ARTIFICIAL INTELLIGENCE

UNIT – 4

Expert System

An expert system is a computer program that is designed to solve complex problems and to provide decision-making ability like a human expert. It performs this by extracting knowledge from its knowledge base using the reasoning and inference rules according to the user queries.

It is called so because it contains the expert knowledge of a specific domain and can solve any complex problem of that particular domain. These systems are designed for a specific domain, such as **medicine, science,** etc

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Various Domains

- o **In designing and manufacturing domain**
  It can be broadly used for designing and manufacturing physical devices such as camera lenses and automobiles.

- o **In the knowledge domain**
  These systems are primarily used for publishing the relevant knowledge to the users. The two popular ES used for this domain is an advisor and a tax advisor.

- o **In the finance domain**
  In the finance industries, it is used to detect any type of possible fraud, suspicious activity, and advise bankers that if they should provide loans for business or not.

- o **In the diagnosis and troubleshooting of devices**
  In medical diagnosis, the ES system is used, and it was the first area where these systems were used.

- o **Planning and Scheduling**
  The expert systems can also be used for planning and scheduling some particular tasks for achieving the goal of that task.

Expert System Shells

An Expert system shell is a software development environment. It contains the basic components of expert systems. A shell is associated with a prescribed method for building applications by configuring and instantiating these components.
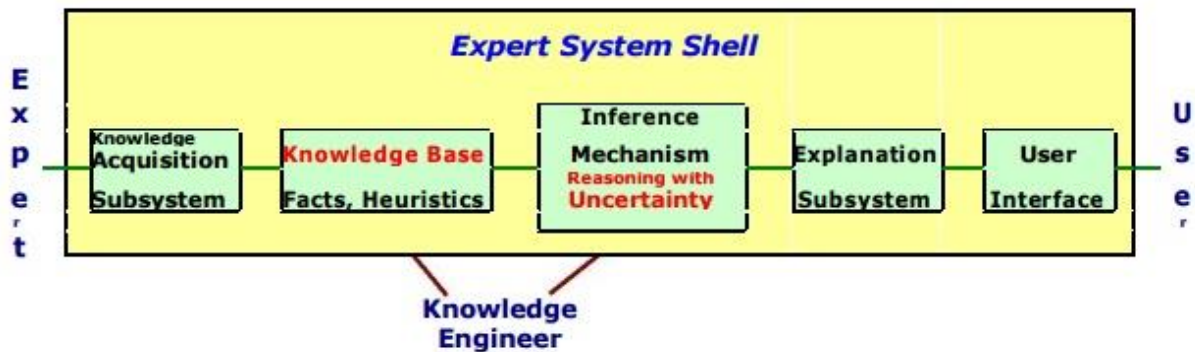
All these components are described in the next slide.

■ **Knowledge Base**

A store of factual and heuristic knowledge. Expert system tool provides one or more knowledge representation schemes for expressing knowledge about the application domain. Some tools use both Frames (objects) and IF-THEN rules. In PROLOG the knowledge is represented as logical statements.

■ **Reasoning Engine**

Inference mechanisms for manipulating the symbolic information and knowledge in the knowledge base form a line of reasoning in solving a problem. The inference mechanism can range from simple modus ponens backward chaining of IF-THEN rules to Case-Based reasoning.

Knowledge Acquisition subsystem

A subsystem to help experts in build knowledge bases. However, collecting knowledge, needed to solve problems and build the knowledge base, is the biggest bottleneck in building expert systems.

Explanation subsystem

A subsystem that explains the system's actions. The explanation can range from how the final or intermediate solutions were arrived at justifying the need for additional data.

User Interface

A means of communication with the user. The user interface is generally not a part of the expert system technology. It was not given much attention in the past. However, the user interface can make a critical difference in the pe eived utility of an Expert system.

Top 5 AI Programming languages

1. **LISP:** It is a family of computer programming language and is the second oldest programming language after Fortran. LISP has developed over time to become strong and dynamic language in coding.

   Some consider LISP as the best AI programming language due to the favour of liberty it offers developers. LISP is used in AI because of its flexibility for fast in prototyping and experimentation which in turn facilitate LISP to grow to a standard AI language. For instance, LISP has a unique macro system which facilitates exploration and implementation of different levels of Intellectual Intelligence.

