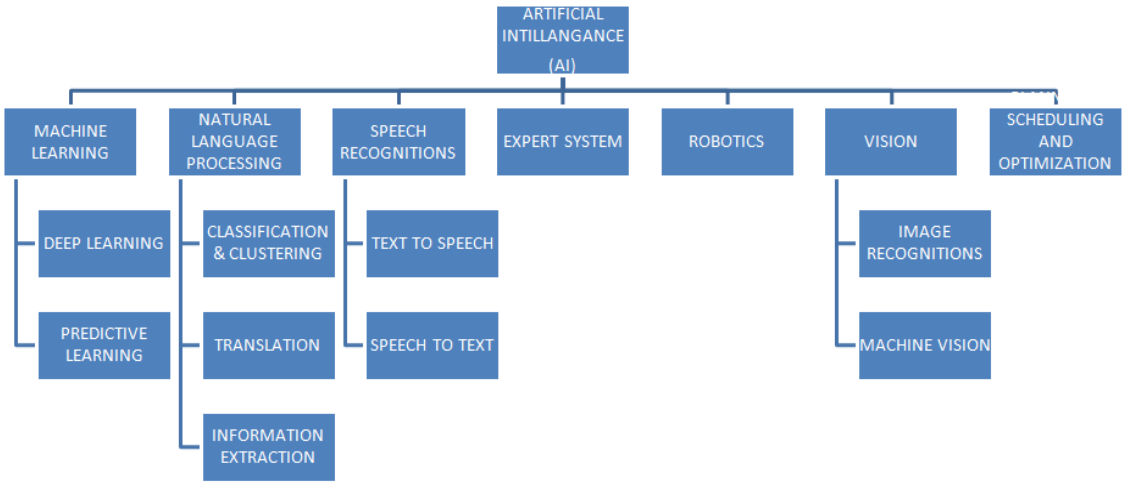

Figure1: classification of different methodologies for designing systems based on Artificial intelligence

3. Different Methodologies for designing an Expert System:

rule based, model based and frame based expert system

1. rule base expert system
2. knowledge-based expert
3. Fuzzy Expert System
4. Artificial Neural Network based expert system
5. real time based expert system
6. back-propagation artificial neural network based expert system
7. feed forward artificial neural network based expert system
8. Neuro-Fuzzy based expert system
9. Neuro-Fuzzy Hybrid based techniques
10. multilayer neural network based expert system
11. neural networks ensemble- based expert system
12. Decision Support System based expert system
13. case-based reasoning based expert system
14. ontology case-based reasoning based expert system
15. deep maxpooling convolutional neural networks based expert system
16. DeepVesselNet based expert system
17. 3-D convolutional networks based expert system
18. orthogonal cross-hair filters based expert system

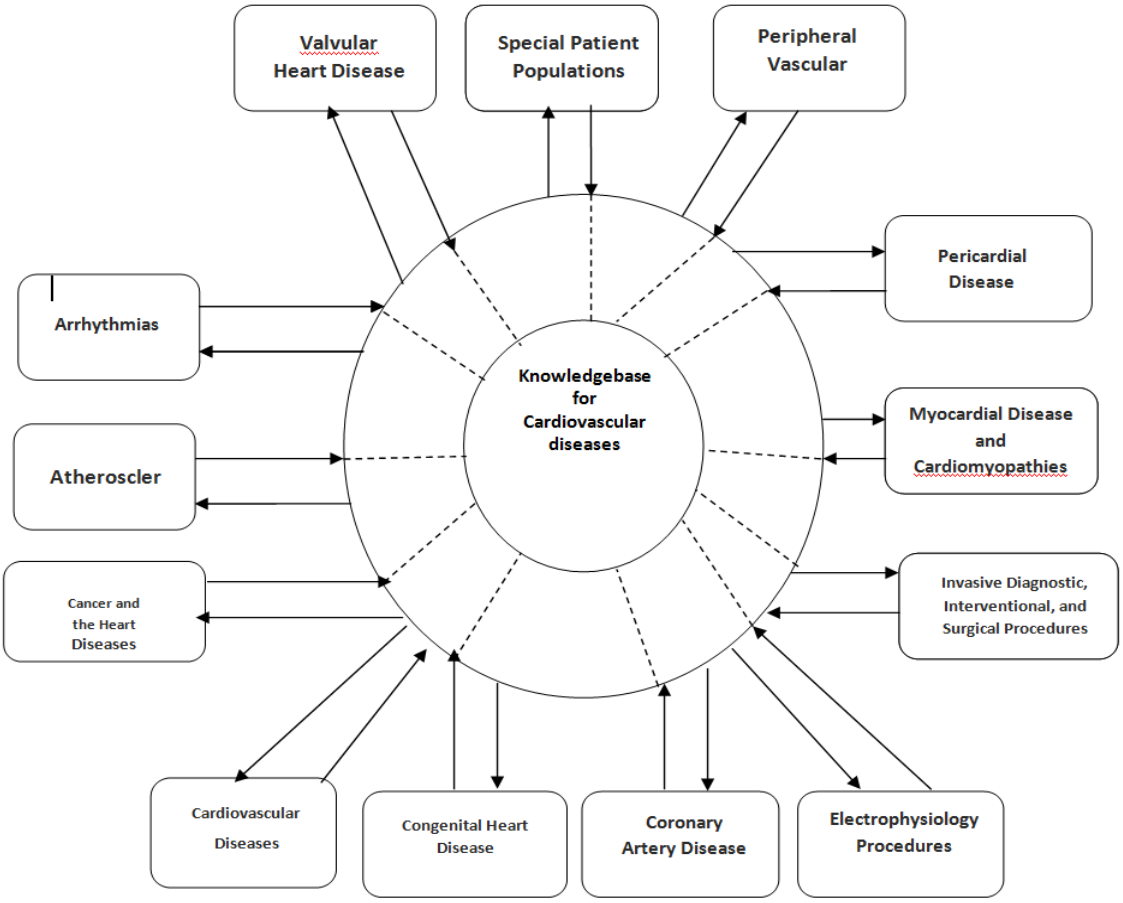

Figure2: Design of Expert system for diagnosis of Selected cardiac diseases

4. Literature Review

1. "Clinical Evaluation of an Automatic Blood Pressure Controller During Cardiac Surgery" by- **Roger H. A. M. Meijers,** et all- In this paper researcher has describe a closed loop blood pressure controller and shown the results of its clinical evaluation . The controller is based on a simple and robust Proportional-Integral controller and a supervising, **rule base expert system**.

2. "Decision making process in cardiac surgery – concept of building an expert system" by- **Tomasz HRAPKOWICZ**, et all- in this paper researchers have designed a knowledge base medical expert system which support the decision process making in cardiac surgery where knowledge from medical guidelines, risk scales, and registries is applied to reason the medical procedure in a particular case scenario using **rule base expert methodology**.

3. "Exploiting Fuzzy Expert Systems in Cardiology" by **Efrosini Sourla** Vasileios Syrimpeis et all - This paper presents a Sugeno-type **Fuzzy Expert System** designed to help Cardiologists and General Practitioners in taking decisions on the most common craniological clinical dilemmas. This system is separated in five sub-systems; Coronary Disease , Hypertension, Atrial Fibrillation, Heart Failure and Diabetes, covering a wide range of Cardiology.

4. "Exploiting expert systems in cardiology: a comparative study" by Vasileios Syrimpeis, et all - This paper presents a Adaptive **Neuro-Fuzzy** Inference System in the field of critical cardiovascular diseases. The system stems from an earlier application based only on a Sugeno-type Fuzzy Expert System with the addition of an **Artificial Neural Network** computational structure. Researchers have tried to , inherent characteristics of ANNs, along with the human-like knowledge representation of fuzzy systems to integrate together. The ANFIS has been utilized into building five different sub-systems, distinctly covering Coronary Disease, Hypertension, Atrial Fibrillation, Heart Failure, and Diabetes, the system aids doctors of medicine. The Fuzzy Rules have been trimmed down and the have been optimized in order to focus into each particular disease and produce results ready-to-be applied to real-world patients.

5. "Diagnosis and explanation by a nuclear cardiology expert system" by- **Kenneth M**., et all-In this article, researcher describes a process of the designing and developing **a knowledge-based expert** system which aids interpretation of radionuclide imaging in the heart. They have designed a multimedia user interface for a diagnostic, testing facility, which help's training clinicians

6. "Expert system for phonocardiographic monitoring of heart failure patients based onwavelet analysis" by- **E. Kail**., et all- Researchers have developed An expert system for the phonocardiographic monitoring in the coronary care unit and as well as at home. The aim of the study is to examine the performance of wavelet transformation in a heart failure group with noisy environment. For detection and interpretation of heart sounds and murmurs. Researchers have developed an expert system basically for the phonocardiographic monitoring of heart murmur noise using Fourier and the wavelet transformation for the time-frequency representation

7. "A Hybrid Expert System Supporting Diagnosis Of Heart Diseases" by-, **Abdel-Badeeh M. Salem and Rania A**. - In this paper, Researchers have developed a hybrid expert system for diagnosis of heart diseases. The system merges uncertainty management techniques and case-based reasoning. The system is able to give diagnosis for 4 heart diseases namely; mitral stenosis, left-sided heart failure, stable angina pectoris and essential hypertension with the corresponding certainty factor. The system has been implemented in visual prolog for windows and has trained set of 42 cases for Egyptian cardiac patients and has been tested by another 13 different cases. Each case contains 33 significant attributes resulted from the statistical analysis performed to 110 cases. It is a Rule-Based Expert System for Diagnosis of Heart Diseases.

