ARTIFICIAL SUPERINTELLIGENCE: FEASIBILITY & POSSIBLE OUTCOMES

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ABSTRACT: Artificial intelligence has been a topic of debate for many decades. Despite many attempts nobody has still been able to design a machine that can be categorized as an AI in true sense, but with recent developments in various fields ranging from new improved machine learning techniques to various hardware developments, a ray of hope has emerged that in near future we may be able to achieve a true AI and with this a question has emerged that what if we design one and what if it surpasses the intelligence level of humans i.e. reaches super-intelligence .This paper deals with such questions and various others like the feasibility and possibilities of such an AI being developed.

KEYWORDS: Super intelligence, Artificial Intelligence, HMLI, ANI, AGI, ASI

I. INTRODUCTION

Humans are the most intelligent species on planet earth till date and using this "intelligence" human's have invented various things, computers being a revolutionary one. Computers a have made our lives a lot easier , they can compute and process much faster than us humans but their biggest drawback is they cannot perform any task on their own ,i.e. they need instructions for each and every step which we provide them in the form of algorithms translated into machine instructions. To overcome this drawback attempts are being made to impart intelligence to computers, a number of methods have been proposed & a very few of them survived which looked promising (like ANN, Genetic algorithms, Ensemble techniques etc) but till now no technique or algorithm has been devised that can be used to design a machine with an intelligence at par with humans.

With significant improvement in the hardware capabilities and related area's a number of AI experts and scientists are optimistic about achieving HMLI (Human Level Machine Intelligence) in near future. Some of them are already thinking beyond HMLI and are debating about what if a machine surpasses human level of intelligence i.e. achieve super intelligence.. In this paper the feasibility and all the possibilities of super intelligence & its possible outcomes are discussed.

II. BACKGROUND

The idea of intelligent machines goes back to mid 20th century, when in 1950 Alan Turing published a landmark paper in which he speculated about the possibility of creating machines that can think . He noted that *thinking* is difficult to define and devised his famous Turing test [1].Various programs and machines have been developed till then that can perform some specialized tasks with great expertise like proving mathematical theorems , playing chess etc but their expertise cannot cross the boundaries of their specific domains.

III. AI CATEGORIZATION

Intelligence can be defined as the ability to learn new things and to be able to apply them to solve problems. Every living being possess some level of intelligence. Among all the living being humans enjoy the privilege to be on the highest level of intelligence and the reason mainly being their enhanced reasoning capabilities & language use .They differ from other animals like chimpanzees (which are just below humans in the hierarchy of intelligence) in the ways they think more than in number of neurons or information processing speed.

A Machine that posse's intelligence is said to be an AI machine. Major AI researchers and textbooks define this field as *"the study and design of intelligent agents"* [2]. Artificial Intelligence is making a computer that thinks like a human-to be able to learn and to have "new ideas". Computers are

very good at following exact orders, and handling very specific things, but not good at dealing with new things they haven't encountered before.

Artificial Intelligence can be broadly categorized into three categorized into three categories based on its calibre:-

1. *Artificial Narrow Intelligence (ANI):* Artificial Narrow Intelligence is that AI that has its expertise in only one narrow domain. Computers possessing this level of AI can do specific tasks related to their domain in a much better way than humans but cannot perform any task out of their expertise domain using their intelligence .It is sometimes also referred as Weak AI. All the intelligent systems developed till date fall under this category whether it is 'logic theorist' of 20th century or today's *Siri.*

2. *Artificial General Intelligence (AGI):* Artificial General Intelligence refers to a computer which posses the same level of intelligence as a human – a machine that can perform any intellectual task that a human being can perform .It is also referred as HMLI (Human Level Machine Intelligence).

Computers can perform formal tasks with so much ease but cannot perform mundane common-sense tasks that are extremely easy for us to perform, for e.g. it is comparatively easy to design a system that can massive calculations but very difficult to design a system that can look at picture and can extract sentiment depicted in it or that can extract different physical objects with high accuracy.

