**ARTIFICIAL INTELLIGENCE**

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***ABSTRACT***

The term **artificial intelligence** is used to describe a property of machines or programs: the intelligence that the system demonstrates. Among the traits that researchers hope machines will exhibit are reasoning, knowledge, planning, learning, communication, perception and the ability to move and manipulate objects. Constructing robots that perform intelligent tasks has always been a highly motivating factor for the science and technology of information processing. Unlike philosophy and psychology, which are also concerned with intelligence, AI strives to build intelligent entities such as robots as well as understand them. Although no one can predict the future in detail, it is clear that computers with human-level intelligence (or better) would have a huge impact on our everyday lives and on the future course of civilization Neural Networks have been proposed as an alternative to Symbolic Artificial Intelligence in constructing intelligent systems. They are motivated by computation in the brain. Small Threshold computing elements when put together produce powerful information processing machines. In this paper, we put forth the foundational ideas in artificial intelligence and important concepts in Search Techniques, Knowledge Representation, Language Understanding, Machine Learning, Neural Computing and such other disciplines.

**INTRODUCTION**

Starting from a modest but an over ambitious effort in the late 50‟s, AI has grown through its share of joys, disappointments and self-realizations. AI deals in science, which deals with creation of machines, which can think like humans and behave

rationally. AI has a goal to automate every machine. AI is a very vast field, which spans:

* Many application domains like Language Processing, Image Processing, Resource Scheduling, Prediction, Diagnosis etc.
* Many types of technologies like Heuristic Search, Neural Networks, and Fuzzy Logic etc.
* Perspectives like solving complex problems and understanding human cognitive processes.
* Disciplines like Computer Science, Statistics, Psychology, etc.

**DEFINITION OF INTELLIGENCE & TURING TEST**

The Turing Test, proposed by Alan Turing (1950), was designed to provide a satisfactory definition of intelligence. Turing defined intelligent behavior as the ability to achieve human-level performance in all cognitive tasks, sufficient to fool an

interrogator. Roughly speaking, the test he proposed is that the computer should be interrogated by a human via a teletype, and passes the test if the interrogator cannot tell if there is a computer or a human at the other end. His theorem (the Church-Turing thesis) states that “Any effective procedure (or algorithm) can be implemented through a Turing machine. “ Turing machines are abstract mathematical entities that are composed of a tape, a read-write head, and a finite-state machine. The head can either read or write symbols onto the tape, basically an input-output device. The head can change its position, by either moving left or right. The finite state machine is a memory/central processor that keeps track of which of finitely many states it is

currently in. By knowing which state it is currently in, the finite state machine can determine which state to change to next, what symbol to write onto the tape, and which direction the head should move.

**AREAS OF ARTIFICIAL INTELLIGENCE**

**KNOWLEDGE REPRESENTATION**

Importance of knowledge representation was realized during machine translation effort in early 1950‟s. Dictionary look up and word replacement was a tedious job. There was ambiguity and ellipsis problem i.e. many words have different meanings. Therefore having a dictionary used for translation was not enough.

One of the major challenges in this field is that a word can have more than one meaning and this can result in ambiguity. E.g.: Consider the following sentence Spirit is strong but flesh is weak.

When an AI system was made to convert this sentence into Russian & then back to English, following output was observed.

Wine is strong but meat is rotten. Thus we come across two main obstacles. First, it is not easy to take informal knowledge and state it in the formal terms required by logical notation, particularly when the knowledge is less than 100% certain. Second, there is a big difference between being able to solve a problem “in principle” and doing so in practice. Even problems with just a few dozen facts can exhaust the computational resources of any computer unless it has some guidance as to which reasoning steps to try first. A problem may or may not have a solution. This is why debugging is one of the most challenging jobs faced by programmers today. As the rule goes, it is impossible to create a program which can predict whether a given program is going to terminate ultimately or not. Development in this part was that algorithms were written using foundational development of vocabulary and dictionary entries. Limitations of the algorithm were found out. Later Formal Systems were developed which contained axioms, rules, theorems and an orderly form of representation was developed. For example, Chess is a formal system. We use rules in our everyday lives and these rules accompany facts. Rules are used to construct an efficient expert system having artificial intelligence. Important components of a Formal System are - Backward Chaining i.e. trying to figure out the content by reading the sentence backward and link each word to another, Explanation Generation i.e. generating an explanation of whatever the system has understood, Inference Engine i.e. submitting an inference or replying to the problem.