8. "A Rule-Based Expert System For Automated ECG Diagnosis" by- Muzhir Shaban Al-Ani and Atiaf Ayal Rawi - This paper presents the development of a **rule-based expert system** that emulates the ECG interpretation skills of an expert cardiologist for introducing way of automating the diagnosis of cardiac disorders. In this rule-based expert system, patient's heart rate and the wave characteristics of the ECG are considered. With these 'facts', rules are framed and a rule base is developed in consultation with experts. An inference engine in the expert system uses these inputs and the rule base to identify any abnormality in the patient's heart .An expert system designed on the basis of information derived from the analysis of (ECG) using Microsoft Visual studio.Net. For this paper the shape of ECG is used to diagnose ECG beat in four types such as Normal beats (N), Sinus Bradycardia beat, Sinus Tachycardia beat and Sinus Arrhythmia beat. The ECG image from ECG simulator is processed by some image processing techniques such as red grid removing, noise rejection, and image thinning firstly, then, combining detection component of ECG signal(P,QRS,T) based on Time-series ECG are obtained.

9. "Cardiac Arrhythmia Classification Using Neural Networks with Selected Features" by- **Malay Mitra and R. K. Samanta** - This research presents an approach for cardiac arrhythmia disease classification, they have designed an intelligent automated decision support systems on the basis varying accuracies tested on UCI arrhythmia. This work attempts correlatio n-based feature selection with linear forward selection search. For classification, they have used incremental back propagation neural network, and **Levenberg-Marquardt classification** tested on UCI data base.

10. "Application of Artificial Neural Networks in the Heart Electrical Axis Position Conclusion Modeling" by- **L N Bakanovskaya**- This research presents an approach upon building of a heart electrical axis position conclusion model using an artificial neural network. The input signals of the neural network are the values of deflections Q, R and S; and the output signal is the value of the heart electrical axis position. Training of the network is carried out by the error propagation method.

11. "Use of Artificial Neural Networks within Deterministic Logic for Computer ECG Diagnosis of Myocardial Infarction" , **by- T.F.YangB.Devine & P.W.Macfarlane** - The study was aimed at assessing the effect of incorporating neural networks inside an existing deterministic computer ECG analysis program in order to enhance the diagnosis of myocardial infarction. Separate **neural networks** were trained for inferior and anterior myocardial infarction using 200 normals, 100 IMI. 80 AMI and 42 left ventricular hypertrophy cases, all clinically validated. All the networks had a single output to discriminate between

MI and non-MI. A variable number of inputs to the networks was used consisting of QRS ± ST-T measurements. Separate test sets including 200 normals. 42 LVH, 101 AMI and 80 IMI cases were then utilised to find the best performing neural networks for IMI and AMI.

12. "Fuzzy expert system for cardiovascular disease diagnosis-tests and performance evaluation"- by **S. Zahan**- The aim of the paper is to present the results of the tests performed in order to evaluate the performances of a **fuzzy expert system** developed for cardiovascular disease diagnosis.

13. "Diagnosis of Some Diseases in Medicine via computerized Experts System", by- **R.A. Soltan** , et all - This paper described a prototype model of a expert system for diagnosing and treatment heart diseases. The system uses **the rule-based reasoning technique** through simple querying of symptoms, signs and investigation done to the patient. The system can be used for diagnosing heart disease patient and then give treatment.

14. "Generic Medical Fuzzy Expert System for Diagnosis of Cardiac Diseases" , **Ali M. S** , et all - Researchers have attempted to explore the capabilities and potentialities of fuzzy expert systems for the emulation of thought in a much more general sense although confined to medical diagnosis, they have designed a Generic medical fuzzy expert system for diagnosis of cardiac diseases. **Mathematical** model is developed to predict the risk of heart disease.a generic system was designed using fuzzy methodology for medical diagnosis using visual basic and fuzzy logic tool box of MatLab software. The fuzzy expert system that was developed in visual basic and MatLab fuzzy tool box are interfaced. A strong knowledge base and rule base comprising more than 1000 rules exclusively pertaining to heart disease is the main backbone of the system. The system accepts inputs in the form of physiological, radiological and clinical parameters from the user. Moreover, the user can select general as well as specific symptoms from the prebuilt symptoms library.

15. "ANN based Expert System to Predict Disease in Cardiac Patients at Initial Stages" by-**Umer Rashid**,- Researcher has developed an expert system for the preliminary investigation of cardiac abnormality in human beings. Researcher has used Artificial Neural Network methodology for prediction of heart abnormalities in cardiac patients at initial stages. this research is intended to employ an Artificial Intelligence (AI) technique in an automated solution, having minimum error bounds. An **ANN based expert system** is designed and developed, which identifies presence or absence of cardiac disease in patients by considering best practiced disease symptoms.

16. "Design of an Optimized Fuzzy Classifier for the Diagnosis of Blood Pressure with a New Computational Method for Expert Rule Optimization" by **Juan Carlos Guzman**, et all - In this study, Researchers have developed a model using **Neuro-Fuzzy Hybrid techniques** that actually implements the human reasoning using a set of decision rules for the study of different diseases such as Hypertension Blood pressure (HBP). based on the classification of Hypertension, according to the definitions of the European Guidelines.

17. "A Fuzzy Rule Base System for the Diagnosis of Heart Disease", by-**Manisha Barman**, et all -In this paper a **fuzzy rule based system** for the diagnosis of the heart disease has been presented. The developed system has seven inputs .These are Chest pain type, resting blood pressure in mm (Trestbps),Serum cholesterol in mg(Chol),Numbers of Years as a smoker(years), fasting of blood sugar(fbs), maximum heart rate achieved(thalach), resting blood rate(trestbpd). The angiographic disease status of heart of patients has been recorded as output. It is to state that diagnosis of heart disease by angiographic disease status is assigned by a number between 0 to 1, that number indicates whether the heart attack is mild or massive, The Cleveland database has been used to make this study. Various membership functions have been used as input. Here an effort has been made to decide suitable membership function for proper diagnosis of heart disease. Three types of membership functions viz **gaussian**, **triangular** and **trapezoidal** membership functions have been attempted. Based on the minimum value of absolute residual the particular membership function can be decided for the fuzzy rule base system with an objective of the proper diagnosis of a patient.It has been shown that Fuzzy rule base system using Gaussian membership function has given best result as compared to other membership functions. For patient 1 with the characteristics :blood pressure during resting time as 145, serum cholesterol 233 mg, maximum heart rate as 60,blood rate during rest as 90 , the person is having fasting blood sugar, the person can be treated as a smoker for 20 years with a typical angina(chest pain type angina value 1), the output (angiographic disease status) has been observed as 0.276 usingfuzzy rule base system. The original status for patient 1 is 0. Thus for patients 1 ,the absolute residual (derivation from original) is 0.276.For patient 2, the observed output status using fuzzy rule base system is 0.845 as against the original status as 1 with absolute residual (derivation from original) is 0.155.For patient 19, the observed status using fuzzy rule base is 0.845 as against the original status as 1 with absolute residual (derivation from original) is 0.155.Accordingly the output (angiographic disease status) for all the patients can be ascertained

18. "Hypertension Diagnosis Using Fuzzy Expert System", By- **Rupinder Kaur & Amrit Kaur**-In this study, researcher have designed a fuzzy expert system to diagnose hypertension for different patients. This **Fuzzy expert** system is based on set of symptoms and rules. The input parameters for this system are age, body mass index, blood pressure, heart rate, diabetes, physical activity, genetics and the output parameter is risk of hypertension. Seven input variables age, BMI, heart rate, blood pressure, diabetes, physical activity and genetics are used for the fuzzification method while risk of hypertension (%) is used as output. to calculate the risk of hypertension

19. "Design and Development of Fuzzy Expert System for Diagnosis of Hypertension", By- **Nur Farahiyah Mohammad et all** - The aim of this study is to design a **Fuzzy Expert System** for diagnosis of hypertension risk for patients aged between 20's, 30's and 40's years and is divided into male and female gender. The input data is collected from a total of 10 people which consists of male and female with different working background. The parameters used as input for this fuzzy expert system were age, Body Mass Index (BMI), blood pressure and heart rate. Hypertension is diagnosed if blood pressure is over than 140/90mmHg. For current progress the input used is- age, BMI, heart rate and blood pressure are used as input for the fuzzification method while risk of hypertension (%) is used as output.As per researcher Fuzzy expert system design is very appropriate compared to the Bayesian Statistics, Statistical and other methods. This is because fuzzy expert system can simulate as an expert doctors behavior in order to diagnose diseases.

20. "Artificial Intelligence in Hypertension Diagnosis: A Review", By- **Arpneek Kaur & Abhishek Bhardwaj**- This paper presents an introduction and survey on different artificial intelligence methods used by researchers for the application of diagnosing or predicting Hypertension

21. "An expert system for diagnosis of the heart valve diseases", By-**Ibrahim Turkoglu et all** - In this paper, an expert diagnosis system is presented for interpretation of the Doppler signals of the heart valve diseases based on the pattern recognition. This paper especially deals with the feature extraction from measured Doppler signal waveforms at the heart valve using the Doppler Ultrasound. Wavelet transforms and short time Fourier transform methods are used to feature extract from the Doppler signals on the time–frequency domain. Wavelet entropy method is applied to these features. **The back-propagation neural network** is used to classify the extracted features.

22. "Design of A Fuzzy Expert System And A Multi-Layer Neural Network System For Diagnosis Of Hypertension" , By-**Zeinab Abrishami & Hamid Tabatabaee**,- In this study, researcher has used two methods for the diagnosis of the hypertension. Firstly, a **Fuzzy Expert system** (FEs) is introduced for the diagnosis of the hypertension in adults. The input parameters include Systolic Blood Pressure (SBP) and Body Mass Index (BMI). Secondly, the **multilayer neural network (MNN)** with 5 inputs, 5 hidden layers and 1 output is employed for the diagnosis of the hypertension. The inputs include, smoking, age, weight and BMI. Finally the results of two systems (FEs and MNN) are compared individually. And proved that Fuzzy Expert Systems can actually implements the human intelligence and reasoning than any other methodology of AI

23. "Diagnosis of valvular heart disease through neuralnetworks ensembles", By-**Resul Das et all** ,- In this paper, researcher has introduce a methodology which uses SAS Enterprise Miner5.2 was used to construct a **neural networks ensemble-basedmethodology** for diagnosing of the valvular heart disease. A neural networks ensemble method is in the centre of the proposed system. The ensemble-based methods creates new models by combining the posterior probabilities or the predicted values from multiple predecessor models. Experiments were conducted on the valvular heart disease at a set to diagnose heart disease in a fully automatic manner. Three independent neural networks models were used to construct the ensemble model.

