Convergence of Artificial Intelligence, Emotional Intelligence, Neural Network and Evolutionary Computing

Neeraj Kumar(15491), Ayush Singla(15462)

INFORMATION TECHNOLOGY

DRONACHARYA COLLEGE OF ENGINEERING

neeraj.136@gmail.com, shubhamsingla081@gmail.com

Abstract

This paper presents a new perspective of Artificial Intelligence (AI). Although, number of attempts has been made to make an artifact intelligent, including evolution theory, neural network etc and a number of problems have been solved using these concepts but each of this theory covers only some aspect of human intelligence. Still there is a large gap between artificial intelligence agent and human being. **Instrumental convergence** is the hypothetical tendency for most sufficiently intelligent agents to pursue certain instrumental goals such as self-preservation and resource acquisition.

Instrumental convergence suggests that an intelligent agent with apparently harmless goals can act in surprisingly harmful ways. For example, a computer with the sole goal of solving the Riemann hypothesis could attempt to turn the entire Earth into computronium in an effort to increase its computing power so that it can succeed in its calculations.

INTRODUCTION Artificial Intelligence (AI)

Although, artificial intelligence is a very general term but defining it precisely is very difficult. And the design of an artificially intelligent agent totally depends on the fact how we define the term _Artificial Intelligence'. Possibly, the right definition can lead us to develop a successful intelligent artifact. There are a number of definitions to define artificial intelligence. As discussed in [1] the successful definitions are along two dimensions: firstly, whether it is with respect to reasoning (thought) or behavior (action) and secondly, whether it is with respect to human or ideal (i.e. rational) as shown in the fig-1. If we consider the category-1 or category- 3 definition of AI then we try to develop an artifact that can think like and can act like human being respectively. Further, if we consider category-2 or category-4 definition of AI then we try to develop an artifact that thinks or acts optimally respectively. Even development of optimal agents (based on definition from category-2 and category-4) could be really useful for solving problems and Category-4 definition (i.e. Acting Rationally) is the standard and modern definition of artificial agent [1]. Fig.1 Four perspective of Artificial Intelligence Definitions given by Haugeland [2] and Bellman[3] belongs to the first category. Definitions given by Charniak[4] and Winston[5] falls under second category. Definitions given by Kurzweil[6] and Rich and Knight[7] belongs to third category. Finally, definitions given by Poole et al. [8] and Nilsson[9] give support to forth category. Brief discussion of all these definition is covered in [1]. A lot of research work has been done among all the dimensions depending upon the need. As a result we have different model of artificial agent following the definitions from different category. In this paper, we would be considering definitions from category 1 and 3 only, means we will be defining the intelligence in terms of human only. The motivation behind this is that rational agent is supposed to take rational decision but human is not expected to do so. And here the main. objective is to design and develop an artefact that can match thinking and acting process of a human being. So, first obvious thing is that what is the factor that differentiate between human being and a rational agent. And second thing is—is that factor plays any important role? So the first question is before us:

What are the factors that blocks the human from taking rational decision? Rational choice theory, also known as choice theory or **rational action theory**, is a framework for understanding and often formally modeling social and economic behavior.[1] Rationality, interpreted as "wanting more rather than less of a good", is widely used as an assumption of the behavior of individuals in microeconomic models and analysis and appears in almost all economics textbook treatments of human decision-making. It is also central to some of modern political science, sociology and philosophy. It attaches "wanting more" to instrumental rationality, which involves seeking the most cost-effective means to achieve a specific goal without reflecting on the worthiness of that goal. Gary Becker was an early proponent of applying rational actor models more widely.[4] Becker won the 1992 Nobel Memorial Prize in Economic Sciences for his studies of discrimination, crime, and human capital. The "rationality" described by rational choice theory is different from the colloquial and most philosophical use of the word. Typically, "rationality" means "sane" or "in a thoughtful clear-headed manner,." Rational choice theory uses a specific and narrower definition of "rationality" simply to mean that an individual acts *as if* balancing costs against benefits to arrive at action that maximizes personal advantage.[6] In rational choice theory, all decisions, crazy or sane, are postulated as mimicking such a "rational" process. Thus rationality is seen as a property of patterns of choices, rather than of individual choices: there is nothing irrational in preferring fish to meat the first time, but there is something irrational in preferring fish to meat *and* preferring meat to fish, regularly.