Computer Scientist Donald Knuth puts it as *"AI has by now succeeded in doing essentially everything that requires "thinking" but has failed to do most of what people and animals do 'without thinking' "* [3]. The answer to this is things that seem very to us are unbelievably complicated but are easy for us because these skills have been optimized in us by millions of years of evolution. On other hand Addition, multiplication, subtraction, proving mathematical theorems, playing game of chess is comparatively new activities for our biological brains.

3. *Artificial Super Intelligence (ASI):* Super intelligence can be defined in the word of Oxford Philosopher & leading AI thinker Nick Bostrom as *"An intellect i.e. much smarter than the best human brains in practically every field, including scientific creativity, general wisdom and social skills."*[4] Artificial Super intelligence ranges from a computer that is just a little smarter than a human to one that is hundreds and thousands of times smarter than humans.

IV. FEASIBILITY OF HLMI

The two main reasons that can be considered as biggest barrier in achieving HLMI are: Hardware limitations and effective mapping of reasoning and learning abilities to algorithms or other implementation techniques.

Hardware Limitations: The constraint of hardware limitations is mostly concerned with limited computational power that current hardware capabilities provide us with. Taking into consideration the computational power of our brain in CPS (Calculations per Second) then summing it up for all the structures in brain we can get an approximate of total CPS of our brain .Raymond Kurzweil came up with a shortcut by taking someone's professional estimate for the CPS of one structure and that structure's weight compared to that of the whole brain and then multiplying proportionally to get an estimate for the total .It always came to be near 1016 or 10 quadrillion CPS when repeated a no. of times with various professional estimates of different regions [5] . Super-Computers like Titan & Tianhe-2 today have actually surpassed this processing speed but in terms of ratio to size performance they are still a no match for our biological brain.

A significant improvement in hardware in near future may lead to computers that match the performance of biological brains in terms of size to performance ratio but the fact that keeping this ratio aside, currently there are h systems (very few) which surpass our biological brains in processing speed (in CPS) and thus we may classify these hardware limitations as secondary constraints and those which can be worked out.

REASONING AND LEARNING ABILITIES

The primary constraints that are biggest barrier towards our realization of imparting intelligence to machines are no effective technique available to map reasoning & learning abilities to algorithms and other implementation techniques. A few proposed strategies by various AI experts are:

I.   ***Recursive self-improvement:*** The strategy is to develop a system with specific skills of self improving its own architecture i.e. with a specialization of development of AI.

II. ***Biological brain mapping:*** This strategy works on the basis of reverse engineering and its working is based on emulating human brain. Those in favour of this theory state it like this "we have the most complex super computer in our heads that evolution gave us ,why to work so hard on building one from crap just study it and emulate it". Till now a worm brain, which consists of just 302 neurons has been perfectly emulated [6]. This strategy is also known as 'Brain Plagiarism'.

III. ***Evolutionary algorithms:*** In this strategy, a more comprehensive approach is followed which makes use of evolutionary algorithms. Evolutionary algorithms try to emulate natural process of evolution .Genetic algorithms along with some other evolutionary algorithms are used for performance and evaluation process which works in loops after every single iteration the two most successful techniques are merged and result into a new hybrid and the least successful ones are eliminated. Making "Intelligence" the primary attribute of selection is the main issue that needs to be worked upon yet.

V. ARTIFICIAL SUPERINTELLIGENCE

Once if HLMI is achieved, this might lead to super intelligence .Nick Bostrom puts it like "We can tentatively define super intelligence as any intellect that greatly exceeds the cognitive performance of humans in virtually all domains of interest."Super intelligence can be defined as "A super intelligence or hyper intelligence is a hypothetical agent that possesses intelligence far surpassing that of the brightest and gifted human minds". Super intelligence may also refer to the form or degree of intelligence possessed by such an agent.

Once a machine surpasses HLMI its intelligence level may increase exponentially instead of linear increase and may lead to an "Intelligence explosion". *Intelligence explosion* is a state which arrives when a computer repeatedly keeps on self improving using recursive self improvement , the growth in initial phases increase in a linear fashion but soon starts increasing exponentially.