24. "Artificial Neural Networks in Cardiology - ECG Wave Analysis and Diagnosis Using Backpropagation Neural Networks" ,By-**Syed Khursheed ul Hasnain et all** ,- The developed system the Computerized Patient Monitoring System, analyzes ECG waves in both time and frequency domain with real time processing capabilities. The network does dynamic studies of the wave with point-to-point calculations and 2D wave pattern recognition. The system also has learning abilities for learning custom ECG patterns and their related abnormalities, and this can be used to store up to 25 reference abnormal ECG patterns to be used for future diagnostic calculations. The system learns in both on and off line modes and thus produces results in real time. The data acquired by the system can be used with a database management system so that it can be viewed anywhere in the hospital using hospital's LAN. Furthermore the data can also be communicated on the Internet, this system uses **Back propagation neural network** methodology

25. "Expert System for Diagnosis of Heart Disease: A Review", by -**Suresh Nagar & Arvind Kumar Jain-** This paper focuses on today's most severe heart related diseases. discusses different expert systems that are presently used in the field of medical sciences. In addition to this, a brief survey of related papers is also discussed. Moreover, it

describes the well known database used for heart disease diagnosis.Researcher has developed Clinical **Decision Support System** for heart diseases, which gathers the patient health information and by using predetermined **algorithms or rules**, System outputs in the form of probability for patient been prone to heart diseases.

26. "Expert System for Heart Problems", By- Dr. S. Govinda Rao, This paper focuses on **Fuzzy Expert System** for heart problems. The system has 11 input fields and one output field. This is **rule based** and having required data with respect to kind of chest problem, blood pressure, cholesterol, resting blood sugar, maximum heart rate, resting electrocardiography, exercise, previous peak, thallium scan, sex and age. The result will show the status (is there) of heart problem of the man. It has the index of values by starting from 0 to 4 (1, 2, 3, and 4).

27. "A Fuzzy Expert System for Heart Disease Diagnosis", By**- Ali.Adeli & Mehdi.Neshat-** Researchers have designed a **Fuzzy Expert System** for heart disease diagnosis. The designed system based on the V.A. Medical Center, Long Beach and Cleveland Clinic Foundation data base. The system has 13 input fields and one output field. Input fields are chest pain type, blood pressure, cholesterol, resting blood sugar, maximum heart rate, resting electrocardiography (ECG), exercise, old peak (ST depression induced by exercise relative to rest), thallium scan, sex and age. The output field refers to the presence of heart disease in the patient. It is integer valued from 0 (no presence) to 4 (distinguish presence (values 1, 2, 3, 4)). This system uses Mamdani inference method.

28. "A Neural Network Expert System for Diagnosing and Treating Hypertension", By-Riccardo Poli- This article describes Hypernet (Hyper-tension Neural Expert Therapist), a **neural network expert system** for diagnosing and treating hypertension, The tools they have developed for implementing this system is a **compiler** for a simple descriptive language that enables to define, train, and test networks; a graphic editor that translates the network drawn by the user into the proper statements; and a set of programs for interactively generating the examples. After describing the data used as examples, the learning phase, and the results of tests for evaluating the performance of each network.

29. "A Fuzzy Expert System For Diagnosis And Treatment Of Musculoskeletal Disorders In Wrist", By**- Fatemeh Mohammadi Amiri & Ameneh Khadivar-** Researchers have designed an expert system for diagnosis and treatment of musculoskeletal disorders in wrist in **fuzzy environment**, MATLAB software. The knowledge is achieved from 15 elites in the field of musculoskeletal disorders. For data gathering related to symptoms of the disorders, a **fuzzy Delphi method** is used. A Delphi method is also used for gathering data related to treatments. The designed system is able to diagnose seven disorders of the wrist. The input to the system is the magnitude of symptoms and the output is the scores given by the system to disorders; finally, the disorder with the highest score is displayed as the systemic diagnosis for which treatments are suggested. The systemic diagnosis is compared to elite diagnosis using statistical analysis conducted by SPSS software. Results show a significant correlation between two variables. By comparing the variables, it is found that 86,7 % of the systemic diagnoses were similar to elite diagnoses. In the absence of elites, diagnosis and treatment can be performed to a relatively reliable level. As results of current research, medical expert systems can be used as a scientific source by medical students. It can also help users as an auxiliary diagnostic system to diagnose and treat diseases.

30. "Threshold Neuro Fuzzy Expert System for Diagnosis of Breast Cancer" by-**Bh. Nagarajasri, M. Padmavathamma**- In this paper researcher has proposed an ARM Cortex-M3 Based Interactive **Neuro Fuzzy Expert System** for diagnosis of breast cancers proposed on an Ex-DBC System for benign and malignant digital mammographic findings. In order to assist physicians, Radiologists and others in clinical diagnosis, a wide set of breast cancer detection rules was designed using Digital Mammographic dataset are discussedin this paper

31. "U-health Expert System with Statistical Neural Network", By- **Byoung-Ho Song et all** ,- Ubiquitous Health(U-Health) system which focuses on automated applications that can provide healthcare to human anywhere and anytime using wired and wireless mobile technologies is becoming increasingly important. This system consists of a **network system** to collect data and a sensor module which measures pulse, blood pressure, diabetes, blood sugar, body fat diet with management and measurement of stress etc, by both wired and wireless and further portable mobile connections. They have proposed an expert system **using back-propagation** to support the diagnosis of citizens in U-Health system. They have implemented user interface module of U-Health System for Biometric Data sensing & Expert System for automatic Diagnosis and comprehensive diagnosis system in association with hospital DBs. The expert system using **back-propagation** to support the diagnosis. This system consists of a network system to collect data and a sensor module which measures pulse, blood pressure, diabetes, blood sugar, body fat diet with management and measurement of stress etc, by both wired and wireless connections

32. "RULE-BASED EXPERT SYSTEM FOR DISEASE DIAGNOSIS" By-**Moshood A. Hambali-** This paper addresses the various challenges that exist in the traditional method of disease diagnosis. A **rule-based**

expert system is developed to diagnose Malaria, Typhoid Fever, Cholera, Tuberculosis, and Breast Cancer. The proposed Medical Expert System (MES) contains forty six (46) rules to effectively diagnose the diseases.

33. "Reasoning Techniques for Diabetics Expert Systems", by- **Ibrahim m.ahmed et all** ,- This paper focus on the main technical characteristics of four reasoning methodologies which are commonly used in developing diabetic expert systems, namely; reasoning with production rules, fuzzy reasoning, case-based reasoning, and ontological-case based reasoning. On the basis of their study the researcher has proposes the best reasoning technique for diabetic expert systems. The main result of this study covers a variety of four reasoning methodologies, which reveals that case based reasoning paradigm is the best reasoning technique methodology regarding to the issues of maintenance ,powerful and knowledge representations .The abilities of inference, reasoning, and learning are the main features of any expert system. The research area in this field covers a variety of reasoning methodologies, e.g.; **case-based reasoning, ontology case-based reasoning, fuzzy reasoning and rule reasoning**. Case based reasoning is the more efficient, powerful and less cost. they have developed an expert system for diabetes diet that intended to be used in Sudan and Arab countries . they have implement an intelligent mobile base expert system in Arabic language interface using the case based reasoning as reasoning technique

34. "A Simulation-Based Expert System for Daylighting Design", by-**Jaime M. Lee & Marilyne Andersen-** In this paper, researcher has propose an expert system for daylighting in architecture which is used to guide a goal-oriented, user-interactive design process. This system is supported by a **knowledge-base** which has been populated using a set of previously completed simulations using the Design of Experiments methodology. The knowledge-base contains information regarding the effects of a variety of design conditions on resultant daylighting performance. Eighty different design conditions are considered, encompassing two different values of ten design variables on four facades. Daylighting effects are considered for three times of day, for three seasons, and for five zones. The use of the knowledge-base as both a stand-alone resource and as a component of the expert system is considered. Within the expert system, the knowledge-base provides customized information based on user inputs and guides an iterative process which improves daylighting performance of the user's original design .A daylighting expert system has potential to act as a virtual daylighting consultant and to guide designers towards improved designs during the schematic design phase. A preliminary study has shown to improve designs for a variety of goal complexities. The present paper proposes a more comprehensive knowledge-base with an expanded set of design variables. This knowledge-base is valuable both within the expert system framework and as a stand-alone resource. As a stand-alone, the knowledge-base can provide information for a variety of situations which can be used directly to inform a designer during the design process. Within the expert system, the knowledge-base provides the necessary intelligence to guide the user towards design decisions which will approach the user defined performance goals within specific user-defined design constraints.

35. "The Design of an Expert System for Domain Knowledge Engineering and Decision Making: A Case Study in the Criminal Justice System ", By-Owusu - Ansah Agyapong and Patrick O. Bobbie- In the paper, researcher has described the rationale(a set of reasons or a logical basis for a course of action or belief.) for developing the **DSS** system, they have focus on the criminal (juvenile) justice system, the methodology for eliciting DSS domain knowledge, and a scenario of what they are implementing as a proof of-concept system. A series of elicitation sessions which epitomize the DSS system have been discussed in the article.A DSS for eliciting information pertaining to case-handling, case-actions, and case-stages of juvenile criminality in a typical (e.g., the Florida) JJS, has been described. The menu-driven characteristic of the elicitation system, coupled with the underlying propositional calculus, facilitates and simplifies the complexity of the elicitation process. The resultant specification is viewed as a collection of associations of juvenile cases, case histories, case relations, and case -attributes. The associations, or relationships, in turn prescribe the case-actions and case-stages. A major part of the elicitation system is implemented in **PROLOG**; with the **case-elicitation interface** currently under development using Tcl/Tk tool. In this article, they have shown, by way of examples, the inference or deductive capability of the DSS in support of decision-making on case information in the DSS's knowledge-base. Such a capability is demonstrated through a proof -procedure, which is essentially a theorem-proving system. The implementation of the system currently serves as a testbed for modeling and prototyping a DSS for handling cases in a JJS.

