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Redefining Cartesian Reductionism in Biological Issues with Big Data, such as COVID-19 Worldwide Pandemic, Using Formalism based on the Intermediate Attitude of Rationalism and Empiricism

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Abstract

Reduction is a concept first introduced by Descartes in explaining his view of the rationalization of philosophy through mathematics. He seeks to consider length, breadth, and depth for phenomena so that reducing the phenomenon to his own analytical geometric apparatus; thus shrinking the whole world into a small machine. In the present study, the authors took into account the deficiency in defining the reduction of phenomena to a mathematically sound system as the reason for a large group of problems and therefore they came to redefine the Cartesian reductionism of phenomena by removing the search space through a learning system. In due definition, it is possible to reduce the NP problems to P space without using a quantum algorithm that requires a quantum computer to exist. The present study points out that the problems arising from the mathematical modeling of the Covid-19 pandemic are due to a deficiency in the definition of Cartesian reduction, which leads to an increase in the computational complexity of its diagnosis and treatment using computational tools.

Keywords: Computational Complexity, Reduction, Phenomenology of Biological Phenomena, Hilbert's Formalism

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Introduction

Phenomenology is the science of describing the phenomena the same as perceived by people; whether it is objective or not. Because from Husserl's point of view every single mental activity has specific perceived dimension. That is to say, what mind thinks of something is the result of certain mental perceptions at a specific moment, while the mental entity may not have an objective representation (Zahavi, 2003: 7-42). With complete and extensive knowledge of phenomena, their models are apt to be extracted. So, experience plays an important role in understanding phenomena and prediction theories. The modeling position of phenomena is grounded in experience and tries to tie it to the rationalist view of mathematics and computation. Phenomenal models are designed according to mathematical models and related existing abstraction (such as geometry, graph theory, Peano axioms, game theory and etc.). Having mathematical models it is possible to analyze and solve the modeled problem with different mathematical methods and present them in the form of computer simulators.

After mathematical modeling, computability as the mathematical basis of computer science answers the fundamental question of whether a model designed for a phenomenon is decidable. If so, is it solvable? If so, what are the various methods and algorithms for solving it, and how much does it cost to solve the problem in terms of computational complexity? This is where the concept of algorithm comes into play. A given algorithm may perform the desired operation with different commands in less or more time / work than another algorithm. Therefore, understanding the structure of algorithm is important in the computation of the phenomenon under the study; hence, selection of the appropriate and efficient algorithm has a high priority in the success and efficiency of given computer programs. Algorithms are considered as a technology that scientists design, analyze, and study. The study of algorithms covers several areas that can be called the life cycle of an algorithm (Skiena, 2012:3).

Descartes was the first one introducing the concept of reduction. He elaborated on the issue in explaining the rationalization of philosophy through mathematics. By considering length, breadth, and depth for given phenomena, he strives for reducing the phenomenon to his own analytical geometric apparatus; hence, reducing the whole world into a small machine. Because analyzing a small machine is much easier and less expensive than analyzing the entire universe(Grosholz, 1991:1-14).

Mathematical modeling of phenomena means the reduction of complex relations of phenomena. But the more complex the relations of a given phenomenon under study, the resulting models become much more incomputable and sometimes even undecidable. For a wide variety of these problems there exists no deterministic solution. And various classes of computational complexity arise from non-deterministic problems that challenge the P and NP problems. Artificial intelligence and machine learning, fuzzy logic, and generally what is called soft computing become helpful and provide a solution by considering the amount of related error. But if the modeling is related to a critical phenomenon such as a biological one that endangers the lives of millions of people in a pandemic worldwide, any amount of error is not desirable and the resulting problem is an NP problem with 23 states of space. It takes 178 centuries to reach a deterministic answer with a nanosecond computer (William J. Cook, 1998:2).

