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Artificial Intelligence and Expert Systems

Mr.Prathamesh Ashok Jaisingpure[1], Ms. Sneha M. Kale[2] , Asst. Prof. Mohit Popat [3]

[1]*IV[th] Year BE (CSE Department), JDIET, Yavatmal- jaisingpure88@gmail.com*
[2]*IV[th] Year BE (CSE Department), JDIET, Yavatmal- kalesneha1992@gmail.com*
[3]*Assistant Professor,JDIET, (CSE Department), Yavatmal – mohit.popat@jdiet.ac.in*

Abstract

Artificial intelligence (AI), deep learning, machine learning and neural networks represent incredibly exciting and powerful machine learning-based techniques wont to solve many real-world problems. within the last several years, AI has gained significant visibility within the community, property right. and academia. This paper introduces the concepts of AI and its six main divisions or sub-fields, so focuses on the architecture and development of expert systems. Since the invention of computers or machines, their capability to perform various tasks went on growing exponentially. Humans have developed the facility of computer systems in terms of their diverse working domains, their increasing speed, and reducing size with relevance time.

Index Terms: Artificial intelligence, Machine learning, Architecture, Expert Systems.

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1. INTRODUCTION

Artificial Intelligence (AI) is an area of computer science which deals with creating machines that are able to process and solve complex problems in a more human-like fashion. AI mainly concerned with designing systems that exhibit the characteristics associated with human intelligence like understanding language, learning, reasoning, solving problems, and so on. Artificial Intelligence imitates the basic human learning and thought process. "AI is the science of making machines do things that would require intelligence if done by men

The human mind is capable of processing and learning new information without destroying previously stored information. The mind draws inferences and deductions from this information. Similarly, AI is a technology that attempts to process information in computers similar to the way information is processed by humans.

Intelligence artificial intelligence is making machines "intelligent" -- acting as we might expect people to act. computing may be a way of constructing a computer, a computer-controlled robot, or a software think intelligently, within the similar manner the intelligent humans think..

AI is accomplished by studying how human brain thinks and the way humans learn, decide, and work while trying to unravel an issue, so using the outcomes of this study as a basis of developing intelligent software and systems.

2. MAJOR BRANCHES OF AI

The AI domain is split into sub-fields thanks to the expanse and highly technical nature of the topic. These six sub-fields or specialties include:

1.Robotics: Mechanical and computer devices that perform tedious tasks with high precision.

2.Vision system: Capture, store and manipulate the visual images and pictures.

3.Natural language processing: Computer understands and reacts to the command and statements to natural language like English.

4.Learning system: Computer changes how it reacts or functions to the feedback provided to it.
5.Neural system: Computer that can act like or simulate the functioning of the brain.

6.Expert system: Programming computers to make decisions in real life situations. (ex: expert system help doctors in diagnosing the diseases).

Below fig. 1 shows Major Branches of Artificial Intelligence (AI).

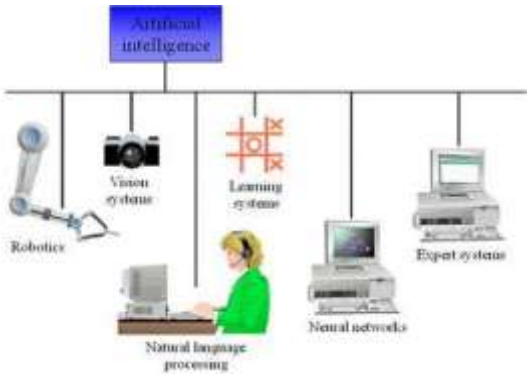

Fig. 1 Major Branches of AI

3. EXPERT SYSTEM ARCHITECTURE

An expert system is **consists** of two major components, the Knowledge-base and the Expert System Shell. The Knowledge base is a collection of rules encoded as metadata in a file system, or more often in a relational database. The Expert System Shell is a problem-independent component housing facilities for creating, editing, and executing rules. A software architecture for an expert system is illustrated in below figure 2.

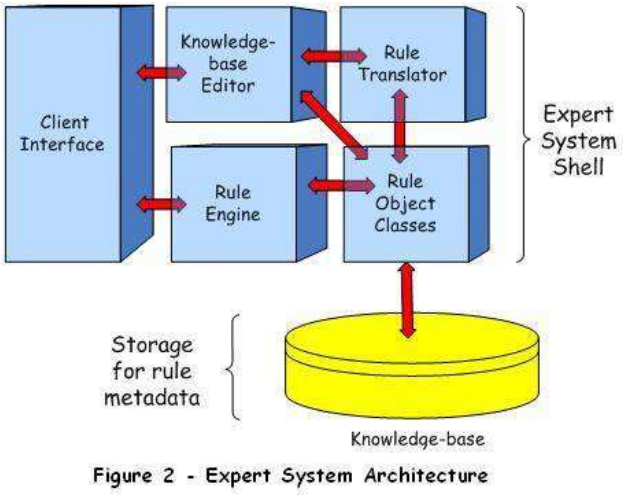

Fig. 2 Expert System Architecture

Architectural features of Expert Systems include:

- **Expert System Shell:** a development and software delivery environment for expert systems. It includes interfaces to one or more knowledge representations and associated inference engines.
  It allows ES development using natural language rather than computer programming languages.
- **Knowledge Base:** the collection of knowledge that includes the assertions, rules. objects, assumptions, and constraints used by an expert for solving difficult problems or tasks.
  - **Rule Base:** a collection of rules used in the howledge base of an expert system. It has an IF-AND/OR-THEN structure.
  - **Fact Base:** a collection of facts used in the knowledge base rules to define factual knowledge.
- **Fmme Base:** a collection of objects used in a knowledge base of an expert system.
- **Induction:** a machine learning technique that derives its decisionmaking capabilities from case histories.
- **Inference:** a process by which pieces of knowledge are combined to arrive at a conclusion (similar to logical thinking).
- **Forward Chaining:** a search strategy that starts with a body of knowledge and attempts to make conclusions.
- **Backward Chaining:** a search strategy that starts with the desired conclusion and tries to prove it with available information.
- **Heuristics:** a "rule of thumb." a general rule based on experience or expertise of human experts.

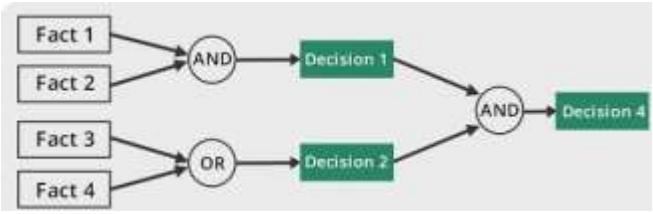

Fig. 3 Forward Chaining

Fig. 4 Backward Chaining

The below fig shows Architecture of a Knowledge-Based Expert System.

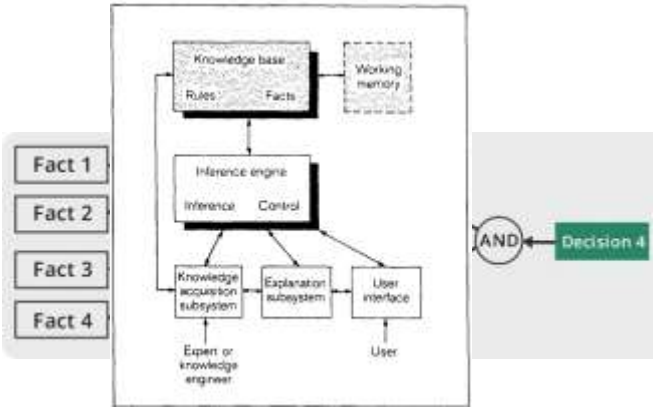

Fig. 5 Architecture of a Knowledge-Based Expert System.

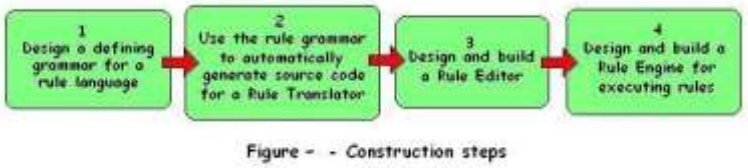

Fig. 6 Construction steps

4. DEVELOPMENT OF EXPERT SYSTEM

Client Interface

The Client Interface processes requests for service from system-users and from application layer components. Client Interface logic routes these requests to an appropriate shell program unit. As an example, when a subject matter expert wishes to make or edit a rule, they use the Client Interface to dispatch the Knowledge-base Editor. Other service requests might schedule a rule, or a gaggleof rules, for execution by the Rule Engine.

User Interface

In ES development, the customer or user interface is extremely important. By definition, expert systems are meant to solve problems using the expert knowledge stored in the system. Therefore, it is implied that the "user" is someone other than the expert, someone

who doesn't have the needed expertise to unravel the matter. Expert systems are interactive and depend upon data input from the user.

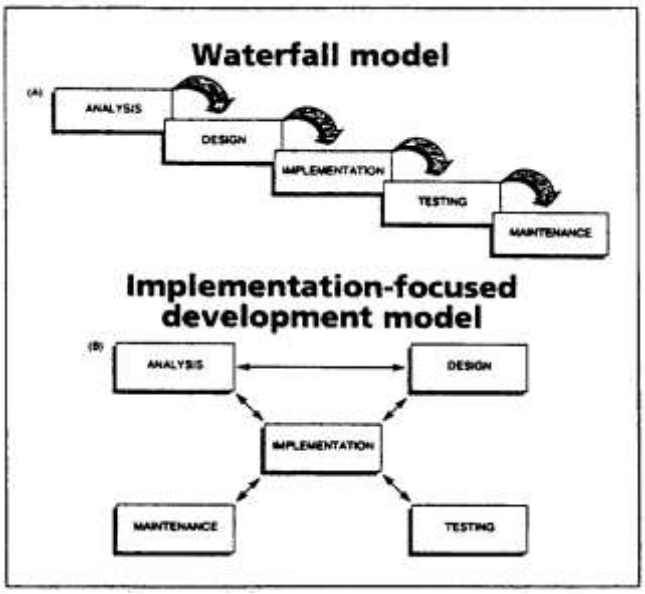

Fig. 7 Software Development life cycle

5. CONSTRUCTING AN EXPERT SYSTEM

The construction of an expert systemis a smaller amount challenging than one might think, given the virtually magical powers attributed to the present class of programs. The task is created easier because,

♣ Large portions of the Rule Translator are often generated automatically using lexical analyzer and parser generators, and

♣Text editors (e.g., TextPad) are often purchased, inexpensively, and integrated into the Expert System Shell. The design and therefore the construction of the expert system involve the four major steps depicted below Figure.