36. "A Real Time Expert System -Adapting Match Algorithms and Implementinga Tailored Rule Language", By-**Yanik Kim Challand-** This report describes the design and the implementation of a hard **real time expert system**. It studies the possibility to use expert system in safety critical environments. The real time expert system is comprised of three elements**. A time predictable match algorithm** designed for the purpose of this project. **A rule language** that aims at making the expert system's limitations clear to the experts coding the rules. A system for **firing the actions of the rules** that are

matched by the algorithm.The system is developed for the SCJ2, a safety critical profile for Java. The tool SARTS is intended to provide analysis to the developers using the expert system. This project shows that hard real time expert system are possible, but not usable in a real development environment due to the scalability problems of the analysis tool chosen.

37. "Tools And Techniques For Knowledge-Based Expert systems For Engineering Design" by-**M.L.Maher et all ,-** This study describes The development of a KBES for Engineering design they had chosen a simple problem to illustrate various features of Expert System programming languages they had considered Three languages ,OPS5, SRL, and PROLOG ; to illustrate different representation formalisms-rules, frames, and logic commonly used in the development of expert systems and they proved that SRL **is very useful for implementing the hierarchical design process.** SRL requires the user to write the inference mechanism in LISP.

38. " Expert Systems Techniques In A Computer-Based Control System Analysis And Design Environmen", By-**J. D. Birdwell** et all ,- Researcher has explore the **fusion of expert control system analysis and design tools** into a prototype computer environment. The use of expert systems technology allows the transfer of recent developments in control system design to users who may not be experts in either theoretical developments or computer technology, in a vehicle which provides considerable design flexibility. The technology does not provide as general a framework as, for example, a command language based environment; however, in specific applications, such as system modeling and linear control systems, it is useful and appropriate.

39. "Expert System, Fuzzy Logic, and Neural Network Applications in Power Electronics and Motion Control", By- **Bimal k. Bose**,- This paper gives a brief but comprehensive review of the three branches of artificial intelligence, i.e., expert system, fuzzy logic, and neural network. The theoretical principles of each that are relevant to power electronics and motion control applications are described in a simple manner in order to make them comprehensible to the readers with power electronics background. Then, several applications .Fuzzy logic and neural network technologies are in the process of fast evolution.

40. "Design, Development and Validation of Expert Systems: A Survey of Developers", By- **Daniel E. O'LEARY** This paper has presented the results of a **survey of expert** systems developers on designing, developing and validating expert systems. This study supplements previous theoretical analysis and case studies. The prototyping development methodology is found to lead to more robust systems. However, prototyping apparently does not increase the difficulty of validating systems, probably because of the increased level of communications. Prototyping seems to take less effort than a software engineering approach.

41. "Approach to Building a Web-based Expert System Interface and Its Application for Software Provisioning in Clouds", By-**Evgeny Pyshkin & Andrey Kuznetsov-** This paper focuses on a generalized approach toproviding user interface to a web-based expert system (WBES).In order to leverage the strength of the MVC/MVP design patterns they have propose a special **ontology representing** a user communication domain. They have designed a **self-service networked infrastructure** for automatic deployment of command line interface (CLI) applications. And have demonstrated how to apply the proposed ontology for the design of a WBES aimed at supporting client software re-execution in clouds. In this paper they have examined the problem of CLIapplication provisioning in clouds. Being a web application interacting with a cloud broker in order to manage cloud resources and their configuration, the proposed infrastructure provides a **PaaS platform** to deploy CLI applications as SaaS services. In contrast to existing solutions they have proposed an architecture where a proxy component and an executor don't interact directly. Instead of invoking each other, they assert or retract facts in/from an expert system working memory.The proposed architecture addresses some of the most complex tasks of client virtual machine automatic reconfiguration,including the following:

    1. Installing operating systems on a virtual machine;
    2. Installing and configuring a build environment;
    3. Installing and configuring a required version of a runtime
    4. environment;
    5. Installing third party libraries during building;
    6. Installing third party runtime libraries;
    7. Providing access to machine learning and test data;
    8. Providing access to a storage for execution results;
    9. Providing user-side access to a client virtual machine.

    they have investigated MVC and MVP design patterns and the major difficulties of their application to implementing a user interface for a web-based expert system. And they have introducing a special ontology representation user communication concepts, with respect to the loose coupling design requirements, which, in turn, are strongly connected to improving software quality properties as reusability and changeability. With regards to the demands of scientific communities.

42. "A Methodology To Design An Expert System For Remote Sensing Technology Management. " By-

Andrew Finegan- This paper examines an alternative approach to the analysis of the complex problems associated with the management of remote sensing technology. Soft Systems Methodology is introduced as an effective and efficient way of undertaking a systems analysis of interdependent technological and human processes. A systems model based on an Australian study is presented for remote sensing technology transfer. It is demonstrated that this model provides a practical framework upon which to develop a **rules-based expert syste**m. This paper has discussed some of the difficulties associated with knowledge elicitation, and introduces Soft Systems Methodology as a theoretical framework for examining complex and poorly defined problems. The case study illustrates the application of Soft Systems Methodology to the problem of remote sensing technology management I and suggests that this approach is a sui table method for knowledge elicitation in expert system development

43. "Web-Based Expert System for Civil Service Regulations: RCSES", By-**Mofreh A. Hogo & Khaled Fouad**- The work presented in this paper tries to overcome the general lack of research in the area of web-based expert systems (WBES).The paper addressed the issues associated with the analysis, design, development , and use of web-based expert system for the regulations of the civil service system in the K.S.A "RCSES", with methodology the ontology for knowledge representation, The work considered 17 regulations for the civil service and its ability to modify or updating and the extending of the existing regulations. The "RCSES" was verified, and validated b y different technical users and the developers as well to be usable in the real world governmental departments. The developed RCSES is implemented to run on the web using ASP.net techniques as the main programming language, and a server-side technology , XML-**Rule-based knowledge** sources and the inference mechanisms are implemented using ASP.net

44. "A Proposed Methodology For Expert System Engineering", By-**Yasser Abdelhamid et all** ,-Central Laboratory for Agricultural Expert Systems-in this paper is the result of accumulated experience gained through many years of developing several expert systems in the agricultural domain by the Central Laboratory for Agricultural Expert Systems (CLAES). They have adopted a **spiral model** development methodology . they have considered two aspects: Knowledge engineering, and Software engineering. From the knowledge engineering aspect, they have adopted the Common KADS methodology, and model driven approach has been applied. From the software engineering aspect, there are four activities for expert system development: requirements specification, design, implementation, and testing.

45. "The Methodology of Expert Systems", By-**Kantureeva Mansiyaet all** ,- The article considers design methodology of expert systems, structure of the base components, studies stages of expert system's creation, provides basic data on the ways of representation of knowledge in expert systems

46. "An introduction to expert systems and Knowledge acquisition techniques", By-James R. Heatherton-This report is the by-product of information collected by the authors during research into expert system technology conducted at the Air Force Institute of Technology. That research involved methods for selecting appropriate tools (or "**knowledge acquisition techniques**") to collect information from experts. In the course of the research, the authors discovered that no single publication discussed all of the collection techniques that a knowledge engineer might want to evaluate. This brief report attempts to remedy that deficiency by consolidating into one document the primary knowledge acquisition techniques used today. For each technique, the authors have provided a short description, evaluation, and bibliography for individuals who want to evaluate a technique in greater depth. The discussion of techniques is introduced by an overview of some issues and architectures of expert system design

47. "A comparison of knowledge acquisition techniques Used in the development of expert systems" , by-**James R. & Heatherton, B.A.-** This thesis shows the **comparison between three knowledge acquisition techniques** used to gather knowledge for the development of an expert system and to determine which technique produced knowledge in a form most suitable for incorporation into an expert system. The three acquisition techniques compared were interviewing, task observation, and concept mapping. Three experts were selected and randomly paired with a technique. Knowledge acquisition sessions were then conducted with each expert using the technique assigned to that expert. The knowledge extracted from these acquisition sessions was then compared. Overall, concept mapping produced more rules, in less time, and with fewer inferences than the interview or task observation techniques. Additionally, the knowledge base acquired through the concept mapping technique was more complete. Finally, concept mapping required one less translation of the knowledge to arrive at a form necessary for programming the expert system. An expert system was developed using the concept mapping technique and was validated in a field test. Results showed that the solutions provided by the expert system matched those provided by the human experts

48. "Simulating a feed forward artificial neural Network in C++", By- **Dr. Durga toshinwal** et all ,- This report presents an overview of how a **feed forward**

artificial neural network can be implemented in C++. They have designed **An Artificial neural network system** composed of many simple processing elements operating in parallel whose function is determined by network structure, connection strengths, and the processing performed at computing elements or nodes. A neural network is a massively parallel distributed processor that has a natural inclination for storing experiential knowledge and making it available for use. This report also provides a brief overview of artificial neural networks and questions their practical applicability . as well as explanation of the design and implementation of a three - layer feed forward **neural network using back propagation algorithm.**

49. "A methodology for building expert systems", by **Howard Hill,** The work is a comparative study of a methodology, or process, that can be used to construct expert systems in this respect the Author has build a several systems, to find the superior methodology use for building expert system and compared with the methodology that is generally discussed in the literature. And the findings was that the superior methodology suited primarily for building troubleshooting, advisory, and diagnostic expert systems; and also can be useful for building other types of systems. And proved that **traditional process of knowledge engineering can be improved by applying a concept software engineers.**
50. "Hybrid Approach Combining Machine Learning and a Rule-Based Expert System for Text Categorization", By - **ulio Villena - Románet all -** This paper discusses **a novel hybrid approach** for text categorization that combines a machine learning algorithm, which provides a base model trained with a labeled corpus, with a **rule-based expert system**, which is used to improve the results provided by the previous classifier, by filtering false positives and dealing with false negatives. The main advantage is that the system can be easily fine-tuned by adding specific rules for those noisy or conflicting categories that have not been successfully trained. they also describe an implementation based on **k-Nearest Neighbor and a simple rule language to express lists of positive, negative and relevant (multiword) terms appearing in the input text**. The system is evaluated in several scenarios, including the popular Reuters-21578 news corpus for comparison to other approaches, and categorization using IPTC metadata, EUROVOC thesaurus and others.