In modeled problems of given phenomena, another problem is their logical description and the use of a logical device because many of these phenomena are time-dependent and cannot be described by only the precedence and recency of propositional logic. As such, we need temporary logic. LTL and CTL as two types the fundamental logic provide a description of probabilistic and even quantum systems, but it is not possible to implement such systems with current hardware in large volumes of state space (Kwaitkowska, 2014:165).

It seems that the way of soft computing is a method based on empiricism, because it operates according to human learning and experience, and the way of using temporary logic is a method based on rationalism and its great tool, namely to say logic.

After the COVID-19 pandemic, which first outset in December 2019 in Wuhan, Hubei Province, China, after people developed pneumonia for no apparent reason and existing vaccines and treatments were ineffective (Organization (WHO), 2020); issues such as time consuming nature of treatment practices, description of pandemic post-situation, economic collapses, and changing political attitudes have been discussed. But there is no reduction system to accurately describe the circumstances. Thus, this challenge has again undervalued man, who, according to Heidegger, "by calculation, the man is not the shepherd of the universe"(Rockmore,1995:216), the situation is more unpredictable for him than ever before . Despite much bulk of research, the exact growth rate is still not available for growth, incidence and mortality from COVID-19 virus. There has also been discussions on treatment and vaccines for a long time, which may lead to the economic and social collapse of societies.

But if a new philosophical system could be created so that the Cartesian reduction possesses validity of mathematical evidence and is a receptive system for John Locke's empiricist system, it might be possible to achieve mathematical modeling systems that are much faster and error-free; and solve problems of NP classes with certainty.

1. Reduction Problem

There are countless successful examples of reducing seemingly irrelevant issues through a limited number of universal rules. Newton's universal rules in mechanics, finding universal interactions such as the gravitational interaction between two objects and reducing the interaction of the earth and the moon to it (Newton, 1687: 12-511), reducing chemistry to quantum electromagnetism or unifying relativity and gravity, and the emergence of general relativity by Einstein, are some examples of reduction based on universal rules (Weinberg, 2001: 15-42) that have sometimes led to the discovery of predictions in reduced models. Obviously, not every attempt regarding the issue of reduction has been successful. Einstein's failure to unify electromagnetism (Weinberg, 2001: 15-42) and gravity is an example of the failure of the reductionist design of problems.

Hilbert's failure to formalize the Peano axioms, which proved to be incompatible with Gödel's incompleteness, is a major example of the failure of the reductionism. The idea of Hilbert's program was that by providing finite-like reconstruction of mathematics, the problem of consistency could be transferred from the whole mathematics to a limited number of obvious axioms with a very satisfactory proof rule. Because the finite-like reconstruction enabled the individual to show that any reference to the infinite objects that are shaped/created along the way can be removed. That is to show that it is only a shortened form of reference. The ultimate goal is to provide a proof for consistency with a finite tool. The ultimate goal was a proof of compatibility of a finite instrument. In philosophical debates, whether right or wrong, it is declared that Hilbert's program has been related to formalism; the idea that mathematics could be reconstructed empty-of-content, or, to put it more rigorously, that mathematics is nothing more than a "formal game with symbols." Others accepted the idea that Hilbert's school was committed to the idea that mathematics was, in principle, descriptive and therefore possessing specific content; therefore, only the correctness of its methods should be formal and finite. (Kennedy, 2018: 1-3).

Now, perhaps one can define the issue of reductionism as follow:

Any phenomenon that can at least be expressed, described, or predicted by a universal law is called a reduction-able phenomenon.

In other words, a problem can be reduced if the answer to three related questions is "yes":

1. Is the problem over? That is, can its mathematical propositions be proved or disproved on the basis of a set of principles?

2. Is the problem compatible? That is, can the truth of its propositions be proved?

3. Is this issue decidable? That is, is there a clear procedure that can be applied to any proposition and tell us at a finite time that the proposition is true?

