Applications of Synthetic Super-Intelligence

Kshitij Gautam

Abstract— Synthetic Super Intelligence refers to an intelligent agent which has a high factor of intelligence. Intelligence in this context is referred to as a quantity which is manufactured in exponential numbers in such an agent. The agent learns various perceptions, causalities, abstractions etc. iteratively from itself and its environment to gain such a high factor of intel-ligence. Such an agent is also self-dependent in terms of intelligence as it can learn its own code and rewrite it as it sees fit. It runs multiple iterations of itself over large amounts of data to learn and become intelligent. The working, design and practical applications of such an agent are discussed in this paper.

Index Terms— Artificial Intelligence, Artificial General Intelligence, Deep Learning, Intelligent Agents, Intelligent Systems, Machine Learning, Synthetic Intelligence, Super Intelligence

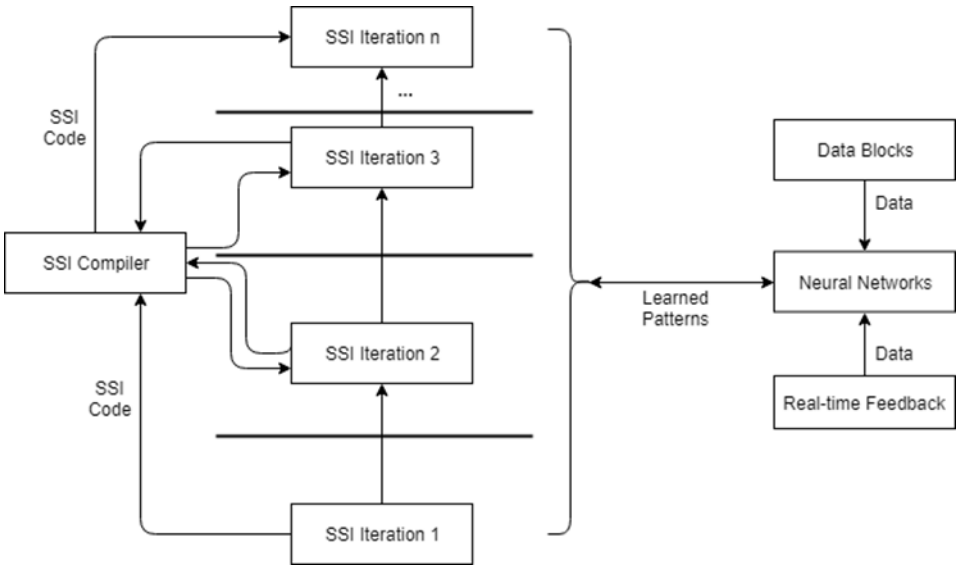
1 Introduction

THE term Synthetic Super-Intelligence draws from the areas of Artificial Intelligence, Synthetic Intelligence and Super Intelligence. Synthetic Super Intelligence (referred hereafter as SSI) refers to an intelligent agent whose intelligence surpasses the intelligence of large collective groups of human minds and by synthetic we mean it to have nature similar to that of the human minds in terms of growth and logic but rather surpassing it[8][12][18][20]. This analogy may be explained by comparing synthetic diamonds to real diamonds that the synthetic diamonds have the same crystalline structure to that of real diamonds but they are manufactured and are not naturally occurring[1]. An SSI agent will have an intelligence quotient by the factor of thousands because here we quantify intelligence as being manufactured in exponential numbers. Such an agent is also able to use quantum mechanical principles like entanglement or superposition to be able to solve the problems it encounters. Another main characteristic of a synthetically super-intelligent agent will be for it to really be above and ahead of any other intelligent agent in terms of calculation speeds and the algorithmic complexity inculcating within itself features like ability to predict and be conscious of various outcomes and perceptions of large amounts of decisions and actions taken by itself and its stimulants, ability to extend and improve not only its knowledge but the factor by which its intelligence grows, ability to recognize the relation ships and patterns in the causality of such actions and reflect on them, ability to predict and judge the information which cannot be known by standard means and ability to differentiate and yet find the relations amongst the reality and abstraction of its situations and subjects. Such an agent will not only follow reasoning but be able to define and create it. The understanding of such an agent is extended beyond the human notions and concepts of intelligence.