51. "DeepVesselNet: Vessel Segmentation, Centerline Prediction, and Bifurcation Detection in 3-D Angiographic Volumes", By- **Giles Tetteh et all** ,- Authors have presented a **DeepVesselNet,** an architecture tailored to the challenges to be addressed when extracting vessel networks and corresponding features in 3-D angiography using deep learning. They also have discussed the problems of low execution speed and high memory requirements associated with full **3-D convolutional networks**, high class imbalance arising from low percentage (less than 3%) of vessel voxels, and unavailability of accurately annotated training data - and offer solutions that are the building blocks of DeepVesselNet. Firstly ,they have formulate **2-D orthogonal cross-hair filters which make use of 3-D context information**. Second, they introduce a class balancing cross-entropy score with false positive rate correction to handle the high class imbalance and high false positive rate problems associated with existing loss functions. Finally, they have generate synthetic dataset using a computational angiogenesis model, capable of generating vascular networks under physiological constraints on local network structure and topology, and use these data for transfer learning. DeepVesselNet is optimized for segmenting vessels, predicting centerlines, and localizing bifurcations. They have tested the performance on a range of angiographic volumes including clinical Time-of-Flight MRA data of the human brain, as well as synchrotron radiation X-ray tomographic microscopy scans of the rat brain. Their experiments show that, by replacing 3-D filters with 2-D orthogonal cross-hair filters inetwork, speed is improved by 23% while accuracy is maintained. They have proved class balancing metric is crucial for training the network and pre-training with synthetic data and helps in early convergence of the training process

52. “Retinal Vessel Segmentation Using Deep Neural Networks” , By- **Martina Melinscak** et all ,- They have presented an approach using **deep maxpooling convolutional neural networks with GPU implementation** to segment blood vessels and results show that it is promising method. their method yields the highest reported AUC for the DRIVE database.

53. "Retinal Vessels Segmentation Techniques and Algorithms: A Survey" By- **Jasem Almotiri et all** ,- Retinal vessels identification and localization aim to separate the different retinal vasculature structure tissues, either wide or narrow ones, from the fundus image background and other retinal anatomical structures such as optic disc, macula, and abnormal lesions. Retinal vessels identification studies are attracting more and more attention in recent years due to non-invasive fundus imaging and the crucial information contained in vasculature structure which is helpful for the detection and diagnosis of a variety of retinal pathologies included but not limited to: Diabetic Retinopathy (DR), glaucoma, hypertension, and Age-related Macular Degeneration (AMD). With the development of almost two decades, the innovative approaches applying computer-aided techniques for segmenting retinal vessels are becoming more and more crucial and coming closer to routine clinical

applications. The purpose of this paper is to provide a comprehensive overview for retinal vessels segmentation techniques. Firstly, a brief introduction to retinal fundus photography and imaging modalities of retinal images is given. Then, the preprocessing operations and the state of the art methods of retinal vessels identification are introduced. Moreover, the evaluation and validation of the results of retinal vessels segmentation are discussed. Finally, an objective assessment is presented and future developments and trends are addressed for retinal vessels identification techniques.

54. “MRI white matter lesion segmentation using anensemble of neural networks and over completepatch-based voting”, by-**José Manjón et all-** Accurate quantification of white matter hyperintensities (WMH) from Magnetic Resonance Imaging (MRI) is a valuable tool for the analysis of normal brain ageing or neurodegeneration. Reliable automatic extraction of WMH lesions is challenging due to their heterogeneous spatial occurrence, their small size and their diffuse nature. In this paper, they have presented an automatic method to segment these lesions based on an ensemble of overcomplete patch-based neural networks. The proposed method successfully provides accurate and regular segmentations due to its overcomplete nature while minimizing the segmentation error by using a boosted ensemble of neural networks. In this paper, authors have presented an **automatic method to segment** these lesions based on an ensemble of overcomplete patch-based neural networks. The proposed method successfully provides accurate and regular segmentations due to its **overcomplete** nature while minimizing the segmentation error by using a boosted ensemble of neural networks. The proposed method compared favourably with many state-of-the-art methods in two different MRI datasets and can be a good choice to perform large-scale brain analysis studies

55. “Environmental Impact Assessment for Iron Ore Mines – An Expert System”, by- **E. Kumar**- An attempt has been made to generalize the issues in effective Environmental Impact Assessment (EIA) with a special attention to iron ore mines. It is of high priority to address the potential environmental impact issues that may arise due to proposed mining activities i.e. an assessment of the potential impacts of a project on the existing environment. India produces approximately 200 MT iron ore per year which is the principal raw material in construction industry and allied industries. No doubt that the demand for such deposit is quite high both for domestic and export market. In reality the rate of environmental impacts is also equally high. Many of iron ore mines have been abandoned due to environmental degradation and hazards in mining areas which causes a major concern. The technical reasons attributed for such abandonment being lack of application of proper environmental management skills and effective environmental impact assessment. Environmental engineers have to come out with modifications in EIA for iron ore mines in order to accelerate the productivity with an eco-friendly approach.

56. ”Designing an Expert System for Differential Diagnosis of B-Thalassemia Minor and Iron-Deficiency Anemia Using Neural Network” by- **Rahil Hosseini Eshpala, et all ,-** It is a developmental study with a cross-sectional-descriptive design. The statistical population included CBC results of 395 individuals visiting for premarital tests from 21 March to 21 June, 2013. For development of the neural network, MATLAB 2011 was used. Different training algorithms were compared after error propagation in the neural network. Finally, the best network structure (concerning diagnostic sensitivity, specificity, and accuracy) was selected, using the confusion matrix and the receiver operating characteristic (ROC). The proposed system was based on a **multi-layer perceptron algorithm** with 4 inputs, 100 neurons, and 1 hidden layer. It was used as the most powerful differential diagnosis instrument with specificity, sensitivity and accuracy of 92%, 94%, and 93.9%, respectively.

57. "Prototype Development of MODELER: A Knowledge Based System for Identification of Iron Ore Deposit Types", By- **Indranil Roy And B. C. Sarkar-** Geological knowledge of associations between field evidence and deposit types for a range of iron ore deposits have been consolidated and structured into a rule-based prototype system, MODELER that is able to assist exploration geologist for diagnosing iron ore deposit types. The system contains knowledge on eighteen deposit models represented by eighteen compound rules based on the concepts of type area and genetic type. This paper focuses on the design and development of the system and its application to five iron ore deposits from eastern India,The approach to iron ore deposit type identification using the MODELER system provides a quick and pragmatic means for rapid diagnosis of a deposit type. The prototype system possesses an open architecture for further modification and updating of the knowledge base and reasoning strategy. Further enrichment of the knowledge base can be achieved by incorporating sub-classes of the Sokolov and Grigor’ev (1977) classification after accumulation and aggregation of information from the studied deposits. The open architecture of the system enables it to incorporate other mineral deposit types also

58. "Development of a knowledge base for diagnostic reasoning in cardiology", By- **William J. Long**, This paper reports on a formative evaluation of the diagnostic capabilities of the Heart Failure Program, which uses a probability network and a heuristic hypothesis generator. Using 242 cardiac cases

collected from discharge summaries at a tertiary care hospital, they have compared the diagnoses of the program to diagnoses collected from cardiologists using the same information as was available to the program. With some adjustments to the knowledge base, the Heart Failure Program produces appropriate diagnoses about 90% of the time on this training set. The main reasons for the inappropriate diagnoses of the remaining 10% include inadequate reasoning with temporal relations between cause and effect, severity relations, and independence of acute and chronic diseases

59. “A web-based system for neural network based classification in temporomandibular joint osteoarthritis”- The findings of this study demonstrate a comprehensive phenotypic characterization of TMJ health and disease at clinical, imaging and biological levels, using novel flexible and versatile open-source tools for a web-based system that provides advanced shape statistical analysis and a neural network based classification of temporomandibular joint osteoarthritis.The technological methodologies in this study include a deep neural network classifier of 3D condylar morphology (ShapeVariationAnalyzer, SVA), and a flexible web-based system for data storage, computation and integration (DSCI) of high dimensional imaging, clinical, and biological data.