But the problem with extracting universal rules in complex systems is that since the discovery of universal rules requires the simplification of system functions to indivisible functions, it is not possible to decompose complex functions with existing tools, even if the function is compatible. Systems involved with big data are complex systems for which the approximation of functions is a debatable problem in computer science, let alone the reduction of principal functions into their primary functions. Mitchell defines a complex system as follows (Mitchell, 2009: 13):

"A system in which a large network of its components lacks central control and operates according to simple rules gives rise to complex collective behavior, advanced information processing, and consistency through learning or evolution".

However, there is no problem in Cartesian reduction by removing ineffective details of a phenomenon, so that it can eventually reduce the problem (phenomenon) through effective details that can be described by universal rules. But there is no mechanism for distinguishing between effective and ineffective details of the problem. This in itself is a great reason for the need to redefine Cartesian reduction. So far, no effective research has been presented for this purpose, so it is obvious that the function of redefining Cartesian reduction has not yet been explained. What is clear, however, is that the need to redefine Cartesian reduction is increasingly felt in the face of current complex systems as well as complex systems that will emerge from the mass of data in the future.

2. Philosophical Systems of Reduction in Biological Computations

As it was mentioned, in computational biology[1], through rational and phenomenological identification, biological phenomena are ultimately simulated with the aim of presenting prediction theory. But this cycle is rooted in Western philosophical thought in phenomenology. So in this section in order to explain the philosophical foundations of computational biology, we introduce empirical and rationalist thinking as the basis of modern Western philosophy to explore the roots of computational biology.

Empiricism is one of the major options of epistemology in philosophy, which is the opposite of rationalism. Simply this view of philosophy states that Human knowledge arises directly or indirectly from experience. From the point of view of empiricism, experience includes beyond sensory perception and any reception such as memory or the testimony of others. Since fundamentalism believes that all our beliefs and knowledge that come about through reasoning are ultimately derived from a certain source and that source needs no justification or argumentation, therefore empiricism is a subset of fundamentalism. Empiricism sees experience as a source of reasoning needless to be justified (Cohen, 1984:71-85).

In contrast, rationalism in its extreme form refers to a theory that considers the way of knowing the outside world only through reasoning, which is separate from the way of experience. But there are paradigms of rationalism that believe rationalism means theories that do not consider rational principles (rational axioms) to be the result of experience. That is, experience has no effect on the stability of these rational principles, but for our awareness of these rational principles experience can be effective as an additional tool. However, the great claim of rationalism is that the mind has the power to discover truths of the universe that make man sure of those truths; what is beyond the strength of experience (Dilworth, 1990: 431-462). The highest instance of human knowledge from the point of view of the school of rationalism is mathematics; because mathematical reasoning is certain and preliminary (pre-experimental). Rationalism tries to create a philosophical system similar to the mathematical one. One of the most prominent figures of rationalism is French philosopher René Descartes. Descartes great interest in mathematics for the knowledge certainty he saw in mathematics but not in other sciences led him to create an intellectual and philosophical system that like mathematics is based on "axiom and conventional principles" which is also doubtless. The foundation of philosophy in mathematical form is the seed of modern philosophical rationalism in recent centuries. He began his work with methodical skepticism and said (Sievert, 1975:52):

"If I doubt everything, I can no longer doubt myself."

At first glance, Descartes' rationalism led him to base philosophy and especially mathematics on precise reasoning, and to develop new and independent methods in mathematics based on sound principles and vivid methods. But perhaps a kind of empiricism elevated Descartes to a higher position in his discovery of analytic geometry through inferential methods. His discovery in analytical geometry made mathematics more precise and prolific. From Descartes' point of view mathematics is so devoted to truth-seeking that there is no denial in it. The important concept that Descartes introduced in his book "Principles of Philosophy" is a new concept related to empiricism i.e. reductionism. This concept is related to the reduction of the nature of objects and the complex behavior of phenomena to sum of their components and fundamental principles.