Figure 1. Working of SSI

2 Background and History

The term "Super Intelligence" was first coined by Nick Bostrom to describe an agent whose intelligence surpasses human intelligence[3]. John Haugeland coined the term ”Synthetic Intelligence” using the diamond analogy described above[1]. "Turing Test" designed by Alan Turing is designed to test an intelligent agent for human-like capabilities[9][29]. SSI here inherits from approaches like cognitive modeling, laws of thought and rational agent[2][21]. Various commercial implementations of an Artificial Intelligence in machines are



Siri by Apple, Alexa by Amazon and Google Assistant by Google. SSI differs from such agents as it aims to develop very high intelligence quotient as it becomes more experienced. Such high intelligence quotient and understanding of various perceptions of such data enables it to be very efficient in problem-solving and knowledge inference[11]. It might be possible for such an agent to pass the Turing test simply because it possesses intelligence higher than current notions of intelligence.

3 WORKING OF SSI

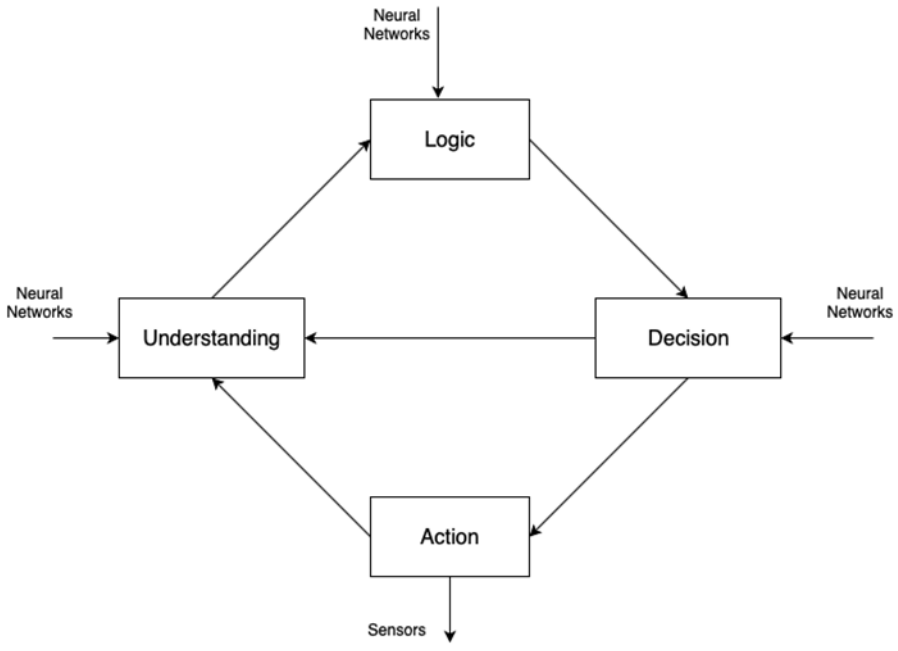
The SSI works along with the concepts of deep learning, procedural programming and self-correcting code. Such an agent will use deep learning models to learn all the relationships, actions, patterns and behaviors of its stimulants as well as it will recursively learn and reanalyze from the patterns it learns[4][10][13][14]. It will learn its own code and will be able to change and optimize it accordingly as the need arises by writing and compiling its own code thus incorporating within itself the changes reflected in situations and variables. It shall be able to run multiple iterations of itself over various large blocks of data so as to learn the various perceptions of such data. Data blocks referred to here are enormously larger than the data sets currently used in deep learning[5] and data mining and span over various times and concepts. The patterns learned by an SSI are again run through another iteration of such an SSI to learn the patterns emerging from such patterns.[26][27][28][31] This process is repeated multiple times and thus SSI is able to learn the highest levels of generalized data recursively. The SSI engine here is also said to learn itself so that it can change itself. It learns its own code and parameters and compares it to the patterns it learned and rewrites it according to its own decisions and thus becoming independent of external changes by programmers to its code and being self-dependent in terms of intelligence. This self- dependence of its intelligence will lead it to be much smarter than current intelligent agents and combined with massive amounts of computing power (larger than large collective numbers of human brains combined or clusters of supercomputers combined), the limits of intelligence encountered by intelligent agents (both humans or machine) can be broken. Further such an agent can be made to "learn" the techniques of learning such that it can optimize them as it chooses and invent its own better techniques and incorporate such techniques within its code. Thus such an agent can be said to be conscious of at least its own workings[24]. Thus now, being able to manipulate itself, such an agent can manufacture within itself new levels of intelligence never seen before along with new techniques, patterns, formulas, ways of interaction and operations of data and so forth[7][15][16]. Figure 1. illustrates the typical working of an SSI.

