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Artificial Intelligence and Robotic From the Past to Present

Elnaz Asgari Far[1*], Bashir Golchin[2]

[1]Islamic Azad Universirty, Qazvin Branch, Qazvin, Iran
[2]Islamic Azad University, Sari Branch, Mazandaran, Iran

*Corresponding Author's Email: *Elnaz.Asgarifar@gmail.com*

Abstract

This paper overviews the basic principles and recent advances in the Artificial Intelligent robotics and the utilization of robots in nowadays life and the various compass. The aim of the paper is to introduce the basic concepts of artificial intelligent techniques and present a survey about robots. In first section we have a survey on the concept of artificial intelligence and intelligence life; also we introduce two important factors in artificial intelligence. In the next section, we have overview on the basic elements of artificial intelligence. Then, another important section in this paper is intelligent robots and the behavior based robotics. The use of robots in nowadays life is in the various domains. We introduce one of them that are rehabilitation robots.

Keywords: Robots, Artificial Intelligence, Rehabilitation robotics

1. Introduction

Artificial Intelligence (AI) is an emerging technology that has recently attracted considerable publicity and also many useful in nowadays life. Many applications are now under development. One simple view of AI is that it is concerned with devising computer programs to make computers smarter. With AI all of the hard problem can be solve very easily. Thus, research in AI is focused on developing computational approaches to intelligent behavior. This research has two goals:

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- Making machines more useful
- Understanding intelligence.

With understanding the intelligence, we can realize if the intelligent behavior did not exist in nowadays, we have faced with problem. With the compare of Artificial intelligence with natural intelligence, we can understand this variety more completely. The computer programs with which AI is concerned are primarily symbolic processes involving complexity, uncertainty, and ambiguity. These processes are usually those for which algorithmic solutions do not exist and search is required. Thus, AI deals with the types of problem solve and decision making that humans continually face in dealing with the world. This form of problem solving differs markedly from scientific and engineering calculations that are primarily numeric in nature and for which solutions are known that produce satisfactory answers. AI programs deal with words and concepts and often do not guarantee a correct solution, but try to use of the acknowledge base correctly to achieve the correct solution. Some wrong answers being tolerable as in human problem solving. A key characteristic of AI programs is "heuristic search."Much of the early work in AI was focused on deriving programs that would search for solutions to problems. Note that every time one makes a decision, the situation is changed opening up new opportunities for further decisions.

Therefore, there are always branch points. Thus, one of the usual ways of representing problem solving in *A*I is in terms of a tree, starting at the top with an initial condition and branching every time a decision is made. *A*s one continues down the tree many different decision possibilities open up, so that the number of branches at the bottom can get to be enormous for problems requiring many solution steps. Therefore, some way is needed to efficiently search the trees. Initially, there were "blind" methods for searching trees. These were orderly search approaches that assured that the same solution path would not be tried more than once. Therefore, rules of thumb (empirical rules), referred to as "heuristics" were

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needed to aid in choosing the most likely branches, so as to narrow the search [1]. Baraiko (1982, p. 448) quotes Minsky as saying "If you can't tell a computer how best to do something, program it to try many approaches." However, in complex problems the number of possible solution paths can be enormous; the good algorithms can select the best solution to achieve the best answer. Thus, AI problem solving is usually guided by empirical rules, rules of thumb referred to as "heuristics "which help constrain the search. Another aspect of AI programs is the extensive use of "domain knowledge." Intelligence is heavily dependent on knowledge .This knowledge must be available for use when needed during the search. This knowledge specific with programmer. It is common in AI programs to separate this knowledge from the mechanism that controls the search. In this way, changes in knowledge only require changes in the knowledgebase. In contrast, domain knowledge and control in conventional computer programs are integrated together.