Descartes first introduced the concept of reductionism in his book "Principles of Philosophy". Descartes imagined the whole world as a machine, which by studying each of its components and elements one would achieve knowledge and understanding. His work and ideas were expanded by Newton and the results of Newton's efforts led to the publication of a book that started by "Principles" in its title i.e. The Mathematical Principles of Natural Philosophy. Although Newton never wrote a systematic philosophical doctrine like Descartes', the effects of Descartes' philosophy on Newton were such that by expanding it many considered Newton to be one of the rationalist philosophers of his day, arguing that in Newton's time all sciences were subordinate to natural philosophy in an interwoven mode. And his great work i.e. "The Mathematical Principles of Natural Philosophy" reinforces the notion. It seems that after reductionism, a systematic strength has been added to mathematics. This capability goes so far that Cartesian certain mathematics have entered the field of experimental sciences (including medical sciences), diagnoses and predicts phenomena (including diseases).

Reductionism was introduced as one of the major features of empiricism by John Locke in the seventeenth century (Cohen, 1984:71-85). As an empiricist, John Locke imposed direct influences on this idea and by defining "self" through the extension of "consciousness", changed the concept of empiricism significantly. John Locke believed that human beings are born as tabula rasa; pure and intact and devoid of knowledge, and have no innate knowledge in the way that everything they know is obtained through observation (experience)(Duschinsky, 2012:509-529). In fact, unlike rationalists, Locke believed that extension (at least extension of consciousness) is empirical. Therefore, knowledge of the attributes and qualities of substances is achieved through this extension of consciousness, so it can be argued that our understanding of substance (existence) is through experience.

But the question is that how does a philosopher like John Locke whose philosophical influences form the basis of liberalism, as he is called the father of classical liberalism, believe in the originality of experience and base his thought on it? It seems that studying undergraduate degree in medicine at Oxford University and his mastery of the medical knowledge of his day have a fundamental influence on John Locke's empiricist perspective. In fact, John Locke turned to a discipline of which rationalist and empiricist struggle dates back to the Hippocratic tradition between physicians and scholars of the same time.

What exactly empiricism stands against? The answer is simple: the Aristotelian tradition. The Aristotelian tradition believing that each science has its own method places mathematical reasoning in an aura far from the natural sciences. Before the seventeenth century the application of mathematics in the natural sciences was unexpected. But where the opposition initiated? Descartes' creation of analytical geometry was the starting point. With creation of coordinate geometry, he turned geometric problems into algebraic problems. This is important both because he conformed nature to Euclidean geometry and because he translated all problems categorized under natural class into algebraic problems. Of course, Descartes' goal, as mentioned, was to create mathematics with sound arguments, so achieving computability of forms and volumes was to meet this goal. But is computability of forms a rational method?

3. Computability: Rationalist or Empiricist

In the following, we will discuss that computability is basically more in line with empirical philosophy than philosophy based on the originality of reason. Descartes used his self-created coordinate system. He considered dot as the simplest component of any geometric form and analyzed it as two components of x and y. He discovered the geometry of x and y through any point that x and y has relationship. This relation, which is written as an algebraic expression is exactly the very algebraic equivalent of its geometric form.

As it was mentioned, writing algebraic equations for forms and volumes means making them computable. In fact, the clarity and distinction intended by Descartes and the certainty in general [the same certainty based on reason that he searched for] is achieved through "reduction"; When the truth of any object or phenomenon is reduced to a few components, naturally, by gaining knowledge of these several components human becomes sure that he has known everything that was possible about the object or phenomenon. But when an object or phenomenon has innumerable aspects, and in addition, some of these aspects are ambiguous and cannot be clearly and distinctly recognized, human will never gain such certainty. Descartes gives the good news to the new human that from now on it is not necessary to attribute anything but spatial form and motion to substance matter in order to understand the objects and phenomena of the universe, and it suffices to regard every object as a "form or set of moving geometric forms."