6. ADVANTAGES

- Smarter artificial intelligence will replace human jobs by automating manufacturing and transportation.
- Self-modifying, self-writing and learning software can relieve programmers of the burdensome tasks of specifying the functions of varied programs.
- Artificial intelligence are used as cheap labor, for increasing profits for the corporation.
- Artificial intelligence can make deployment easier and fewer resource intensive.
- Compared to traditional programming techniques, expert-system approaches provide the added flexibility (and hence easier modifiability) with the flexibility to model rules as data rather than code. In situations where an organization's IT department is overwhelmed by a software-development backlog, rule-engines, by facilitating turnaround, provide a way that may allow organizations to adapt more readily to changing needs.
- In practice, modern expert-system technology is utilized as an adjunct to traditional programming techniques, and this hybrid approach allows the mix of the strengths of both approaches. Thus, rule engines allow control through programs (and user interfaces) written in a very traditional language and also incorporate necessary functionality like interoperability with existing database technology.

7. DISADVANTAGES

- Rapid advances in AI could lead on massive structural unemployment.
- Unpredictable and unforeseen impacts of recent features.
- An expert system or rule-based approach isn't optimal for all problems, and considerable knowledge is required so on not misapply the systems.
- Ease of rule creation and rule modification are often double-edged. A system may be sabotaged by a non-knowledgeable user who can easily add worthless rules or rules that conflict with existing ones. Reasons for the failure of the many systems include the absence of (or neglect to use diligently) facilities for system audit, detection of possible conflict, and rule lifecycle management (e.g. version control, or through testing before deployment). the issues to be addressed here are the maximum amount technological as organizational.

8. APPLICATIONS

- Introduction to Machine Learning Approaches
- Fuzzy Logic Improves Decision Support Software
- Shell Programming in Expert Systems Applications
- Smart Home Appliances for Better Quality of Life – Combining artificial intelligence with home automation in smart home appliances ends up in an improved quality of life for several, including the elderly and disabled.

- Voice Recognition Software for Disabled Students – Disabled students are often at an obstacle within the classroom. Voice recognition software improves communication, enables note-taking, and increases participation.
- Teaching Special Needs Children with Autism – Robots are acting as therapy assistants to help parents and therapists in teaching special needs children with autism.

9. SCOPE OF EXPERT SYSTEM

- An expert system i s prepared to do and do the work of knowledgeable. Moreover, a computing system are often trained quickly, has virtually no disbursal, never forgets what it learns, never calls in sick, retires, or goes on vacation. Beyond those, intelligent computers can consider an oversized amount of data that will not be considered by humans.
- But to what extent should these systems replace human experts? Or, should they at all? or instance, some people once considered an intelligent computer as a possible substitute for human control over nuclear weapons, citing that a computer could respond more quickly to a threat. and plenty of AI developers were scared of the likelihood of programs like Eliza, the psychiatrist, and therefore the bond that humans were making with the pc. We cannot, however, overlook the advantages of getting a expert. Forecasting the weather, for instance, relies on many variables, and a expert can more accurately pool all of its knowledge. Still, a computer cannot depend upon the hunches of a person's expert, which are sometimes necessary for predicting an outcome.
- In conclusion, in some like forecasting the weather or finding bugs in computer software, expert systems are sometimes more accurate than humans. except for other fields, like medicine, computers aiding doctors are going to be beneficial, but the human doctor shouldn't get replaced. Expert systems have the facility and range to assist to learn, and in some cases replace humans, and computer experts, if used with discretion, will benefit humankind.

10. SUMMARY

Since its inception, the field of Artificial Intelligence has been transformed from a narrow topic of academic research into broadlyused technologies. Today, practical applications of AI are common in just about every walk of life - medicine, banking, manufacturing,
defense, and security systems.

Our experience in applying Expert Systems technology in the **U.S.** Navy has reinforced the need to **set** realistic expecvdtions and to have management support. Management must be committed to making available the required resources to develop. install, test, and train
users in the new system - everything necessary for successful implementation. At least in the shipboard machinery diagnostics arena, AI and Expert Systems are helping to make a new Navy.

It's now the time to sit and think upon for the future of artificial intelligence in expert systems whether as to go with traditional technologies or to adopt the science of artificial intelligence. The overall motivation behind this paper is to modernize our ancestral methods so as to bring in a rapid change in the growth of highly developed expert systems so as to cater to the needs of a growing population.

The development process may be incremental but the overall concept requires a paradigm shift in the way we think about the modernization of production that is based more on needs and novel ways of meeting them rather than modifying existing techniques.

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