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Artificial Intelligence:Simulated Embodied Agents

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Abstract

Probably everybody has heard of Artificial Intelligence (AI for short), but relatively few people have a really good idea of what the term really means. My purpose here is to introduce a few of the basic ideas behind AI, and to try and offer a means by which people can come to grips with the current state of the art in the field. Roughly speaking, Artificial Intelligence is the study of man-made computational devices and systems which can be made to act in a manner which we would be inclined to call intelligent. The birth of the field can be traced back to the early 1950s. The fundamental strategy which lay behind all these successes led to the proposal of what is known as the Physical Symbol Systems Hypothesis, by Newell and Simon in 1976. The Physical Symbol System Hypothesis amounts to a distillation of the theory which lay behind much of the work which had gone on up until that date and was proposed as a general scientific hypothesis. Newell and Simon (1976: p. 41) wrote;

"A physical symbol system has the necessary and sufficient means for general intelligent action."

Although there has been a great deal of controversy about exactly how this hypothesis should be interpreted, there are two important conclusions which have been drawn from it. The first conclusion is that computers are physical symbol systems, in the relevant sense, and thus there are grounds (should the hypothesis be correct) to believe that they should be able to exhibit intelligence. The second conclusion is that, as we humans also are intelligent, we too must be physical symbol systems and thus are in a significant sense, similar to computers.

Keywords: *Embodied Agents, AI.*

1. Introduction

Artificial intelligence (AI) is an area of computer science that emphasizes the creation of intelligent machines that work and reacts like humans. Some of the activities computers with artificial intelligence are designed for include speech recognition, learning, planning and problem solving. Its aims to create intelligent machines. It has become an essential part of the technology industry. A.I. is a branch of computer science that studies the computational requirements for tasks such as perception, reasoning and learning and develop systems to perform those tasks.

It is the ability to achieve complex goals in complex environment using limited computational resources. AI is a broad topic, consisting of different fields, from machine vision to expert systems. The element that the fields of AI have in common is the creation of machines that can "think".

In order to classify machines as "thinking", it is necessary to define intelligence:-

A. To respond to situations very flexibly.
B. To make sense out of ambiguous or contradictory messages.
C. To recognize the relative importance of different elements of situations
D. To find similarities between situations despite difference
E. To draw distinctions between situations despite similarities which may link them.

AI currently encompasses a huge variety of subfields, from general-purpose areas such as perception and logical reasoning, to specific tasks such as playing chess, proving mathematical theorems, writing poetry{poetry}, and diagnosing diseases. Often, scientists in other fields move gradually into artificial intelligence, where they find the tools and vocabulary to systematize and automate the intellectual tasks on which they have been working all their lives. Similarly, workers in AI can choose to apply their methods to any area of human intellectual endeavor. In this sense, it is truly a universal field.

AI has always been on the pioneering end of computer science. Advanced-level computer languages, as well as computer interfaces and word-processors owe their existence to the research into artificial intelligence. The theory and insights brought about by AI research will set the trend in the future of computing. The products available today are only bits and pieces of what are soon to follow, but they are a movement towards the future of artificial intelligence. The advancements in the quest for artificial intelligence have, and will continue to affect our jobs, our education, and our lives.

2. Approaches to AI

A. **Symbolic Computational Systems**-The thesis of *Good Old Fashioned Artificial Intelligence* (GOFAI) is that the processes underlying intelligence are symbolic in nature. A Turing model [10] of intelligent behavior, viewed as essentially computational, inspired these first steps into the development of “artificial intelligence”. More specifically, GOFAI models human intelligence as von Neumann computational architectures that perform computations on abstract symbolic

representations. These computations are governed by a stored program, which contains an explicit list of instructions or rules. These rules transform the symbolic representations into new symbolic states. As such, GOFAI depicts mentality within the context of what philosophers know as the *Representational Theory of Mind* , according to which the mind is an entity that performs calculations on mental representations or symbols, which refer to features of the outer world.