Now, the more important question is whether reduction is a rationalist or empiricist process. It was pointed out that Locke considered our understanding of existence to be due to the extension of consciousness, which is something achieved through experience (Cohen, 1984:71-85). Could it not be claimed that reduction is also one of the aspects of prominence being possible through extension of consciousness? In computability science, reductionism is characteristics of some problems. These problems are called NP_Complete problems (Sipser, 2013:2). Such issues are surprisingly reduced to one another. It has been proven that by solving one of these problems we have practically solved all the same problems. Not only these issues are important in terms of computability, but their computational complexity is also an important issue in computer sciences.

With the growth of mathematics, physics and engineering within the framework of the Cartesian design the world became more and more an image made by modern human. A plan that seems to be rationalism-driven while its empiricism foundations are quite obvious. The foundations derived out of reductionism; and it was after this that according to Heidegger, as stated earlier, man instead of being the shepherd of the universe found himself a master who could control everything by computation.

In order to define reductionism, it is necessary to define a hypothetical device such as the Turing Machine, which has a preliminary mechanism and is sufficient and extended to cover very complex functions (Sipser, 2013:165-191):

(1) $M = (Q, \Sigma, \Gamma, \delta, q_0)$

Q is a finite set of internal states. Γ is a finite set called the tape alphabet and contains a specific symbol B to represent a blank space on the machine tape. δ is a partial function called the transfer function from $Q \times \Gamma$ domain to $\Gamma \times Q \times \{L, R\}$.

Turing is a machine with limited number of states. There are two distinct states among the others. One is the q_0 state, which is the state of the start off, and the other is the q_{Halt} state. When the machine is in q_{Halt} state the program stops running.

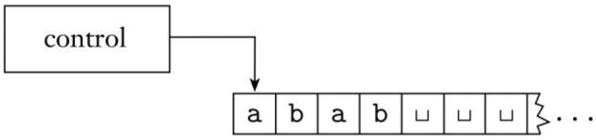

Figure 1: Turing Machine (sipser, 2013:166)

A universal Turing Machine can be built capable of simulating any other Turing Machines. This machine, abbreviated to UTM, is actually the theoretical model of today's programmable computers. In today's computers we can add new softwares to our computer to make our first computer do something newer. Now we can define reduction as follows:

We say that language A can be reduced to language B if there is a Turing Machine M that calculates for each $x \in A$ a given polynomial $R(x) \in B$ string and the following condition holds:

(۲) $R(x) \in B \leftrightarrow x \in A$

This is to say that instead of deciding whether x string belongs to language A, we can decide on the related equivalent issue i.e. R(x) string in language B only by recognizing the due polynomial's tense. In other words, instead of solving the problem x, we can solve the equivalent problem i.e. R(x) only by recognizing its polynomial tense. When this property is applicable for $x \in A$, then the problem or language A is reduced to the problem or language B.

In a family of languages, for example L, we say that language C is L-complete if all the languages belonging to the language L are reducible to C. The most important complete languages are those in the NP class called NP-complete languages or problems. In 1970, Cook and Levin showed that the 3-Sat[1] problem was an NP-complete one. Since then a lot of NP-complete problems have been found. The implication of these results is that whenever a polynomial algorithm is found for one of these problems, then all problems in NP class will be solved in polynomial tense and an equation $P = NP$ [2] will be established.

So far, researchers have tied the beginning of the science of computability to the concept of formalism. Formalists thought of all mathematics not as an essence but as a set of forms and symbols. By attacking the sanctity of mathematics they supposed its rules as forms of a formal system. David Hilbert is known as the founder of the school of formalism. Hilbert's mathematics is inherently based on the principle of subject matter (axiom) and formal logic. Hilbert's plan was in short to formalize all existing theories with a complete and finite set of subject-matter principles, and to provide an argument for the compatibility of these subject-matter principles. This was proposed by Hilbert in the early 1920s, which was generally challenged by proving Gödel's incompleteness (Detlefsen, 1986:1-44) (Lucas, 1996:24-103).