   LISP, unlike most AI programming languages, is more efficient in solving specific as it adapts to the needs of the solutions a developer is writing. It is highly suitable in inductive logic projects and machine learning.

Advantages
- Fast and efficient in coding as it is supported by compilers instead of interpreters.
- Automatic memory manager was invented for LISP, therefore, it has a garbage collection.
- LISP offers specific control over systems resulting to their maximum use.

Drawbacks
- Few developers are well acquainted with Lisp programming.
- Being a vintage programming language artificial intelligence, LISP requires configuration of new software and hardware to accommodate it use.

2. Python is among developers favorites programming languages in AI development because of its syntax simplicity and versatility. Python is very encouraging for machine learning for developers as it is less complex as compared to C++ and Java. It also a very portable language as it is used on platforms including Linux, Windows, Mac OS, and UNIX. It is also likable from its features such as Interactive, interpreted, modular, dynamic, portable and high level which make it more unique than Java.

Also, Python is a Multi-paradigm programming supporting object-oriented, procedural and functional styles of programming. Python supports neural networks and development of NLP solutions thanks to its simple function library and more so ideal structure.

Advantages
- Python has a rich and extensive variety of library and tools.
- Supports algorithm testing without having to implement them.
- Python supporting object-oriented design increases a programmer's productivity.
- Compared to Java and C++, Python is faster in development.

Drawbacks
- Developers accustomed to using Python face difficulty in adjusting to completely different syntax when they try using other languages for AI programming.
- Unlike C++ and Java, python works with the help of an interpreter which makes compilation and execution slower in AI development.
- Not suitable for mobile computing. For AI meant for mobile applications, Python unsuitable due to its weak language for mobile computing.

3. C++ is the fastest computer language, its speed is appreciated for AI programming projects that are time sensitive. It provides faster execution and has less response time which is applied in search engines and development of computer games. In addition, C++ allows extensive use of algorithms and is efficient in using statistical AI techniques. Another important factor is that C++ supports re-use of programs in development due to inheritance and data-hiding thus efficient in time and cost saving.

C++ is appropriate for machine learning and neural network.

Advantages
- Good for finding solutions for complex AI problems.
- Rich in library functions and programming tools collection.
- C++ is a multi-paradigm programming that supports object-oriented principles thus useful in achieving organized data.

Drawbacks
- Poor in multitasking; C++ is suitable only for implementing core or the base of specific systems or algorithms.
- It follows the bottom-up approach thus, highly complex making it hard for newbies developers at using it for writing AI programs.

4. Java is another programming language to answer 'which computer language is used for artificial intelligence?' Java is also a multi-paradigm language that follows object-oriented principles and the principle of Once Written Read/Run Anywhere (WORA). It is an AI programming language that can run on any platform that supports it without the need for recompilation.

Java is one of the most commonly used and not just in AI development. It derives a major part of its syntax from C and C++ in addition to its lesser tools that them. Java is not only appropriate for NLP and search algorithms but also for neural networks.

Advantages

- Very portable; it is easy to implement on different platforms because of Virtual Machine Technology.
- Unlike C++, Java is simple to use and even debug.
- Has an automatic memory manager which eases the work of the developer.

Disadvantages
- Java is, however, slower than C++, it has less speed in execution and more response time.
- Though highly portable, on older platforms, java would require dramatic changes on software and hardware to facilitate.
- Java is also a generally immature programming AI language as there are still some developments ongoing such as JDK 1.1 in beta.

5. Prolog is also one of the oldest programming languages thus also suitable for the development of programming AI. Like Lisp, it is also a primary computer language for artificial intelligence. It has mechanisms that facilitate flexible frameworks developers enjoy working with. It is a rule-based and declarative language as it contains facts and rules that dictate its artificial intelligence coding language.

Prolog supports basic mechanisms such as pattern matching, tree-based data structuring, and automatic backtracking essential for AI programming. Other than its extensive use in AI projects, Prolog is also used for creation of medical systems.

Advantages
- Prolog has a built-in list handling essential in representing tree-based data structures.
- Efficient for fast prototyping for AI programs to be released modules frequently.
- Allows database creation simultaneous with running of the program.

Drawbacks
- Despite prolog old age, it has not been fully standardized in that some features differ in implementation making the work of the developer cumbersome.