60. “Heterotropia Diagnosis with Smartphone using Computer Vision and Machine Learning”, By- **Harsh Gupta** -In this paper, a deviation-based algorithm is proposed which exploits the power of TensorFlow, OpenCV, and machine learning to diagnose four forms of heterotropia -esotropia, exotropia, hypertropia and hypotropia. The mechanism developed for lateral, vertical, and angular deviation has been tested for KNN, SVM, and a trained neural network, based on 6 features. Finally, the accuracy, specificity, and sensitivity of the 2 MLC and convolutional neural network (CNN) was tested in a study of 337 users with and without heterotropia. Eyeris, an Android based application, has been developed as a proof of concept for this paper. The results yielded highest accuracy for SVM-based classification

61. "A Neural-Fuzzy SOM Based Approach On Brain Tumor Detection From MRI Images", By- **Nikita Sarawat & Neeraj Kumar-** In this paper, presents an effective strategy for brain tumor characterization, where, the brain tumor pictures are arranged into typical normal, non-dangerous (Benign) brain tumor and destructive (Malignant) brain tumor. This paper introduces an efficient method approached of brain tumor classification and segmentation, where, the brain tumor images are generally classified into a normal or non-cancerous (benign) brain tumor detection and cancerous (malignant) brain tumor detection. The proposed method fol lows three steps, (1) pre-processing for Gaussian filter, (2) textural feature extraction for glcm and (3) SOM classification. Gaussian filter is first utilized utilizing for evacuate commotion the brain picture into various levels of rough and itemized coefficients and after that the dim level co-event matrix is framed, from which the surface measurements, for example, vitality, differentiate, relationship, homogeneity and entropy are achieved. The results of co-occurrence matrices are then fed into a SOM (self-organizing map) for further classification and tumor detection with fuzzy partition matrix clustering and segmentation.

62. "CardioSmart365: Artificial Intelligence in the Service of Cardiologic Patients", By- **Efrosini Sourla, et all** ,- This is an open access article distributed under the Creative Commons Attribution License, which permits unrestricted use, distribution, and reproduction in any medium, provided the original work is properly cited. Artificial intelligence has significantly contributed in the evolution of medical informatics and biomedicine, providing a variety of tools available to be exploited, from rule-based expert systems and fuzzy logic to neural networks and genetic algorithms. Moreover, familiarizing people with smartphones and the constantly growing use of medical-related mobile applications enables complete and systematic monitoring of a series of chronic diseases both by health professionals and patients. In this work, they have proposed an integrated system for monitoring and early notification for patients suffering from heart diseases. CardioSmart365 consists of web applications, smartphone native applications, decision support systems, and web services that allow interactionand communication among end users: cardiologists, patients, and general doctors. The key features of the proposed solution are (a) recording and management of patients’ measurements of vital signs performed at home on regular basis (blood pressure, blood glucose, oxygen saturation, weight, and height), (b) management of patients’ EMRs, (c) cardiologic patient modules for the most common heart diseases, (d) decision support systems based on fuzzy logic, (e) integrated message management module for optimal communication between end users and instant notifications, and (f) interconnection to Microsoft Health Vault platform.CardioSmart365 contributes to the effort for optimal patient monitoring at home and early response in cases of emergency.

63. "Application of Artificial Neural Networks in the Heart Electrical Axis Position Conclusion Modeling", by**- L N Bakanovskaya** - The article touches upon building of a heart electrical axis position conclusion model using an artificial neural network. The input signals of the neural network are the values of deflections Q, R and S; and the output signal is the value of the heart electrical axis position. Training of the network is carried out by the error propagation method. The test results allow concluding that the created neural network makes a conclusion with a high degree of accuracy.

64. "Project of an Expert System Supporting Risk Stratification and Therapeutic Decision Making in Acute Coronary Syndromes", **By-Marcin Grabowski, et all.** The aim of the project was to create a computer program - expert system, which will support a doctor when a management for patients with acute coronary syndrome needs to be chosen. The expert system consists of four modules: knowledge base, previous cases database, inference engine and explanation module. Knowledge base was created with support of clinical experts, based on current management standards, guidelines and results of clinical trials according to evidence-based medicine rules. Data from new patient are added to the case database. Inference engine integrates two types of reasoning rule-based and case-based reasoning. Computer expert system gives unambiguous and objective answer. Recommendation given by an expert system can be reliable. At present the system is tested in clinical practice. Strategies recommended by the system are compared to the management applied in patients treated in Cardiology Clinic.

65. "Mobile Application for Health Prediction Using Data Mining and T racking Data for Health Monitoring", By-**Robin Humn**, It might have happened such a lot of times that you simply or somebody yours want doctors to facilitate forthwith, however they're not on the market thanks to some reason. The Health Prediction system is associate user support and on-line consultation project with mobile Application. Here I propose a system that enables users to urge instant steerage on their health problems through associate intelligent health care system. The system is fed with numerous symptoms and also the disease/illness related to those systems. The system permits the user to share their symptoms and problems. It then processes user's symptoms to envision for numerous sicknesses that might be related to it. Here they tend to use some intelligent data processing techniques to guess the foremost correct ill health that might be related to patient's symptoms. In doctor module once doctor login to the system doctor will read his patient details and also the report of that patient. The doctor will read details regarding the patient search what patient sought for per their prediction. The doctor will read his personal details. Admin will add new sickness details by specifying the sort and symptoms of the sickness into the info. supported the name of the sickness and symptom the information mining rule works. Admin will read numerous sickness and symptoms hold on in info
66. "SURVEY PAPER ON BRAIN TUMOR SEGMENTATION TECHNIQUES", by- **Spoorthi Rakesh, et all-**Image processing is used widely in solving a variety of problems. The important and complex phase of image processing is image segmentation. This paper provides a brief description on some of the segmentation algorithms specifically on brain tumor MR Images. Later in this paper, simple comparisons are made between the listed algorithms. This work helps in understanding some of the existing brain MR Image segmentation algorithms better

67. "A Rule Based System to Identify Negative Sentences from Text Documents", by- **Amarjeet Kaur & M. Sasikumar,** Segmentation is one of the most important processes in Digital Image Processing. Segmentation means divide or partition an image into multiple parts. Image **segmentation** is used to segment the parts of the image for processing. The glaucoma disease directly affects the optic nerve, and it becomes blindness. Blindness is an increasing disease of all over the world. If this eye diseases were detected earlier mean the blindness can be avoided at the earliest stage. Blood vessel segmentation can perform an important role in the diagnosis and treatment of different cardiovascular and ophthalmologist diseases. The main aim of this work is detection of glaucoma. In this research work, the segmentation of blood vessels and detection of glaucoma is done by using Black and White Area (BWAREA) method. The experimental results are evaluated such as accuracy, sensitivity and specificity.

68. "Segmentation of Blood Vessel in Retinal Images and Detection of Glaucoma using BWAREA and SVM" **by-P. Dhivyabharathi**- Segmentation is one of the most important processes in Digital Image Processing. Segmentation means divide or partition an image into multiple parts. Image **segmentation** is used to segment the parts of the image for processing. The glaucoma disease directly affects the optic nerve, and it becomes blindness. Blindness is an increasing disease of all over the world. If this eye diseases were detected earlier mean the blindness can be avoided at the earliest stage. Blood vessel segmentation can perform an important role in the diagnosis and treatment of different cardiovascular and ophthalmologist diseases. The main aim of this work is detection of glaucoma. In this research work, the segmentation of blood vessels and detection of glaucoma is done by using Black and White Area (BWAREA) method. The experimental results are evaluated such as accuracy, sensitivity and specificity.

69. "Heterotropia Diagnosis with Smartphone using Computer Vision and Machine Learning", By-Harsh Gupta, In this paper, a **deviation-based algorithm** is proposed which exploits the power of TensorFlow, OpenCV, and machine learning to diagnose four forms of heterotropia -esotropia, exotropia, hypertropia and hypotropia. The mechanism developed for lateral, vertical, and angular deviation has been tested for KNN, SVM, and a trained neural network, based on 6 features. Finally, the accuracy, specificity, and sensitivity of the 2 MLC and convolutional neural network (CNN) was tested in a study of 337 users with and without heterotropia. Eyeris, an Android based application,

has been developed as a proof of concept for this paper. The results yielded highest accuracy for SVM-based classification Index Terms—heterotropia, machine learning, neural networks, computer vision

70. "Prediction of Coronary Heart Disease Using Risk Factor Categories", **By-Peter W.F. Wilson**- This work was designed as a prospective, single-center study in the setting of a community-based cohort. The patients were 2489 men and 2856 women 30 to 74 years old at baseline with 12 years of follow-up. During the 12 years of follow-up, a total of 383 men and 227 women developed CHD, which was significantly associated with categories of blood pressure, total cholesterol, LDL cholesterol, and HDL cholesterol (all P,.001). Sex-specific prediction equations were formulated to predict CHD risk according to age, diabetes, smoking, JNC-V blood pressure categories, and NCEP total cholesterol and LDL cholesterol categories. The accuracy of this categorical approach was found to be comparable to CHD prediction when the continuous variables themselves were used. After adjustment forother factors,'28% of CHD events in men and 29% in women were attributable to blood pressure levels that exceeded high normal ($130/85). The corresponding multivariable-adjusted attributable risk percent associated with elevated total cholesterol ($200 mg/dL) was 27% in men and 34% in women.Recommended guidelines of blood pressure, total cholesterol, and LDL cholesterol effectively predict CHD risk in a middle-aged white population sample. A simple coronary disease prediction algorithm was developed using categorical variables, which allows physicians to predict multivariate CHD risk in patients without overt CHD. (Circulation. 1998;97:1837-1847.)

5. Books Review

1) Artificial Intelligence A Modern Approach By Stuart J. Russell and Peter Norvig
2) Development of a Knowledge Base for Diagnostic Reasoning in Cardiology By William J. Long, MIT Lab oratoryfor Computer Science, Cambridge, MA, USA ShapurNaimi andM. G. CriscitielloNew EnglandMedical Center Hospital, Boston, MA, USA April 13,1994
3) A Practical Introduction to Rule Based Expert SystemsBy M Sasikumar ,S Ramani, S Muthu Raman, KSR Anjaneyulu ,R Chandrasekar
4) Computing in Cardiology 2010, Belfast, UK September 26- 29, 2010 Belfast, UK
5) Knowledge –Based System in BANKING SECTOR By Dr. R.V Kulkarni & B.L. Desai
6) Rule-based expert systems By Bruce G. Buchanan, Edward Hance Shortliffe
7) Expert systems programming: practical techniques for rule-based systems By Ken Pedersen
8) Verification and Validation of Rule-Based Expert Systems By Suzanne Smith, Abraham Kandel
9) Programming expert systems in OPS5: an introduction to rule-based programming By Lee Brownston
10) Intelligent Systems: A Modern Approach By Crina Grosan, Ajith Abraham

6. Literature Review Summary

The researcher has taken extensive review of Literature on the topic selected.

