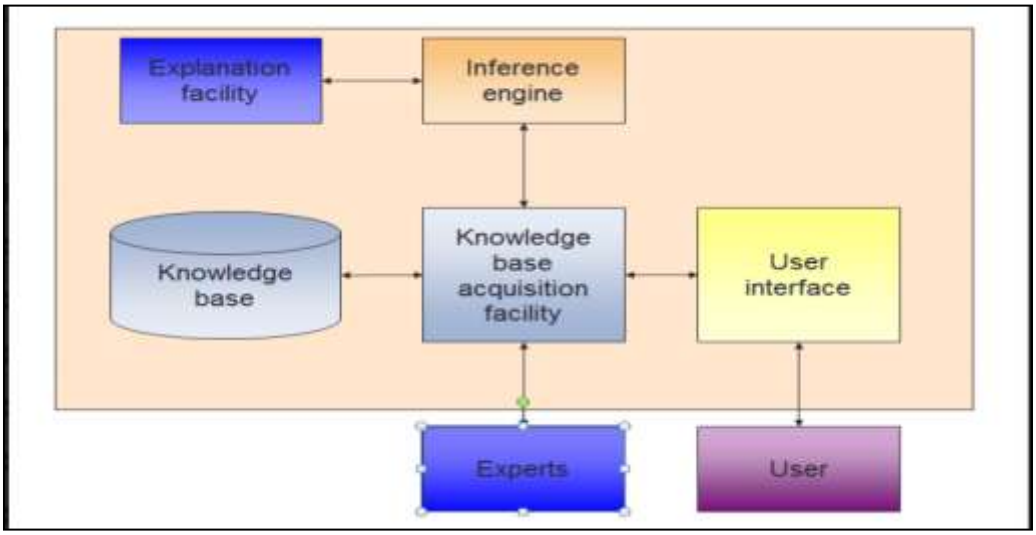
AIM: To do a survey and research on different expert system with respect to their features, characteristics, advantages, disadvantages and the application area where they are used.

THEORY:

1. What is expert system.

"An expert system is an intelligent computer program that can perform special and difficult task in some fields, at the level of a human expert". In artificial intelligence, an expert system is a computer system emulating the decision-making ability of a human expert. Expert systems are designed to solve complex problems by reasoning through bodies of knowledge, represented mainly as if–then rules rather than through conventional procedural code.

2. Block diagram with main components.



1.Knowledge base: Stores all relevant information, data, rules, cases, and relationships used by the expert system

2.Inference engine: Seeks information and relationships from the knowledge base and provides answers, predictions, and suggestions in the way a human expert would

3.Explanation facility: A part of the expert system that allows a user or decision maker to understand how the expert system arrived at certain conclusions or results

4.Knowledge acquisition facility: Provides a convenient and efficient means of capturing and storing all components of the knowledge base

5.User interface: mechanism by which user and system communicate.

6.Users in expert system are Domain expert, Knowledge user, Knowledge engineer.

3. Different existing expert system and their comparative study based on (features, characteristics, advantages, disadvantages and the application area)

DOMAIN : MEDICAL

A. INTERNIST I:

Features : One of the first clinical decision support systems, designed to support diagnosis, in 1970.

Characteristics : It is a rule-based expert system designed at the University of Pittsburgh in 1974 for the diagnosis of complex diagnosis of complex problems in general internal medicine. It uses patient observations to deduce a list of compatible disease states (based on a tree-structured database that links diseases with symptoms).

Advantages : It is like a electronic medical textbook . It has the ability to assist users with generating hypotheses in complex patient cases

Disadvantages : It was not that user friendly,it cannot solve some problems which had very extreme and complex patterns

Application area : Used for supporting diagnosis of complex problems in medicine.

B. DENDRAL :

Features : It was an artificial intelligence based expert system used for chemical analysis. It used a substance's spectrographic data to predict it's molecular structure.

Characteristics : It generates branching tree to analyze interstellar mass spectrometry data in the search for evidence of extra terrestrial life.

Advantages : Flexible since it is written in Lisp which is considered the language of AI

Disadvantages : It cannot assume that the empirical data given to the program is complete and correct or not.

Application area : Used in chemical mass spectroscopy to identify chemical constituents.

C. MYCIN :

Features : Earliest expert systems based on backward chaining. It can identify various bacteria that can cause severe infections and can also recommend drugs based on the person's weight.

Characteristics : Identifying the bacteria that causes meningitis and bacteremia, and to recommend antibiotics, with the dosage adjusted for patient's body weight and blood clotting diseases.

Advantages : It is fast and easy to use. It is user friendly. Uses minimal number of drugs and maximizes coverage of organisms

Disadvantages : It uses a very high level algorithm which is not understood by all. The system ignores relevant rules if the data is not provided.