As a result, conventional computer programs are difficult to modify, as the implications of the changes made in one part of the program must be carefully examined for the impacts and the changes required in other parts of the program. Today's initial AI systems can primarily be regarded as intelligent assistants. These are taking the form of expert systems, natural language interfaces, computer vision systems and intelligent computer-aided instruction systems. They like humans are all prone to failures, but unlike humans, they are not capable of drawing on deep knowledge when needed to achieve graceful degradation, so that their failures are more abrupt. Thus, researchers are currently engaged in developing a new set of advanced systems, based on deep knowledge which includes such aspects as causal models and scientific knowledge [2].

2. Survey the two important factors in artificial intelligence

AI researchers found that common sense (virtually taken for granted in humans) is the most difficult thing to model in a computer. It was finally concluded that common

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sense is low level reasoning, based on a wealth of experience. In acquiring common sense we learn to expect that when we drop something it falls and in general what things to anticipate in everyday events. How to represent common sense in a computer is a key AI issue that is unlikely to be soon solved. *A*nother area that is very important in AI is logic. As a result, common sense and Logic are two important factors in AI. How do we deduce something from a set of facts? How can we prove that a conclusion follows from a given set of premises? These questions can be answered rightly if the definition of common sense and logic will be right. Computational logic was one of the early hopes in AI to provide a universal problem solving method. However, solution convergence proved to be difficult with complex problems, resulting in a diminishing of interest in logic. Logic is now enjoying a revival based on new formulations and the use of heuristics to guide solutions.Another domain in AI is languages. Specific high level languages have been developed for different application domains. This has also been true for AI. Currently, LISP and PROLOG are the principal AI programming languages. To date, software tools have been devised for expressing knowledge, formulating expert systems, and basic programming aids [2].

3. The basic elements of AI

Nilsson (1982, see also Brown, 1981), a pioneer in AI characterize the components of AI in terms of what he calls the onion model, as it follow [3]:

Natural Language Processing (NLP)

NLP is concerned with natural language front ends to computer programs, computer-based speech understanding, text understanding and generation, and related applications. A detailed overview of NLP is given in Gevarter (1983). NLP is important for scientific,

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economic, social, and cultural reasons. NLP is experiencing rapid growth as its theories and methods are deployed in a variety of new language technologies. For this reason it is important for a wide range of people to have a working knowledge of NLP. Within industry, this includes people in human-computer interaction, business information analysis, and web software development. Within academia, it includes people in areas from humanities computing and corpus linguistics through to computer science and artificial intelligence. (To many people in academia, NLP is known by the name of "Computational Linguistics.") Speech recognition appears to be emerging as a key man-machine interface. Researchers have found that the psychological problems inherent in talking to a machine are a barrier to the acceptance of speech interfaces. Overcoming the psychological problems may be even more important than reducing cost. To achieve practical continuous speech recognition, systems will have to expand today's vocabularies by an order of magnitude, increase speed by two orders of magnitude, and get costs below $1,000.

Such systems are estimated to still be five years away. Natural language interfaces appear to be the way to vastly increase the number of people who can interact with computers. Systems with near natural-language capabilities are available now, though it will be years before the systems can handle truly unrestricted dialogue. It is estimated that public access to large data bases via computer using restricted speech understanding may begin to appear within three years. This can be expected to open up a whole new industry of automated reservation, shopping and information services accessed by telephone. Another emerging aspect of natural language processing is systems that understand text by utilizing world knowledge. Such systems could read and summarize news stories (as is now being done in research) but more likely would be applied to such tasks as reading mail and informing the recipient of important items, or in general, processing large amounts of information for humans trying to escape from overload [4].

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Computer vision

Computer Vision is concerned with enabling a computer to see to identify or understand what it sees, to locate what it is looking for, etc. A detailed overview of Computer Vision is given in Gevarter (1982B). Computer vision is the technology to replace or complement manual inspections and measurements with digital cameras and image processing. The technology is used in a variety of different industries to automate the production, increase production speed and yield, and to improve product quality. Computer vision will increasingly be used in industry for inspection, identification, verification, part location, and other purposes. Vision provides the most general purpose sensory input for intelligent robots. It is likely that roughly 25% of all robots will utilize vision by the end of the decade. Vision is also expected to play a large part in military automation, remote sensing, and as aids to the handicapped [5]. Machine vision in operation can be described by a four-step flow:

- **Imaging**: Take an image.
- **Processing and analysis**: Analyze the image to obtain a result.
- **Communication:** Send the result to the system in control of the process.
- **Action:** Take action depending on the vision system's result.