**REASONING**

It is to use the stored information to answer questions and to draw new conclusions. Reasoning means, drawing of conclusion from observations. Reasoning in AI systems work on three principles namely:

DEDUCTION: Given 2 events „P‟ & „Q‟, if „P‟ is true then „Q‟ is also true. E.g.: If it rains, we can't go for a picnic.

INDUCTION: Induction is a process where in , after studying certain facts , we reach to a conclusion. E.g.: Socrates is a man; all men are mortal; therefore Socrates is mortal.

ABDUCTION: „P‟ implies „Q‟, but „Q‟ may not always depend on „P‟. E.g.: If it rains , we can't go for a picnic.

The fact that we are not in a position to go for a picnic does not mean that it is training. There can be other reasons as well.

**LEARNING**

The most important requirement for an AI system is that it should learn from its mistakes. The best way of teaching an AI system is by training & testing. Training involves teaching of basic principles involved in doing a job. Testing process is the real test of the knowledge acquired by the system wherein we give certain examples & test the intelligence of the system. Examples can be positive or negative. Negative examples are those which are 'near miss' of the positive examples.

**NATURAL LANGUAGE PROCESSING (NLP)**

**NLP can be defined as:**

* Processing of data in the form of natural language on the computer. i.e. making the computer understand the language a normal human being speaks.
* It deals with under structured / semi structured data formats and converting them into complete understandable data form. The reasons to process natural language are; Generally - because it is exciting and interesting, Commercially – because of sheer volume of data available online, Technically – because it eases out Computer-Human interaction.

**NLP helps us in:**

* Searching for information in a vast NL (natural language) database.
* Analysis i.e. extracting structural data from natural language.
* Generation of structured data.
* Translation of text from one natural language to other. Example English to Hindi.

**Application Spectrum of NLP:**

* It provides writing and translational aids.
* Helps humans to generate Natural Language with proper spelling, grammar,

style etc.

* It allows text mining i.e. information retrieval, search engines text categorization, information extraction.
* NL interface to database, web software system, and question answer explanation in an expert system.

**There are four procuring levels in NLP:**

1. Lexical - at word level it involves pronunciation errors.
2. Syntactical - at the structure level acquiring knowledge about the grammar and structure of words and sentences. Effective representation and implementation of this allows effective manipulation of language in respect to grammar. This is usually implemented through a parser.

3. Semantic - at the meaning level.

4. Pragmatic – at the context level.

**HURDLES**

There are various hurdles in the field of NLP, especially speech processing which result in increase in complexity of the system. We know that, no two people on earth can have similar accent and pronunciations. This difference in style of communicating results in ambiguity.

Another major problem in speech processing understands of speech due to word boundary. This can be clearly understood from the following example: I got a plate. / I got up late.

**UNIVERSAL NETWORKING LANGUAGE**

This is a part of natural language processing. The key feature of a machine having artificial intelligence is its ability to communicate and interact with a human. The only means for communication and interaction is through language. The language being used by the machine should be understood by all humans. Example of such a language is ENGLISH. UNL is an artificially developed language consisting universal word library, universal concepts, universal rules and universal attributes. Necessity of UNL is that a computer needs capability to process knowledge and content recognition. Thus UNL becomes a platform for the computer to communicate and interact.

**VISION (Visibility Based Robot Path Planning)**

Consider a moving robot. There are two things, robots have to think and perform while moving from one place to another:

1. Avoid collision with stationary and moving objects.

2. Find the shortest distance from source to destination.

One of the major problems is to find a collision free path amidst obstacles for a robot from its starting position to its destination. To avoid collision two things can be done viz

1.Reduce the object to be moved to a point form.