But what is at stake is how does Hilbert's formalism try to formalize the whole mathematics? He tried to complete his mastery of formalism by reducing all mathematics to elementary arithmetic. But he could not find any proof of the consistency of his subject-matter principles for the elementary arithmetic. The amazing thing about proving Gödel's incompleteness is that there are issues not inherently reduced to any other issue. Therefore, it is not possible to comment on the computability or non-computability of these problems. It was pointed out that NP problems were the gateway to computations that have mostly empirical roots to use than making use of certain mathematics. Concepts such as artificial intelligence, machine learning, data mining, etc., and the methods that were born from these concepts are all the intersection of empiricism and rationalism. Because these methods try to model the experience mathematically and use it to solve related problems.

4. Reduction of Biological Problems by Artificial Intelligence and Soft Computing

If we look at biological structures from the point of view of decidability and solvability through the lenses of Turing Machine, we encounter some kind of NP and even more complex problems that learning algorithms and artificial intelligence can achieve some answers at the expense of error. But as mentioned before, many biological problems are critical issues for which the approximate answer wouldn't be optimal. Especially, problems at the genome level are very complex. On the other hand, the implementation of temporary logics is also challenging for achieving due models. Recently, the idea of using quantum algorithms has emerged that also face the profound challenge of implementing quantum computers, which do not seem to be reliable for genome problems in forthcoming decades. This is because redefining all systems from the beginning is so time consuming. This is for that today's systems have a performance efficiency of one century.

But the complexity of genome problems in the discussion of phylogenetic trees has a special crystallization. The phylogenetic tree is a branching graph and shows evolutionary relationships between different biological species or even individuals based on physical (phylogenetic) similarities and differences or genetic characteristics. The units that are connected to each other in the tree are derived out of a common ancestor. In a rooted racial evolution tree, each node represents a common ancestor for the offspring of the same node, and the length of the edges in some trees represents time estimation. Each node is called a taxonomic unit. Internal nodes are commonly called hypothetical classification units (HTUs) and cannot be viewed directly (Kolekar, 2011:1-28).