B. **Computational Representational Understanding of Mind**- Thagard defines a central hypothesis of cognitive science, the Computational-Representational Understanding of Mind (CRUM):

C. **The Real World & New Artificial Intelligence** - The fundamental difference between the *representation* (or "Classic AI") and *perception* (or "New AI") based approaches lies in the degree of interaction between the "body" and the "brain". The term *New Artificial Intelligence* is a recently coined term and has been used by researchers like Pfeifer *et al.* [8] in discussing embodied cognitive systems and in particular mobile robots. *New AI* is a new methodology for studying intelligence and for understanding the mind with a view to providing a framework for alternative approaches to the classical stance. One of the main characteristics of *New AI* is its investigation of system-environment interaction. Although neuroscience, and in particular the field of neural information processing, has a bias towards information processing, it is becoming ever more obvious that there are two dynamics, namely the control architecture, and the environment. When integrated properly, there can be cooperation between the two, which could result in control architectures utilizing certain environmental properties to their benefit. A robot's control architecture determines how behavior is generated based on signals from sensors and to motor systems.

3. Embodiment in Robotics

René Descartes is referred to as the father of cybernetics due to his study of the human body as a machine. Descartes, in *Meditations* [1], aimed to show that mind is distinct from body. He points out that even though he may have a body, his true identity is that of a thinking thing alone and, indeed, his mind could exist without his body. He argues that humans are spirits, which occupy a mechanical body, and that the essential attributes of humans are exclusively attributes of the spirit (such as thinking, willing and conceiving), which do not involve the body at all. Sense perception, movement, and appetite may require a body but they are only attributes of our body and not of our spirit and, hence, do not comprise our essence.

Experience in building robots has led Brooks to argue that embodiment is vital to the development of artificial intelligence [5] [2]. Brooks advocates the behaviorist approach to combat the difficulty in developing purely internal symbolic representational models of reality utilized in classical AI approaches.

Clark uses the term "blueprints", indicating a highly detailed plan or specification, in discussing cognition and specifically "embodied cognition" in relation to the developmental process in infants, according to which "*mind, body and world act as equal partners*" [13]. Clark follows the notion that embodiment is crucial to intelligent systems, which research has traditionally tended to dissect.

Embodied cognition is unique for all natural systems. This is due to the individual experiences collected during a system's lifetime. It is little argued that intelligent systems are required to have some learning from experience mechanisms in order to function in complex nondeterministic environments. The system must be able to update and add to its knowledge set in order to survive.

4. Applications of AI

Expert systems - An Expert System is a computer program designed to act as an expert in a particular domain (area of expertise).

Expert systems currently are designed to assist experts, not to replace them, They have been used in medical diagnosis, chemical analysis, geological explorations etc.

A. **Natural Language Processing (NLP)-** The goal of NLP is to enable people and computers to communicate in a natural (humanly) language (such as, English) rather than in a computer language.

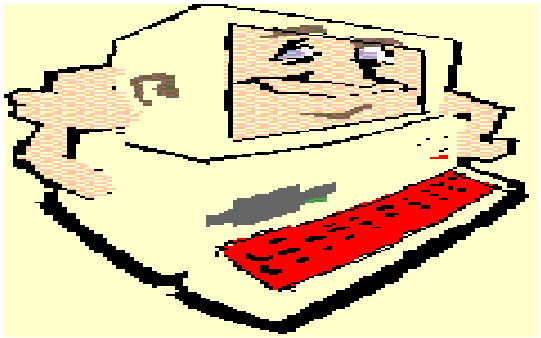

Figure 1. Natural Language Processing

B. **Speech Recognition**- The primary interactive method of communication used by humans is not reading and writing, it is speech. The goal of speech recognition research is to allow computers to understand human speech. So that they can hear our voices and recognize the words we are speaking. It simplifies the process of interactive communication between people and computers, thus it advances the goal of NLP.