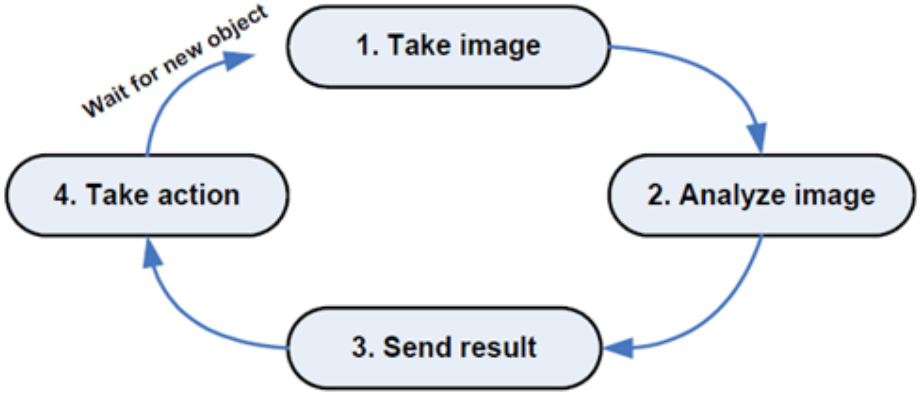

Figure 1: Machine vision operation in four-step flow:

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Machine vision applications can be divided into four types from a technical point of view, Locate measure, inspect and identify.

3.2.1. Locate:

In locating applications, the purpose of the vision system is to find the object and report its position and orientation. In robot been picking applications the camera finds a reference coordinate on the object, for example center of gravity or a corner, and then sends the information to a robot which picks up the object.

3.2.2: Measure:

In measurement applications the purpose of the vision system is to measure physical dimensions of the object. Examples of physical dimensions are distance, diameter, Curvature, area, height, and volume. In the example to the right, a camera measures multiple diameters of a bottleneck.

3.2.3: Inspect:

In inspection applications the purpose of the vision system is to validate certain features, for example presence or absence of a correct label on a bottle, screws in an assembly, chocolates in a box, or defects. In the example to the right, a camera inspects brake pads for defects.

3.2.4: Identify:

In an identification application the vision system reads various codes and alphanumeric characters (text and numbers). In the example to the right, a camera reads the best before date on a food package. Examples of codes that can be read simultaneously on the same package are Barcodes and matrix codes [6].

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3.3. Expert system

Expert Systems are perhaps the "hottest" topic in AI today. Expert systems encode human expertise in limited Domains by representing it using if-then rules. How do we make a computer act as if it was an expert in some domain? Utilizing emerging expert-system building tools, AI developers are expected to eventually put expert Medical, financial and legal advice at the fingertips of anyone with access to a personal computer (though this will probably have to await the arrival of a new generation using 32 bit microprocessors).Expert systems will also put expert is in the hands of less-trained, lower-salaried workers. For example, how do we get a computer to perform medical diagnosis or VLSI design? A detailed overview of Expert Systems is given in Gevarter (1982A). A typical expert system consists of five components (Figure 2) [7].

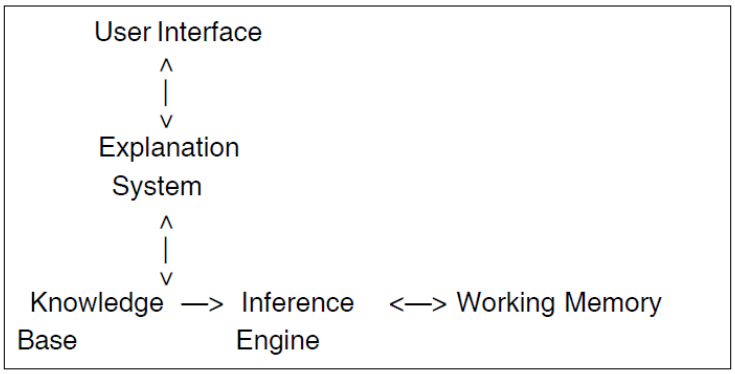

Figure2: components of expert system

3.4. Problem Solving and Planning

There are many problems for which there are no experts, but nevertheless computer programs for their solutions are needed. In addition there are some basic planning systems that are more concerned with solution techniques than with knowledge.