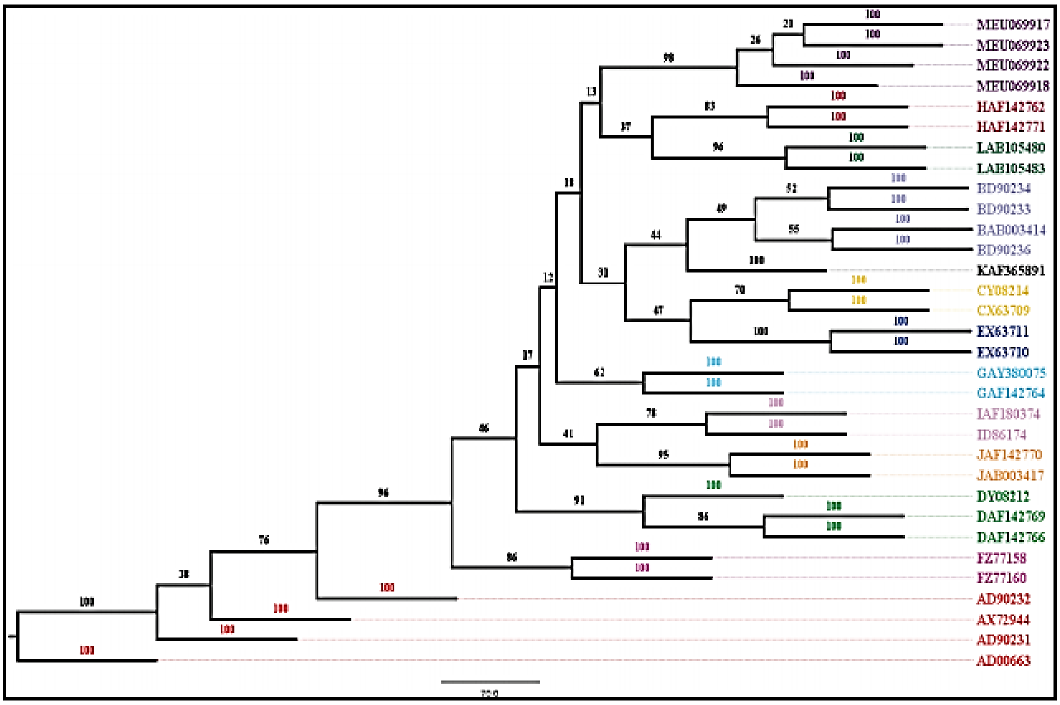

Figure (2) Phylogenetic tree without obtained agreement for omega virus genotypes using the structuring neighborhood method.

The first letter in the OTU tags indicates the genotype (A-M) followed by the GenBank registered numbers for the sequences. OTUs are also in the following order according to color genotypes: A: red; B: light blue; C: yellow D: light green; E: dark blue; F: amethyst; G: turquoise; H: brick; I: pink; J: orange; K: black; L: dark green; M: Purple (Kolekar, 2011:22).

The most famous challenges and opportunities in the field of bio-computation are sequencing the genomes of humans and other organisms, recognizing and predicting the first, second, third and fourth structures of proteins. Proteins are the most important compounds in the body. And they play an important role in many functions of living organisms including the movement of organs, defense mechanisms against foreign substances, the formation of enzymes and the creation of the most important cell wall of the same organisms. Each specific protein is composed of several certain amino acids that are arranged in a specific molecular structure. Most of the proteins are only of one type of amino acid, for example, 44% of the protein in silk is glycine. The main amino acids in the body must be obtained from food digestion. Generally, out of twenty amino acids, eight of them are synthesized in the body and do not enter the living organism through nutrition, but the rest of them enter the living organism through nutrition while being biosynthesized in the body. Amino acid monomers are linked by peptide bonds. This chemical reaction is an acid-base reaction in which two monomers join together when they lose a molecule of water. Part of the unique characteristics of each human being among other human beings is due to the uniqueness of some individual protein structures. In the case of billions of humans, this implies that a very large number of protein structures are possible. When two amino acids combine, two different combinations are possible, depending on which amino group is combined with which acidic group. For example, when glycine combines with alanine, glycine-alanine and alanine-glycine may be formed. When four amino acids combine in all possible modes, 24 different molecules are formed. And if 17 different amino acids are combined in the same way, only the number of molecules composed of 17 different monomers, which are unique in their kind, will reach 356 trillion. Obviously, if more than one molecule is used from each amino acid, the number of possible states will be much higher.

But living cells make only the relatively small and selected number of proteins they need from the many different proteins that can be made from a single set of amino acids. The structure of a protein, or protein construct, is the structure that a protein is shaped. Now this amount of complexity requires centuries of experience to know its angles. Therefore, the need for computer systems is inevitable, and as mentioned, the reduction design that mathematical modeling system implements is not efficient concerning such large amount of data.

5. The Reduction Complexity of COVID-19

Coronavirus belongs to the category of capsulated viruses. Except COVID-19, six types of human coronavirus (HCoVs) that cause disease and are transmitted through respiration have been identified so far. Among them, SARS virus (2003) and MERS virus (2012) are among the most highly pathogenic viruses which have already spread worldwide or regionally. The other four human coronaviruses are the most common causes of respiratory illness in humans accounting for approximately 15 to 30 percent of all cases of related disease. At present, there is no effective and specific medication in clinical conditions to deal with these 7 types of viruses. COVID-19 have killed more than 160,000 people worldwide by April 25, 2020. Kahn et.al compared the RNA sequences of COVID-19 and SARS viruses and showed their differences in Figure 3 (Tavakoli, 2020: 432-450).