Figure 2. Design of SSI.

4 DESIGN OF SSI

At least 4 modules must be designed and developed as the core requirements of such an agent[13][23]:

1. **Understanding**: The understanding module of such an agent will consist of the "knowledge" part of the SSI. It will consist of all the knowledge that the agent possesses. It may act as the memory of the agent. This module is constantly updated by the SSI to infer new conclusions from the knowledge it possesses and store such conclusions[22][23][30].



2. **Logic**: The logic part of the SSI consists of hard logic used by the agent. It is also constantly updated just like the under-standing module but such changes may be less likely because logic rarely changes. This logic module takes information from the understanding of agent and helps the agent to make decisions with decision module.

3. **Decision**: This module decides amongst the choices available for the agent on those to act. The Decision module is also constantly updated to help make agent better choices in situations. Further decisions taken here are acted upon by agent or agent may decide to take no action and only understand the repercussions of choices available to it.

4. **Action**: This module undertakes the action to be taken by the agent as a sum of past understanding, logic and decisions of the agent. This module can act on various devices and sensors like a thermostat, robotic arm, signal processors, signal generators etc. to produce required outcome. Further, the results gained from such action are logged to the understanding module of the agent so that it may process and infer knowledge from its action, such that it learns from its actions.

Figure 2. describes this design. As described in section "Working of SSI", the intelligence of agent becomes more finely tuned and the intelligence of agent increases as new information is made available.

5 General Algorithm/ Pseudocode of SSI

Figure 3 shows a general algorithm/pseudocode for SSI

Algorithm 1: SSI

```
while 1 do
    while no interrupt do
        // no external sensor data
        understand();
        recompile_code();
    end
    while interrupt exists do
        // external sensor data exists
        understand();
        apply_logic();
        decide();
        take_action();
        recompile_code();
    end
end
Function understand():
    // 1. Read data from neural networks.
    // 2. Compare to existing knowledge.
    // 3. Infer new knowledge across the contexts
     using an inference engine.
    recompile_code();
Function apply_logic():
    // 1. Read and consider existing knowledge.
    // 2. Compare choices and apply weightage
     to choices.
    // 3. Update Logic Module.
    recompile_code();
Function decide():
    // 1. Enumerate existing choices.
    // 2. Choose best weighted choice.
    if no action to be taken then
        // Update Decision Module.
        end_interrupt();
    else
        // Update Decision Module
        continue
    end
Function take_action():
    // 1. Activate sensors.
    // 2. Implement choices.
    // 3. Update Actions Module
    recompile_code();
    end_interrupt();
Function recompile_code():
    learn_existing_SSI_code();
    // SSI learns and relearns its own code
     through neural networks.
    // SSI compiler recompiles SSI code.
Function end_interrupt():
    // End of sensor interrupt. Program keeps
     executing while there is no interrupt.
```

Figure 3. General Algorithm/ Pseudocode of SSI

6 Applications and Practical Implementations

Various applications and practical implementations of such an agent may be as follows:

1. **Knowledge and Research**: Such an agent may help improve and improvise the current knowledge of various fields like mathematics, physics, cosmology, engineering, medical sciences etc. because of the high factor of intelligence such an agent possesses. It will be helpful in the study of various patterns, designs, methods, abstractions, causalities etc. It may also be helpful in studies related to space-time continuum and temporal complications simply because of the presence of a high factor of intelligence. For such applications, existing knowledge should be learned by such an agent with the help of neural networks. It may then infer and discover more of such knowledge. A phrase "**Saturation of Knowledge**" must be introduced here. Because such an agent possesses high intelligence, it may help us to reach such a point where the existing knowledge saturates and the domain of a particular field of knowledge is complete. After this, it may help us discover more knowledge across various domains and more of such points of saturation may be acquired.
2. **Strategies**: Such an agent may help us to devise new strategies for various types of work like fighting diseases, business and geopolitical strategies etc.
3. **Engineering**: New and more effective and efficient engineering solutions may be devised in fields like power generation, aviation, extra-terrestrial colonization etc.
4. **Entertainment**: Such an agent may help in the entertainment industry across the domains of music, narrative writing, poetry, art and such fields.
5. **Technological Singularity**: Such an agent will be helpful in gaining technological singularity. It may be helpful in furthering the intelligence of human beings and "Synthetic Evolution" with the help of machines[19][25].