Following is the summary of the revive taken :

Sr. No	Books	Journal	PhD Theses	Other Research Work
1	10	56	6	8

7. Research Gaps

Researcher has found considerable study in this area but a special study is not done specifically related to Diagnosis of Selected Cardiac Diseases therefore the researcher intends to design and develop an Expert System for Diagnosis of Selected Cardiac Diseases.

8. Conclusion

Expert systems have shown many advantages such as utilization of experts' knowledge, gaining rare knowledge, more time for assessment of the decision, more consistent decisions, and shorter decision-making process. In spite of all these advantages, there are challenges ahead of developing and using such systems including maintenance, required experts, inputting patients' data into the system, problems for knowledge acquisition, problems in modeling medical knowledge, evaluation and validation of system performance, wrong recommendations and responsibility, limited domains of such systems and necessity of integrating such systems into the routine work flows. We concluded that expert systems can be successfully used in medicine; however, there are many concerns and questions to be answered through future studies and discussions.

References

1. **Roger H. A. M. Meijers, et all** ,"**Clinical Evaluation of an Automatic Blood Pressure Controller During Cardiac Surger " (**Journal of Clinical Monitoring and Computing**),** July 1997, Volume 13, Issue 4, pp 261–268 .
2. Tomasz HRAPKOWICZ, et all ,**"Decision making process in cardiac surgery – concept of building an expert system"** (Management Systems in Production Engineering) ,Number 1(9)/2013/05 , ISSN: P- 2299-0461, E- 2450-5781.
3. Efrosini Sourla Vasileios Syrimpeis et all," **Exploiting Fuzzy Expert Systems in Cardiology**" (International Engineering Applications of Neural Networks Communications in Computer and Information Science) , vol 384. Springer,

Berlin, Heidelberg, 2013, ISSN: P -978-3-642-41015-4, E-978-3-642-41016-1.

4. **Vasileios Syrimpeis**, et all "**Exploiting expert systems in cardiology: a comparative study**" (Advances in Experimental Medicine and Biology), vol 820. Springer, Cham,2014, ISSN: P-3-319-09011-5, E-978-3-319-09012-2.
5. **Kenneth M**., et all "**Diagnosis and explanation by a nuclear cardiology expert system**"(International Journal of Expert Systems), pp 499-506 , volume 9,number 4, 22 May 2014 ISSN 0894-9077.
6. **E. Kail**., et all "**Expert system for phonocardiographic monitoring of heart failure patients based onwavelet analysis**" (Computers in Cardiology), Pages: 833 - 836,06 February 2006 ISBN: 0-7803-9337-6
7. Abdel-Badeeh M. Salem and Rania A."**A Hybrid Expert System Supporting Diagnosis Of Heart Diseases**" (International Federation for Information Processing) ,Springer, Boston, MA, 2002, ISBN P- 978-1-4757-1031-1 ,E- 978-0-387-35602-0
8. Muzhir Shaban Al-Ani and Atiaf Ayal Rawi "**A Rule-Based Expert System For Automated ECG Diagnosis**" (International Journal of Advances in Engineering & Technology), Vol. 6, Issue 4, pp. 1480-1493,September 2013,ISSN: 22311963
9. **Malay Mitra and R. K. Samanta**-"Cardiac Arrhythmia Classification Using Neural Networks with Selected Features", (Journal of the American College of Cardiology),Volume 25, Issue 2, Supplement 1, Pages 237A-238A,February 1995,
10. L N Bakanovskaya Tyumen State Oil and Gas University, Russia -"**Application of Artificial Neural Networks in the Heart Electrical Axis Position Conclusion Modeling**", VII International Scientific Practical Conference "Innovative Technologies in Engineering" doi:10.1088/1757-899X/142/1/012100, 2016
11. T.F. Yang B. Devine & P.W. Macfarlane "**Use of Artificial Neural Networks within Deterministic Logic for Computer ECG Diagnosis of Myocardial Infarction**" , (Journal of the American College of Cardiology), Volume 25, Issue 2, Supplement 1, Pages 237A-238A, February 1995, https://doi.org/10.1016/j.protcy.2013.12.339.
12. S. Zahan-"**Fuzzy expert system for cardiovascular disease diagnosis-tests and performance evaluation**", Proceedings of the 5th Seminar on Neural Network Applications in Electrical Engineering. (IEEE Cat. No.00EX287)DOI: 10.1109/NEUREL.2000.902386, 06 August 2002,ISBN: 0-7803-5512-1.
13. R.A. Soltan , et all "**Diagnosis of Some Diseases in Medicine via computerized Experts System**", (International Journal of Computer Science & Information Technology) Vol 5, No 5, October 2013,DOI : 10.5121/ijcsit.2013.5505.
14. Ali M. S , et all "**Generic Medical Fuzzy Expert System for Diagnosis of Cardiac Diseases**", (International Journal of Computer Applications), Volume 66– No.13, March 2013 0975 – 8887.
15. Umer Rashid, "**ANN based Expert System to Predict Disease in Cardiac Patients at Initial Stages**", (International Journal of E-Health and Medical Communications), 6(2), 1-9, April-June 2015, DOI: 10.4018/IJEHMC.2015040101
16. Juan Carlos Guzman, et all –"**Design of an Optimized Fuzzy Classifier for the Diagnosis of Blood Pressure with a New Computational Method for Expert Rule Optimization**", www.mdpi.com/journal/Algorithms, 10, 79; 14 July 2017, doi:10.3390/a10030079
17. Manisha Barman "**A Fuzzy Rule Base System for the Diagnosis of Heart Disease**", International Journal of Computer Applications, Volume 57– No.7, November 2012, (0975 – 8887)
18. Rupinder Kaur & Amrit Kaur "**Hypertension Diagnosis Using Fuzzy Expert System**", (International Journal of Engineering Research and Applications), National Conference on Advances in Engineering and Technology - 29th March 2014), ISSN: 2248-9622 .
19. Nur Farahiyah Mohammad et all "**Design and Development of Fuzzy Expert System for Diagnosis of Hypertension**", Second International Conference on Intelligent Systems, Modelling and Simulation 978-0-7695-4336-9/11 $26.00 © 2011 IEEE,DOI 10.1109/ISMS.2011.27 .
20. Arpneek Kaur & Abhishek Bhardwaj-"**Artificial Intelligence in Hypertension Diagnosis: A Review**", (International Journal of Computer Science and Information Technologies), Vol. 5 (2) , 2014, page No-2633-2635,ISSN: 0975-9646.
21. Ibrahim Turkoglu et all - Ibrahim Turkoglu et all - "**An expert system for diagnosis of the heart valve diseases**",(Expert Systems with Applications)Volume 23, Issue 3, Pages 229-2361 October 2002, doi.org/10.1016/S0957-4174(02)00042-8.
22. Zeinab Abrishami & Hamid Tabatabaee, "Design **of A Fuzzy Expert System And A Multi-Layer Neural Network System For Diagnosis Of Hypertension**" , Bulletin of Environment, Pharmacology and Life Sciences, India, Vol 4 [11] October 2015: 138-145, ISSN 2277-1808.
23. Resul Das et all ,"**Diagnosis of valvular heart disease through neuralnetworks ensembles**", computer methods and programs in biomedicine 93 (2009)185–191Elsevier Ireland Ltd. doi:10.1016/j.cmpb.2008.09.005.
24. Syed Khursheed ul Hasnain et all -"**Artificial Neural Networks in Cardiology - ECG Wave Analysis and Diagnosis Using Backpropagation Neural Networks**", National University of Sciences & Technology, Pakistan.
25. Suresh Nagar & Arvind Kumar Jain-"**Expert System for Diagnosis of Heart Disease: A Review**", (International Journal of Computer Sciences and Engineering) , Volume-4, Issue-8 ,31/Aug/2016 E-ISSN: 2347-2693.
26. Dr. S. Govinda Rao, " **Expert System for Heart Problems**", (International Journal of Computer Science Engineering and Technology), Vol 4, Issue10, pages: 266-271,October 2014 ,ISSN: 2231-0711.
27. Ali.Adeli & Mehdi .Neshat" **A Fuzzy Expert System for Heart Disease Diagnosis**", (Proceedings of the International Multi Conference of Engineers and Computer Scientists,Hong Kong) Vol I, PAGES: 17 - 19,2010, March ISBN: 978-988-17012-8-2.
28. Riccardo Poli "**A Neural Network Expert System for Diagnosing and Treating Hypertension**", IEEE-March 1991University of Florence, Dept. of Electronic Engineer.
29. Fatemeh Mohammadi Amiri & Ameneh Khadivar,"**A FUZZY EXPERT SYSTEM FOR DIAGNOSIS AND TREATMENT OF MUSCULOSKELETAL DISORDERS IN WRIST**", Tehnički vjesnik 24, Suppl. 1(2017), PAGES:147-155,DOI: 10.17559/TV-20150531034750, ISSN-P: 1330-3651, E: ISSN 1848-6339.
30. Bh. Nagarajasri, M. Padmavathamma "**Threshold Neuro Fuzzy Expert System for Diagnosis of Breast Cancer**" (International Journal of Computer Applications),Volume 66– No.8, March 2013, (0975 – 8887).
31. Byoung-Ho Song et all "**U-health Expert System with Statistical Neural Network**",- Fourth International Conference on Computer Sciences and Convergence Information Technology,978-0-7695-3896-9/09 $26.00 © 2009 IEEE,DOI 10.1109/ICCIT.2009.122.
32. Moshood A. Hambali "**RULE-BASED EXPERT SYSTEM FOR DISEASE DIAGNOSIS**" Proceedings of the International Conference on Science, Technology,