2. Give the obstacles some extra space. This method is called Mikownski method of path planning.

Recognizing the object and matching it with the contents of the image library is another method. It included corresponding matching and depth understanding, edge detection using idea of zero crossing and stereo matching for distance estimation. For

analysis, it also considers robot as a point body.

Second major problem of path planning is to find the shortest path. The robot has to calculate the Euclidean distance between the starting and the ending points. Then it has to form algorithms for computing visibility graphs.

These algorithms have certain rules associated with.

* Join lesser number of vertices to reduce complexity.
* Divide each object into triangles.
* Put a node in each triangle and join all of them.
* Reduce the unnecessary areas because they might not contribute to the shortest path.
* Compute minimum link path and proceed.

This problem of deciding shortest path prevails. Robot might be a bulky and a huge object so can‟t be realized as a point. Secondly a robot is a mechanical body which can‟t turn instantly so it has to follow the procedure of wait-walk-wait-turn-wait-walk---- which is very time-consuming and so not feasible. Therefore shortest distance should have minimum number of turns associated with it. For path planning the robot has to take a snap shot of the area it is going to cover. This snap shot is processed in the above mentioned ways and then the robot moves. But then the view changes with every step taken. So it has to do the calculation at every step it takes which is very time consuming and tedious. Experts decided to make the robot take the snap shot of the viewable distance and

decide the path. But this again becomes a problem because the device used for viewing will have certain limitation of distance. Then these experts came to a conclusion that the robot be given a fixed parameter i.e. take to take the snap shot of a fixed distance say 10 meters, analyze it and decide the shortest path.

**NEURAL-NETWORKS**

Neural networks are computational consisting of simple nodes, called units or processing elements which are linked by weighted connections. A neural network maps input to output data in terms of its own internal connectivity. The term neural network derives from the obvious nervous system analogy of the human brain with processing elements serving as neurons and connection weights

equivalent to the variable synaptic strengths. Synapses are connections between neurons - they are not physical connections, but miniscule gaps that allow electric signals to jump across from neuron to neuron. Dendrites carry the signals out to the various synapses, and the cycle repeats.

Let us take an example of a neuron:

It uses a simple computational technique which can be defined as follows

y= 0 if Σ Wi Xi <θ

y=1 if Σ Wi Xi > θ

Where θ is threshold value

Wi is weight

Xi is input

Now this neuron can be trained to perform a particular logical operation like AND.The equivalent neural network simulation for AND function is given on the left and its equation format on the right.

Perceptron training convergence theorem

Whatever be the initial choice of the weights, the PTA will eventually converge by

finding the correct weight values provided the function being trained is linearly

separable.

This implies Perceptron Training Algorithm will absorb the threshold with negative

weight. Σ Wi Xi + (-1) θ ≥ 0

A B Y

0 0 0

0 1 0

1 0 0

1 1 1

0 W1 + 0 W2 =0 (< θ)

0 W1 +1 W2 =0 (< θ)

1 W1 +0 W2 =0 (< θ)

1 W1 +1 W2 =1 (>θ)

0 W1 + 0 W2 =0 < θ

0 W1 +1 W2 =1 > θ

1 W1 +0 W2 =1 > θ

1 W1 +1 W2 =0 < θ

**FUTURE SCOPE OF STUDY**

In the next 10 years technologies in narrow fields such as speech recognition will continue to improve and will reach human levels. In 10 years AI will be able to communicate with humans in unstructured English using text or voice, navigate (not perfectly) in an unprepared environment and will have some rudimentary common sense (and domain-specific intelligence).

We will recreate some parts of the human (animal) brain in silicon. The feasibility of this is demonstrated by tentative hippocampus experiments in rats. There are two major projects aiming for human brain simulation, CCortex and IBM Blue Brain.

There will be an increasing number of practical applications based on digitally recreated aspects human intelligence, such as cognition, perception, rehearsal learning, or learning by repetitive practice.

**CONCLUSION**

E-bomb is the device that works on the current-magnetism dependency. Working of nuclear and non-nuclear e-bomb is studied in detail. Other important facts about e-bomb are also discussed. From the above discussions, it is clear that in the next few years, modern warfare would include e-bomb as an important weapon to target the abrupt increase in technological dependency.

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