Figure 2. Speech Recognition

C. **Game playing**- You can buy machines that can play master level chess for a few hundred dollars. There is some ai in them, but they play well against people mainly through brute force computation--looking at hundreds of thousands of positions. To beat a world champion by brute force and known reliable heuristics requires being able to look at 200 million positions per second.

D. **Computer Vision**- The world is composed of three-dimensional objects, but the inputs to the human eye and computers' TV cameras are two dimensional. Some useful programs can work solely in two dimensions, but full computer vision requires partial three-dimensional information that is not just a set of two-dimensional views. At present there are only limited ways of representing three-dimensional information directly, and they are not as good as what humans evidently use.

5. Advantages of AI

A. THE INTRODUCTION OF AN ARTIFICIAL INTELLIGENCE INTO MACHINE WILL ENABLE THEM TO THINK.

B. AI MAKE THEM CAPABLE OF LEARNING AND REASONING.

C. IT MAKES THE MACHINES ABLE DO TO CRITICAL TASKS.

6. Disadvantages of AI

A. **Human Feel** - as they are machines they obviously can't provide you with that 'human touch and quality', the feeling of a togetherness and emotional understanding, that machines will lack the ability to sympathise and empathise with your situations, and may act irrationally as a consequence.

B. **Inferior** - as machines will be able to perform almost every task better than us in practically all respects, they will take up many of our jobs, which will then result in masses of people who are then jobless and as a result feel essentially useless. This could then lead us to issues of mental illness and obesity problems etc.

C. If robots start replacing human resources in every field, we will have to deal with serious issues like unemployment In turn leading to mental depression, poverty and crime in the society.

D. Secondly, replacing human beings with robots in every field may not be a right decision to make. There are many jobs that require the human touch. Intelligent machines will surely not be able to substitute for the caring behavior of hospital nurses or the promising voice of a doctor. Intelligent machines may not be the right choice for customer service.

E. One of the major disadvantages of intelligent machines is that they cannot be 'human'. We might be able to make them think. But will we be able to make them feel?

F. Intelligent machines will definitely be able to work for long hours. But will they do it with dedication? Will they work with devotion? How will Intelligent machines work wholeheartedly when they don't have a heart?

G. Compared to a biological mind, an artificial mind is only capable of taking in a small amount of information.

7. Simulated Embodied Agents

Why simulated embodied Agents

Embodied artificial intelligence research may thus be pursued using artificial simulated agents (animats).

Simulators are a useful tool. It is a very simple (and thus, fast and convenient) simulator that allows the study of an agent capable of spatial movement and the manipulation of discrete objects.

A. Embodiment and Artificial Intelligence

There is an increasing awareness among the scientific community that genuine intelligence (adaptable, flexible, robust) can emerge only in a system that is embodied (i.e., has a body through which can interact with the external environment, using sensors and effectors), and is situated in an environment it can interact with. The essential implication of embodiment is the bidirectional, circular interaction between the body of the cognitive agent and the environment: some of the agent's actions change the state of the environment, thus changing also the influence of the environment on the agent (partly perceived through the sensors). This coupling permits the exploration by the agent of the structure of the environment and the discovery of structural invariants, through a process which depends on the sensorimotor capabilities of the agent and its goal. The agent can thus develop its own conceptualization of the environment, through self-organization and learning. The grounding of concepts on the sensorimotor interaction with the environment eliminates the problems of classical AI (lack of robustness; the lack of access to the semantic content of designer-provided symbols or categories; the confusion between the agent's perspective While embodiment generally implies a real and the observer's perspective).

B. Simulated Embodied Agents

Physical body, like those of animals and robots, several studies have argued that the importance of embodiment is not necessarily given by materiality, but by its special dynamic relation with the environment. This relation can also emerge in environments other than the material world, such as computational ones. The environment can be a simulated physical environment, or a genuinely computational one, such as the internet or an operating system. Simulated physical environments may be connected to the sensors and effectors of real physical agents, as in virtual reality, or may also simulate the body of the agent.