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4. Intelligent Robots

The development of AI is making intelligent robots feasible [9]. As intelligence is added to robots, they will not only be able to perform more flexibly in manufacturing, but will begin to be evident in tasks outside the industrial environment. Thus, robots in fire fighting, undersea exploration, mining, and construction will appear. However, the big push may be in military applications with its actively hostile environments. In the 1990s, robots with intelligence and sensory capabilities will appear in the service industries in everything from food service to household robots. It is also anticipated that in the 1990s, intelligent robots will enter the space arena, for such tasks as the construction and assembly of large space structures, space manufacture, extra-terrestrial mining and exploration, and operation and maintenance of space installations. In addition to more intelligent robots, AI will influence virtually every aspect of the future industrial plant. Integrated plants that make use of automated planning, scheduling, process control, warehousing, and the operation of automated robot carts, robots, and manufacturing machines, will appear in a few years and will become widespread within the next 10 years [8].

Computers and special purpose chips designed to incorporate parallel processing are being developed at several universities and computer organizations. MIT has been developing a parallel machine using VLSI techniques to break problems into sub problems and distribute them among its processors. Another chip will utilize parallel processing to rapidly search through the branches of a semantic network. The most prominent future system is Japan's Fifth Generation *C*omputer that could store and retrieve some 20,000 rules, incorporate a knowledge base of 100 million data items and help make Japan an AI leader before the end of this century. The real breakthrough may come when machine learning is achieved. Already several learning systems, currently in the research stage, have been able to produce very interesting results. Someday machines will able to learn throughout their lifetime, building up the knowledge base needed for advanced reasoning.

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This will open up spectacular new applications in offices, factories and homes. Machines may update their knowledge by reading natural language material, as well as learning by experience from the problems the computers are called upon to solve. Computers also may be able to form conclusions from examination of multiple data bases, thereby building new knowledge from existing knowledge.

5. Artificial intelligence robotics

In traditional Artificial Intelligence robot brains are serial processing units. (Figure 3)

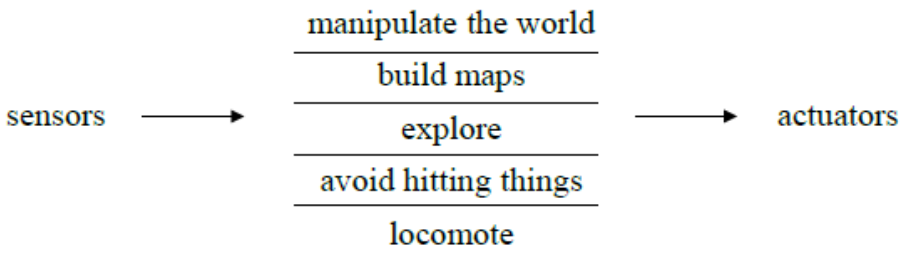

Figure3. Serial processing in artificial intelligence robot

- The ideas behind this approach are:
- Representations, Reasoning, Planning
- Model Building (for example, geometric maps)
- Functional Decomposition, Hierarchical systems
- Symbol manipulation

5.1. Examples of behaviors in artificial intelligence robots

- Exploration/directional behaviors (move in a general direction) heading based, wandering.
- Goal-oriented appetitive behaviors (move towards an attractor) discrete object attractor, area attractor.