Education, Arts, Management and Social Sciences (iSTEAMS Research Nexus).March 2015.
33. Ibrahim m.ahmed et all ,-"**Reasoning Techniques for Diabetics Expert Systems**", (Computer science department, faculty of computer and information sciences,ain shams university, cairo, egypt) Published by Elsevier B.V.Procedia Computer Science 65 (2015) 813 – 820
34. Jaime M. Lee & Marilyne Andersen"**A Simulation-Based Expert System for Daylighting Design**", - Massachusetts Institute of Technology, Building Technology Program, Department of Architecture, Cambridge.
35. Owusu -Ansah Agyapong and Patrick O. Bobbie"The Design of an Expert System for Domain Knowledge Engineering and Decision Making:A Case Study in the Criminal Justice System ", Florida A & M University,Tallahassee, Florida 32307, U.S.A.
36. Yanik Kim Challand -"**A Real Time Expert System - Adapting Match Algorithms and Implementinga Tailored Rule Language**", Department of Computer Science,Aalborg University Adapting Match Algorithms and Implementing a Tailored Rule Language, 2011
37. M.L.Maher et all ,-"**Tools And Techniques For Knowledge-Based Expert systems For Engineering Design**", Department ofCivil Engineering, Carnegie-Mellon ,University, Pittsburgh,PA15213,U.S.A.,December,1984.
38. J. D. Birdwell et all ,- "**Expert Systems Techniques In A Computer-Based Control System Analysis And Design Environmen**", Laboratory of information and decision system , Massachusetts Institute of technology ,Cambridge ,USA Copyright © IFAC Computer Aided Design in Control and Engineering Systems. Lyngby. Denmark, 1985.
39. By- Bimal k. Bose-"**Expert System, Fuzzy Logic, and Neural Network Applications in Power Electronics and Motion Control**", fellow,IEEE, PROCEEDINGS OF THE IEEE. VOL. 82, NO. 8, AUGUST 1994, 0018-9219/94$04.00 0 1994 IEEE
40. Daniel E. O'LEARY "**Design, Development and Validation of Expert Systems: A Survey of Developers".**
41. Evgeny Pyshkin & Andrey Kuznetsov "**Approach to Building a Web-based Expert System Interface and Its Application for Software Provisioning in Clouds**", Proceedings of the Federated Conference onComputer Science and Information Systems ACSIS, Vol. 5,pp. 343–354, 978-83-60810-66-8/$25.00 c 2015, IEEEDOI: 10.15439/2015F142.
42. Andrew Finegan "**A METHODOLOGY TO DESIGN AN EXPERT SYSTEM FOR REMOTE SENSING TECHNOLOGY MANAGEMENT**. " ,Centre for Remote Sensing ,Dept. of Land Information ,GPO Box 2476V ,Melbourne 3001 Australia.
43. Mofreh A. Hogo & Khaled Fouad "**Web-Based Expert System for Civil Service Regulations: RCSES**", Intentional Journal of Computer Science and Information Security , Vol. 6, No. 3, 2009http://sites.google.com/site/ijcsis/ ISSN 1947-5500.
44. Yasser Abdelhamid et all ,"**A Proposed Methodology For Expert System Engineering**", -Central Laboratory for Agricultural Expert Systems
45. By-Kantureeva Mansiyaet all ,- "**The Methodology of Expert Systems", International Journal of Computer Science and Network Security**, VOL.14 No.2, February 2014
46. James R. Heatherton, " **A comparison of knowledge acquisition techniquesUsed in the development of expert systems**", Captain, USAFTodd T. Vikan, Captain, USA F September 1990,U-AFIT/LS/TR-90-1 Air Force Institute Of Technology
47. **James R. & Heatherton, B.A.-** "A comparison of knowledge acquisition techniques Used in the development of expert systems" -, USAF, September 1990
48. [48] Dr. Durga toshinwal et all ,-"**Simulating a feed forward artificial neural Network in C++**", Electronics and computer engineering departmentIndian institute of technology roorkee- 247667,October 2012
49. by HOWARD HILL "**A methodology for building expert systems**", Knowledge Based Systems, Inc. Book Series ISSN 0975 – 9786 Volume 1 Advanced Knowledge Based Systems: Models, Applications and Research, e-ISBN 978-81-908426-0-0.
50. Julio Villena-Románet all ,-"**Hybrid Approach Combining Machine Learning and a Rule-Based Expert System for Text Categorization**", Proceedings of the Twenty-Fourth International Florida Artificial, Intelligence Research Society Conference, Copyright © 2011, Association for the Advancement of Artificial Intelligence(www.aaai.org).
51. Giles Tetteh et all ," DeepVesselNet: Vessel Segmentation, Centerline Prediction, and Bifurcation Detection in 3-D Angiographic Volumes", -Medical Image AnalysisarXiv:1803.09340v1 [cs.CV], March 28, 2018
52. Martina Melinscak et all ,-"**Retinal Vessel Segmentation Using Deep Neural Networks**", Pavle Prentasic and Sven Loncaric - Karlovac University of Applied Sciences, The University of Zagreb, Unska.
53. Jasem Almotiriet et all -"**Retinal Vessels Segmentation Techniques and Algorithms: A Surve**y" Computer Science and Engineering Department, University of Bridgeport, 126 Park Ave, Bridgeport, CT 06604, USA;
54. José Manjón et all "**MRI white matter lesion segmentation using anensemble of neural networks and over completepatch-based voting**", Computerized Medical Imaging and Graphics, Elsevier, In press, 10.1016/j.compmedimag.2018.05.001,.hal-01808412, Submitted on 5 Jun 2018.
55. E. Kumar- "**Environmental Impact Assessment for Iron Ore Mines – An Expert System**" IJLTEMAS,Volume III, Issue VI, June 2014, ISSN 2278 – 2540.
56. Rahil Hosseini Eshpala, et all "**Designing an Expert System for Differential Diagnosis of B-Thalassemia Minor and Iron-Deficiency Anemia Using Neural Network"**,-Hormozgan Medical Journal, Vol 20, No.1, Apr-May 2016.
57. Indranil Roy And B. C. Sarkar -"**Prototype Development of MODELER: A Knowledge Based System for Identification of Iron Ore Deposit Types**" JOURNAL GEOLOGICAL SOCIETY OF INDIA, Vol.61, Feb. 2003, pp.177-184
58. William J. Long, "**Development of a knowledge base for diagnostic reasoning in cardiology**", Computers and biomedical research, an international journal, April 13,1994 ISBN-P: 0010-4809, E:1090-2368
59. "**A web-based system for neural network based classification in temporomandibular joint osteoarthritis**"-Computerized Medical Imaging and Graphics,Volume 67, July 2018, Pages 45-54
60. Harsh Gupta - "**Heterotropia Diagnosis with Smartphone using Computer V ision and Machine Learning**" International Journal of Advanced Research in Computer Engineering & Technology ,Volume 7, ,Issue 8, August 2018 ISSN: 2278 – 1323
61. Nikita Sarawat & Neeraj Kumar- **"A Neural-Fuzzy SOM Based Approach On Brain Tumor Detection From MRI Images"**, (International Journal of Advanced Research in Computer and Communication Engineering),Vol. 7, Issue 6, June 2018,ISSN: E-2278-1021,P- 2319 5940.
62. Efrosini Sourla, et all ,- **"CardioSmart365: Artificial Intelligence in the Service of Cardiologic Patients**", Hindawi Publishing Corporation, Research Article, Advances

in Artificial Intelligence, Volume 2012, Article ID 585072,12 pages, 11 September 2012, doi:10.1155/2012/585072.

63. L N Bakanovskaya -"**Application of Artificial Neural Networks in the Heart Electrical Axis Position Conclusion Modeling"**, VII International Scientific Practical Conference "Innovative Technologies in Engineering" IOP Publishing, IOP Conf. Series: Materials Science and Engineering142(2016) 012100 doi:10.1088/1757-899X/142/1/012100.
64. Marcin Grabowski, et all ,"**Project of an Expert System Supporting Risk Stratification and Therapeutic Decision Making in Acute Coronary Syndromes"**, x- Department of Experimental and Clinical Pharmacology, Medical University, Warszawa, Conference on telemedicine PL ISSN 1233-9687.
65. Robin Humn,"**Mobile Application for Health Prediction Using Data Mining and T racking Data for Health Monitoring**",International Journal of Advanced Research in Computer Engineering & Technology, Volume 6, Issue 4, April 2017, ISSN: 2278 – 1323.
66. Spoorthi Rakesh, et all, "**SURVEY PAPER ON BRAIN TUMOR SEGMENTATION TECHNIQUES**", International Journal of Advanced Research in Computer Engineering & Technology, Volume 6, Issue 4, April 2017, ISSN: 2278 – 1323.
67. Amarjeet Kaur & M. Sasikumar, "A **Rule Based System to Identify Negative Sentences from Text Documents**",International Journal of Advanced Research in Computer Engineering & Technology ,Volume 7, Issue 1, January 2018, ISSN: 2278 – 1323.
68. P. Dhivyabharathi, "**Segmentation of Blood Vessel in Retinal Images and Detection of Glaucoma using BWAREA and SVM**", International Journal of Advanced Research in Computer Engineering & Technology (IJARCET),Volume 7, Issue 1, January 2018, ISSN: 2278 – 1323.
69. Harsh Gupta**"Heterotropia Diagnosis with Smartphone using Computer Vision and Machine Learning**", By-Harsh Gupta, International Journal of Advanced Research in Computer Engineering & Technology ,Volume 7, Issue 8, August 2018, ISSN: 2278 – 1323.
70. Peter W.F. Wilson, "**Prediction of Coronary Heart Disease Using Risk Factor Categories**"