Embodied artificial intelligence research may thus be pursued using either physical robots or artificial simulated agents (animats). There are several advantages of using animats. It is much simpler to modify the body of a simulated agent than to modify a preexisting robot: it may require changing a few lines of code, versus many hours of engineering work. A simulated agent may be much cheaper to code, in comparison with the cost of a real robot. In simulation, one does not have to worry about charging the batteries. Common real robots have an autonomy of just several hours, when running on batteries. Simulated robots do not wear off, thus imposing recurrent costs on the experiment, neither break, which may result in unwanted interruptions of the experiments. In general, since the hardware considerations may be omitted, there is more time to focus on the conceptual issues.

Simulation of some simple environments, like in navigation experiments, may also be faster than real time. This makes simulation preferable for experiments where the cognitive system of the agent is generated with evolutive methods, where the behavior of generations of agents in the environment has to be tracked for long periods of time. Evolutive methods may also require the repositioning of the agent in the environment, when starting a new training epoch, which may need to be done manually for robots, but can be done automatically for animats.

There are also disadvantages of simulation. It is hard to simulate the dynamics of a physical robot and of an environment realistically, especially if the simulated agents have many degrees of freedom. In the real world, the dynamics is simply given by the laws of physics. A simulated environment is always simpler than the real world, with its infinite richness. This simplification is based on the designer's perspective of what features of the environment are important and what are negligible. On one hand, this limits the possible ontologies that the agent may develop. On the other hand, it may limit the capability of the agent to deal with the complexity of the real world.

However, if the purpose of the research is not the design of control systems that should also work in the real world, but rather the study of theoretical issues (e.g., sensorimotor integration, the self-organization of a neural system in interaction with an environment, the grounding of concepts on the sensorimotor interaction, paradigms for the emergence of representation in embodied neural systems), simulators are a useful tool. This paper presents a new simulator adapted for this purpose. It is a very simple (and thus, fast and convenient) simulator that allows the study of an agent capable of spatial movement and the manipulation of discrete objects. The simulator may thus be useful for studies of the emergence of the concept of object from the sensorimotor interaction, and also for studies involving navigation or spatial cognitive skills.

Advantages of Animats-

a) It agent than to modify the body of a preexisting robot .is much simpler to modify the body of a simulated.
b) Simulated agent may be much cheaper to code, in comparison with the cost of a real robot.
c) In simulation, one does not have to worry about charging the batteries. common real robots have an autonomy of just several hours, when running on batteries.

8. Conclusion

We conclude that if the machine could successfully pretend to be human to a knowledgeable observer then you certainly should consider it intelligent. AI systems are now in routine use in various field such as economics, medicine, engineering and the military, as well as being built into many common home computer software applications, traditional strategy games etc.

AI is an exciting and rewarding discipline. AI is branch of computer science that is concerned with the automation of intelligent behavior. The revised definition of AI is - AI is the study of mechanisms underlying intelligent behavior through the construction and evaluation of artifacts that attempt to enact those mechanisms. So it is concluded that it work as an artificial human brain which have an unbelievable artificial thinking power.

A. A.I. is becoming more and more prominent in our society each year
B. From its origins, A.I. has become a topic of extreme interest, and endless possibilities
C. As time goes on its effect on the business world will only become stronger

9. Future Work

The day is not far when you will just sit back in your cozy little beds and just command your personal Robot's to entirely do your ruts . He will be a perfect companion for you. Just enjoy the Technology**.**

But wait, don't be happy. It may end in other way too. Some day there will be a knock to your door. As you open it, you see a large number of Robots marching into your house destroying everything you own and looting you.

This is because ever since there is an advantage in the Technology, it attracts anti-social elements. This is true for Robots too. Because now they will have full power to think as human, even as of anti-social elements. So think trice before giving them power of Cognition.

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