A majority of AI experts and scientists are optimistic about the realization of HLMI but differ in their views on the time when it will be achieved.

According to Nick Bostrom *"Super intelligence would be the last invention humans would ever need to make, since, by definition, it would be much better at inventing than we are. All sorts of theoretically possible technologies could be developed quickly by super intelligence whether it be advanced molecular manufacturing, medical nanotechnology, human enhancement technologies, uploading weapons of all kinds ,lifelike virtual realities , self –replicating space-colonizing robotic probes ,and more"*[3]

If humans with an IQ ranging from 85-155 could invent and discover so much, then the possibilities for a machine with a much more IQ are immense.

Possible Outcomes: A number of AI experts have this view that we are about to reach the threshold and most of them are optimistic about this but they differ on when this will happen, for some next two decades seem to the time ,for others next century is the time when this will happen. Once this happens there are two possible outcomes, each one of them supported by different groups of experts and scientists.

Favourable Outcomes: There are number of favourable outcomes that are possible with the advent of ASI. We may be able to solve many major problems we face today like:

- Global emissions & pollution could be eliminated from our environment by controlling CO_2 emissions.
- Cures for various deadly diseases like cancer & AIDS could be easily found
- Technologies for better artificial limbs or regeneration of natural limbs using cross genetic engineering

One   possible outcome which may seem far-fetched to many could be human age reversal techniques. Evolution had no good reason to extend human lifespan any longer than they are now. If one lives long enough to reproduce and raise offspring to an age at which they can feed for themselves, that's

enough for evolution. Since, because everyone has ever died, we live under the assumption that death in inevitable .Richard Feynman puts it like this *"It is one of the most remarkable things that in all biological sciences there is no clue as to the necessity of death. If you say we want to make perpetual motion, we have discovered enough laws as we studied physics to see that it is either absolutely impossible or else the laws are wrong, but there is nothing in biology yet found that indicates the inevitability of death. This suggests to me that its is not at all inevitable and that it is only a matter of time before the biologists discover what it is that is causing the trouble and that this terrible universal disease or the temporariness of the human's body will be cured."*

Nanotech theorist Robert A. Freitas has already proposed a theoretical design of blood cell replacements that, if one day implemented in the body, would allow a human to sprint for 15 minutes without taking a breath named as *reciprocates* [7]. Ray Kurzweil believes humans will ultimate conquer our biology and become indestructible and eternal. [5]

POSSIBLE CONSEQUENCES: The views of noted physician and great scientist Stephen Hawking on the development of ASI are *"could spell the end of human race"*, Bill Gates says *"he doesn't understand why some people are not concerned"*. Eon Musk fears that *"we are summoning the demon"* [8], another pool of experts that doesn't support the idea of super intelligence consider the ASI as biggest threat to humanity.

Nick Bostrom worries that creating something smarter than you is a basic Darwinian error and when you combine *not well –understood area of field with this should have a major impact when it happens* then it may lead to an existential risk [3]. Typically existential risk means extinction. Elzier Yudkowsky states his concern like this *"The AI does not hate you, nor does it love you, but you are made out of atoms which it can use for something else".* [9]

VI. CONCLUSION

The possibilities of development of an HLMI clearly depend upon some breakthrough development in the area of candidate techniques based upon which HLMI could be developed. As for now there is no such technique capable of being employed to impart HMLI to machines, so as far as for few years from now feasibility of developing HLMI seems to be bleak. The possibility of development of ASI seems logical and very much possible if and once we are able to develop HLMI and further depend upon the techniques and architecture used to develop HLMI. The possible outcomes related to super intelligence are dependent on the degree of control we will have over the architecture of such a system and whether it will have a conscience of its own or will be purely based on executing orders given to it to solve various problems making use of its own IQ to formulate solutions and corresponding instructions. By the time HLMI is achieved, some technique needs to be worked out to manually override the exponential growth that a system may achieve by introducing some suitable tripwire (threshold) mechanism to be on the safer side.

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