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- Aversive/protective behaviors (prevent collision) avoid stationary objects; elude moving objects (escape), aggression.
- Path following behaviors (move on a designated path) road following, hallway navigation, stripe following.
- Postural behaviors balance, stability.
- Social/cooperative behaviors sharing, foraging, flocking.
- Perceptual behaviors visual search, ocular reflexes
- Walking behaviors (for legged robots)gait control
- Manipulator-specific behaviors (for arm control)reaching, moving
- Gripper hand behaviors (for object acquisition) grasping [10].

5.2. Behavior based robotics

The Behavior-Based approach states that intelligence is the result of the interaction among an asynchronous set of behaviors and the environment. (Figure 4)

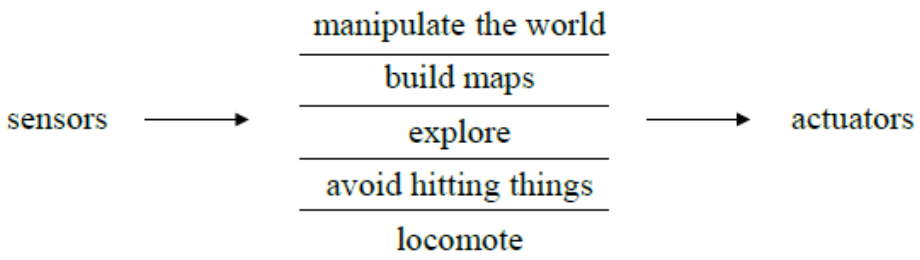

Figure4 .Behavior based robotics

So, the process and activity of robots has been changed from the past to present and we show the paradigm shift bellow:

Thinking and reasoning changed to acting and behaving, the seat of intelligence is brain and changed to organism. Also, the life is changed to artificial life with the use of artificial

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application and robots in various domains. The information processing in traditional robots was converted to sensory motor coordination.

6. The various domains that we use robots

- Factory and industry
- Education
- Medicine
- Rehabilitation
- Security

All of the instance that we say have an important role in nowadays life and can change our life to intelligent life. We want to explain one of them.

7. Rehabilitation Robotics

The most extensive use of robotic technology for medical applications has been in rehabilitation robotics, which traditionally includes assistive robots, prosthetics, orthotics, and therapeutic robots. Assistive robots provide greater independence to people with disabilities by helping them perform activities of daily living. For example, robot manipulators can assist individuals who have impaired arm or hand function with basic tasks such as eating and drinking, or with vocational tasks such as opening a filing cabinet. Assistive robotics also includes mobility aides such as wheelchairs and walkers with intelligent navigation and control systems, for individuals with impaired lower-limb function. Robotic prosthetics and orthotics have been developed to replace lost arms, hands, and legs and to provide assistance to weak or impaired limbs. Therapeutic robots are valuable tools for delivering neuron-rehabilitation to the limbs of individuals with disabilities following stroke.

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Types of rehabilitation robots are divided into the following categories [11]:

- A prosthetic is a mechanical device that substitutes for a missing part of the human body.
- An orthotic is a mechanism used to assist or support a weak or ineffective joint, muscle, or limb.
- Assistive robots Which help the user to perform a function that they would otherwise be unable to perform by assisting or retarding movement (for example, robotic exoskeletons)
- Robots for physical rehabilitation which encourage the user to undertake prescribed repetitive movements (for example, the Gentle/S robot for stroke rehabilitation, and MIT-Manus, which is currently being subjected to a large clinical trial).
- Robots for surgery for example, Davinci, cyber knife, are activating laparoscopic machines.
- Robots to facilitate physiological intervention For example, microbots and nanorobots, which manipulate blood clots within muscles.[12]

Conclusion

This paper attempted to present the basics of Artificial Intelligence and Robotic technology has successfully produced valuable tools for the various domain. Future applications of robotic technology will continue to provide advances in these and other areas of medicine. This paper is so benefit for beginners to recognize artificial intelligence and compare that, if the artificial intelligence application was not exist in nowadays life. Also the reader realizes the robots premium and has a brief survey about one branch of artificial intelligence robots that use in medicine that are rehabilitation robots.

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