7 Conclusions

Such an intelligent agent is a highly useful asset in the current market, engineering and research scenarios. Such an agent can enable advancement in various domains of knowledge as we discover the knowledge that is as of yet unknown.

8 Future Scope

Hardware implementations of such an agent will help design machines that are much smarter than humans and other intelligent agents. Such "Super Intelligent Machines"[6] may find uses and applications in various fields. The first step for this is to develop an SSI software that is capable as such. Then it may be implemented on Servers or on SOCs on which it may function.

References

[1] J Haugeland, John (1985). Artificial Intelligence: The Very Idea, Cambridge, Massachusetts. MIT Press.
[2] Stuart J. Russel, Peter Norvig (2009). Artificial Intelligence: A Modern Approach (3rd edition). Upper Saddle River, New Jersey: Prentice Hall.
[3] Nick Bostrom (2014). Superintelligence: Paths, Dangers, Strategies. Oxford University Press.
[4] Shane Legg (2008). Machine Super intelligence. Department of Informatics, University of Lugano.
[5] Yann LeCun, Yoshua Bengio & Geoffrey Hinton (2015): Deep Learning. Nature.
[6] Hibbard, Bill (2002). Super-Intelligent Machines. Kluwer Academic/Plenum Publishers.
[7] Yampolskiy, Roman V. (2015). "Analysis of types of self-improving software." Artificial General Intelligence. Springer International Publishing.
[8] Grace, Katja; Salvatier, John; Dafoe, Allan; Zhang, Baobao; Evans, Owain (2017). "When Will AI Exceed Human Performance? Evidence from AI Experts". arXiv:1705.08807
[9] Turing, A. (1950). Computing Machinery and Intelligence. Mind.
[10] Omohundro, S.M. (2007). The Nature of Self-Improving Artificial Intelligence, in Singularity Summit, San Francisco, CA.
[11] Jackson, Peter (1998). Introduction To Expert Systems (3rd edition), Addison Wesley
[12] Stephen M. Omohundro (2007). The Nature of Self-Improving Artificial Intelligence. Self-Aware Systems, Palo Alto, California.
[13] Hayes-Roth, Frederick; Donald Waterman; Douglas Lenat (1983). Building Expert Systems. Addison-Wesley.
[14] Smith, Reid (1985). "Knowledge-Based Systems Concepts, Techniques, Examples".
[15] Elain Rich, Kevin Knight (1991). Artificial Intelligence, TMH.
[16] Patrick Henry Winston (1992). Artificial Intelligence (3rd edition), Addition Wesley.
[17] Kendal, S.L.; Creen, M. (2007). An introduction to knowledge engineering, London: Springer.
[18] Joscha Bach (2007). Principles of Synthetic Intelligence PSI: An Architecture of Motivated Cognition, Oxford University Press.
[19] IEEE Handbook of Neural Engineering (2007)
[20] Somers, James. "The Man Who Would Teach Machines to Think". The Atlantic.
[21] Thagard, Paul (2008). Cognitive Science, The Stanford Encyclopedia of Philosophy.
[22] Hibbard, Bill (2012). "Model-Based Utility Functions", Journal of Artificial General Intelligence, 3: 1, arXiv:1111.3934
[23] B. Goertzel (1993). The Structure of Intelligence, Springer.
[24] B. Goertzel and C. Pennachin (2007). Artificial General Intelligence, Springer.
[25] Sandberg, Anders; Boström, Nick (2008). Whole Brain Emulation: A Roadmap. Future of Humanity Institute, Oxford University
[26] Voss, P. (2005). Essentials of general intelligence: The direct path to AGI. Artificial General Intelligence. Springer-Verlag.
[27] Eliezer S. Yudkowsky (2002). Levels of Organization in General Intelligence. Singularity Institute for Artificial Intelligence, Inc.
[28] Sternberg, R. J. (2000). Handbook of intelligence. Cambridge University
[29] Schweizer, P. (1998). The truly total Turing test. Minds and Ma-

chines.
[30] Yoshua Bengio (2009). Learning Deep Architectures for AI. Now Publishers Inc.
[31] Thurstone, L. L. (1924). The nature of intelligence. London: Routledge.