Application area : Used for medical diagnosis of illness.

D. DxPLAIN :

Features : Selection and generation of stratified diagnoses based on user input of patient signs and symptoms, laboratory results, and other clinical findings

Characteristics : It was Designed by the Laboratory of Computer Science at the Massachusetts General Hospital. It is a Clinical decision support system (CDSS) available through the World Wide Web began in 1984 with a first version being released in 1986.Use of DXplain as a tool for medical consultation has been common to some institutions since it fills a gap, particularly for medical students in clinical rotations, that is not adequately covered by textbook literature.

Advantages : Very user friendly and had a good accuracy

Disadvantages : Did not expand due to lack of clinical proffesionals

Application area : Used to assists clinicians by generating stratified diagnoses based on user input.

E. CASNET/Glaucoma :

Features : It is the most significant Expert System application based on CASNET

Characteristics : Expert clinical knowledge was represented in a causal-associational network (CASNET) model for describing disease processes. CASNET/Glaucoma was developed at Rutgers University and implemented in FORTRAN

Advantages : It is accurate to detect glaucoma.

Disadvantages : Due to the limitations of current knowledge, the difficulties of gathering clinical data and the variability of definitions in medicine, there are usually few systematic links between patterns of findings and intermediate pathophysiological states and mechanisms

Application area : Used for diagnosis and treatment of glaucoma.

4. Explain in detail of any one expert system.

DOMAIN : MEDICAL

DXplain

DXplain is an evolving computer-based diagnostic decision-support system designed for use by the physician who has no computer expertise. It is a Clinical decision support system (CDSS) available through the World Wide Web. DXplain accepts a list of clinical manifestations and then proposes diagnostic hypotheses. The program explains and justifies its interpretations and provides access to a knowledge base concerning the differential diagnosis of the signs and symptoms. DXplain was developed with the support and cooperation of the American Medical Association. The system is distributed to the medical community through AMA/NET—a nationwide computer communications network sponsored by the American Medical Association—and through the Massachusetts General Hospital Continuing Education Network. A key element in the distribution of DXplain is the planned collaboration with its physician-users whose comments, criticisms, and suggestions will play an important role in modifying and enhancing the knowledge base.

Characteristics and Features:

It was Designed by the Laboratory of Computer Science at the Massachusetts General Hospital, work on DXplain began in 1984 with a first version being released in 1986.Use of DXplain as a tool for medical consultation has been common to some institutions since it fills a gap, particularly for medical students in clinical rotations, that is not adequately covered by textbook literature.

The system's large knowledge base combined with its ability to formulate diagnostic hypotheses have made it a popular education tool for US-based medical schools; by 2005, DXplain was supporting more than 33,189 total users.

Methodology:

DXplain generates ranked differential diagnoses using a pseudo-probabilistic algorithm.Each clinical finding entered into DXplain is assessed by determining the importance of the finding and how strongly the finding supports a given diagnosis for each disease in the knowledge base. Using this criterion, DXplain generates ranked differential diagnoses with the most likely

diseases yielding the lowest rank. Using stored information regarding each disease's prevalence and significance, the system differentiates between common and rare diseases.

Accuracy:

Analysis of accuracy has shown promise in DXplain and similar clinical decision support systems. In a preliminary trial investigation of 46 benchmark cases with a variety of diseases and clinical manifestations, the ranked differential diagnoses generated by DXplain were shown to be in alignment with a panel of five board-certified physicians.In another study investigating how well decision support systems work at responding to a bioterrorism event, an evaluation of 103 consecutive internal medicine cases showed that Dxplain correctly identified the diagnosis in 73% of cases, with the correct diagnosis averaging a rank of 10.7.

Advantages:

Like similar clinical systems,Dxplain has a good accuracy to correct diagnose of disease as per the given inputs by clinicians.

The system was to be "user-friendly," usable by a physician with limited computer skills and without the need for training in its operation.

Disadvantages:

DXplain has not expanded beyond the research laboratory or medical training setting, due in part to a lack of support by clinicians in real-world settings.

References:

1.https://www.researchgate.net/publication/272163982_AI_Expert_System_in_Medical_Field_A_study_by_survey_method

2. https://en.wikipedia.org/wiki/DXplain

3. https://www.ncbi.nlm.nih.gov/pmc/articles/PMC100779/

4. http://www.mghlcs.org/projects/dxplain

5. https://jamanetwork.com/journals/jama/article-abstract/366898

CONCLUSION:

In this experiment , we were introduced to expert systems. We understood what expert systems are using the architecture and understood each component of the architecture. We later saw, multiple existing expert systems and differentiated them with multiple criteria. Finally, DXplain was a expert system that was researched in detail. It is similar to other clinical systems, but it is widely used from 20 years because it is very user friendly and accurate enough.