Early neoclassical economists writing about rational choice, including William Stanley Jevons, assumed that agents make consumption choices as to maximize their happiness. Twentieth century refinements of rational choice theory have eliminated such presumptions. In essence, the rationality assumed under modern rational choice theory is considerably narrower than its name might suggest—it mandates just a consistent ranking of choice alternatives. Contemporary work done under the rational choice theory paradigm typically does not investigate the origins, nature, or validity of the vast array of human motivations of human desire.

II. BIOLOGICALLY INSPIRED SOFT COMPUTING DOMAINS

2.1 Soft Computing The idea of Soft Computing was initiated in 1981 and was first discussed in [10] by Dr. Zadeh 1997. Dr Zadeh defined Soft Computing in its latest incarnation as the combination of the fields of Fuzzy Logic, Neuro-computing, Evolutionary and Genetic Computing, and Probabilistic Computing into one multidisciplinary system. The main goal of Soft Computing is to develop intelligent machines and to solve nonlinear and mathematically un-modeled system problems [11]. Out of these main five fields Neurocomputing, Evolutionary Computing and Genetic Computing are biologically inspired fields (i.e. they are developed on the basis of some biological phenomenon). Following paragraphs give a brief introduction of each field one by one. Neuro-Computing or Neural Networks As per discussion in [12] and [13] by Morton, ―Neural computing is the study of networks of adaptable nodes which, through a process of learning from task examples, store experiential knowledge and make it available for use‖. ANNs (Artificial Neural Networks) were actually realized in the 1940s. Warren McCulloch and Walter Pitts designed the first ANNs [14]. The first learning rule for ANNs was designed by Donald Hebb in McGill University [15]. Back-Propagation, Hopfield Nets, Neocognitron, and Boltzmann Machine were the most remarkable developments of that era [16].

2.3 Evolutionary Computing and Genetic Computing In nature, evolution is mostly determined by natural selection or different individuals competing for resources in the environment. Those individuals that are better are more likely to survive and propagate their genetic material. The encoding for genetic information (genome) is done in a way that admits asexual reproduction, which results in offspring that are genetically identical to the parent. Sexual reproduction allows some exchange and reordering of chromosomes, producing offspring that contain a combination of information from each parent. This is the recombination operation, which is often referred to as crossover because of the way strands of chromosomes cross over during the exchange. The diversity in the population is achieved by mutation operation. Usually found grouped under the term evolutionary computation or evolutionary algorithms [16], are the domains of genetic algorithms (GA) [17], evolution strategies [18][19], evolutionary programming [20], and genetic programming [21]. These all share a common conceptual base of simulating the evolution of individual structures via processes of selection, recombination, and mutation reproduction, thereby producing better solutions. Now, Let we see the genetic computing from the perspective of artificial intelligent agent. The main key concept behind evolutionary algorithm is that the next-generation exhibits the intelligence or quality (capability to solve problem) better than parent or at least equal to parent generation. If it is not then it has got less probability for surviving. Now, question is what makes a human capable to solve problems? Obvious answer is brain (i.e. Neural network). So if we say that child exhibits its parent's problem solving capability then (possibly) it is because it has got neural-architecture somewhat similar to its parent. Although medical science has proven that the genes of child match with those of parent but it does not say that this is the only similarity between parent and child. I argue that like genes, each child inherits neural-network from its parent (especially in case of artificial agents). Genes is the way through which the process of inheritance is possible but the actual reason behind the fact that new generation is expected to have some inherent problem solving capability from birth is due to Inheritance of neural-architecture (brain architecture) from parent generation.

III. ARTIFICIAL INTELLIGENCE AND EMOTIONS

The Emotion Machine: Commonsense Thinking, Artificial Intelligence, and the Future of the Human Mind [1] is a 2006 book by cognitive scientist Marvin Minsky. The book is a sequel to Minsky's earlier book *Society of Mind*.

Minsky argues that emotions are different ways to think that our mind uses to increase our intelligence. He challenges the distinction between emotions and other kinds of thinking. His main argument is that emotions are "ways to think" for different "problem types" that exist in the world. The brain has rule-based mechanisms (selectors) that turns on emotions to deal with various problems. The book reviews the accomplishments of AI, what and why it is complicated to accomplish in terms of modeling how human beings behave, how they think, how they experience struggles and pleasures.[2]

IV.INHERITANCE OF NEURAL NETWORK After discussing about the importance of emotions for designing intelligent agent in Section-III, in this Section we would see that instead of inheriting only genes if neural network is also inherited from parent generation to child generation then it can immediately solve some of the problems. Although, medical science has found a number of diseases that a child inherits from its parent due to genes. But, as far as I know medical science has not discovered any genes responsible for transferring intelligence of one generation to another. We can see the fitness of the argument that child inherits its parent neural architecture by considering some natural phenomenon. Generally, if parent generation is intelligent, good at solving problem etc then the child generation also exhibits somewhat similar properties. But, some time it does not happen---Even the genes of child match with parent. Why so? The question can easily we answered by considering the theory that child inherits its parent's neural-architecture. If child does not exhibit parent intelligence then it is because it has not inherited the neural architecture properly (although it has inherited the genes). So the moral of the discussion is, instead of giving emphasis on only inheriting the parent's genes as in Evolutionary Computing the emphasis should be given on inheriting the neural-architecture too. This could solve a number of problem and limitations we are facing with evolutionary computing, especially when applying these to design intelligent systems i.e. artificial agents (of course, optimization problems can be solved just by considering inheritance of genes only).

V. DO WE NEED TO INHERIT ENTIRE THE NEURAL ARCHITECTURE FROM PARENT TO CHILD? Now, if we assume that child must inherit its parent's neural architecture to match the intelligence of previous generation. But still, the fact is child is rarely as intelligence as parent. Child is more intelligence than parent in only some of the quality (that makes it fit for survival). But generally parent always found to be having more wide range of intelligence than child. So, if we copy the entire neural architecture than child will become intelligent exactly like parent which does not happen in nature. Further it would incur more cost as copying the entire neural architecture is not so easy. Therefore, in order to take into account all these facts we should divide the neural architecture of an agent into two parts:

1. Inheritable Neural Architecture
2. Non-Inheritable Neural Architecture Inheritable Neural Architecture is that part of neural architecture in an agent that is copied (after some mutation) into child during crossover. While, Non-Inheritable Neural Architecture is that part which is not copied to next generation and remains local to that generation only. In this paper I tried to present a new view of artificial intelligence from scratch. No doubt, the tradition view (rational agent approach) that we are following from very long time is also successful up to some extent, but it lacks the feel of actual intelligence. In this paper the main emphasis is given on two things. Firstly, emotions must be takes into account while developing an intelligent agent. Secondly, instead of inheriting only genes as a result of crossover as in Evolution Computing, we should inherit some part of neural architecture of the parent generation for applying evolutionary computing on artificial agents. At the core, this paper extends the concept of intelligence by augmenting it with emotions and extends the concept of Evolution Computing by augmenting it with neuralinheritance.

VI.CONCLUSION Finally, although there is no formal proof of the concept I have introduced in this paper, I have realized them by explaining some natural phenomenon. And since, these are nature inspired computing they must be able to confirm maximum possible natural phenomenon.

VII. RESULTS AND FUTURE There is no as such result to discuss here except that newly introduced concepts discussed in this paper make the artificial agent more close to natural agent with respect to intelligence. In this paper we discuss these concepts only by theoretical discussion without giving any architecture for agent or anything that can be used directly in designing the agent. In the near future I or some other one might be developing some agent architecture based on these specifications.

VIII. REFERENCES

[1] Sturt Russel, Peter Norvig, ―Artificial Intelligence: A Modern Approach‖, Third Edition PHI

[2] Haugeland, J. (Ed.). (1985). Artificial Intelligence: The Very Idea. MIT Press.

[3] Bellman, R. E. (1978). An Introduction to Artificial Intelligence: Can Computers Think? Boyd & Fraser Publishing Company.

[4] Charniak, E. and McDermott, D. (1985). Introduction to Artificial Intelligence. Addison-Wesley.
[5] Winston, P. H. (1992). Artificial Intelligence (Third edition). Addison-Wesley.
[6] Kurzweil, R. (1990). The Age of Intelligent Machines. MIT Press.