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CLUSTAL 2.1 multiple sequence alignment

SARS-CoV-Nprotein       MSDNGPQSNQRSAPRITFGGPTDSTDNNQNGGRNGARPKQRRPQGLPNNTASWFTALTQH
2019-nCoV-Nprotein      MSDNGPQ-NQRNAPRITFGGPSDSTGSNQNGERSGARSKQRRPQGLPNNTASWFTALTQH
                        ******* ***.*********:***..**** *.***.**********************

SARS-CoV-Nprotein       GKEELRFPRGQGVPINTNSGPDDQIGYYRRATRRVRGGDGKMKELSPRWYFYYLGTGPEA
2019-nCoV-Nprotein      GKEDLKFPRGQGVPINTNSSPDDQIGYYRRATRRIRGGDGKMKDLSPRWYFYYLGTGPEA
                        ***:*:*************.**************:********:****************

SARS-CoV-Nprotein       SLPYGANKEGIVWVATEGALNTPKDHIGTRNPNNNAATVLQLPQGTTLPKGFYAEGSRGG
2019-nCoV-Nprotein      GLPYGANKDGIIWVATEGALNTPKDHIGTRNPANNAAIVLQLPQGTTLPKGFYAEGSRGG
                        .*******:**:******************** **** **********************

SARS-CoV-Nprotein       SQASSRSSSRSRGNSRNSTPGSSRGNSPARMASGGGETALALLLLDRLNQLESKVSGKGQ
2019-nCoV-Nprotein      SQASSRSSSRSRNSSRNSTPGSSRGTSPARMAGNGGDAALALLLLDRLNQLESKMSGKGQ
                        ************..***********.******..**::****************:*****

SARS-CoV-Nprotein       QQQGQTVTKKSAAEASKKPRQKRTATKQYNVTQAFGRRGPEQTQGNFGDQDLIRQGTDYK
2019-nCoV-Nprotein      QQQGQTVTKKSAAEASKKPRQKRTATKAYNVTQAFGRRGPEQTQGNFGDQELIRQGTDYK
                        *************************** **********************:*********

SARS-CoV-Nprotein       HWPQIAQFAPSASAFFGMSRIGMEVTPSGTWLTYHGAIKLDDKDPQFKDNVILLNKHIDA
2019-nCoV-Nprotein      HWPQIAQFAPSASAFFGMSRIGMEVTPSGTWLTYTGAIKLDDKDPNFKDQVILLNKHIDA
                        ********************************** **********:***:**********

SARS-CoV-Nprotein       YKTFPPTEPKKDKKKKTDEAQPLPQRQKKQPTVTLLPAADMDDFSRQLQNSMSGASADST
2019-nCoV-Nprotein      YKTFPPTEPKKDKKKKADETQALPQRQKKQQTVTLLPAADLDDFSKQLQQSMSSADSTQA
                        ****************:**:*.******** *********:****:***:***.*.: .:

SARS-CoV-Nprotein       QA
2019-nCoV-Nprotein      --
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Figure (3) W cluster analysis for (N) SARS-CoV Nucleocapsid Protein and COVID-19 (A. Tavakoli, 2020: 432-450)

Phylogenetic analysis has shown that the new CoV-SARS-2 coronavirus is closely related to two bat-like SARS coronaviruses namely bat-SL-CoVZC45 and bat-SL-CoVZXC21 (82-89% similarity), but shows less similarity with SARS coronaviruses (79%) and MERS (approximately 50%).

Phylogenetic analysis also shows that the new CoV-SARS-2 coronavirus is similar to the circulating coronavirus in Rhinolophus (horseshoe bats) (98.7% nucleotide similarity with the polymerase gene of BtCoV/4991 and 87.9% nucleotide similarity with the variant coronavirus bat-SL-CoVZC45 and bat-SL-CoVZXC21).

Now any logical and mathematical system that tends to model this complex system for treatment purposes is practically faced with an NP problem in degree $n!$ and it turns out that existing computers need centuries to solve these models. Even the study of the epidemic behavior and growth rate of the virus has become practically impossible due to the inconsistency of different countries' policies in dealing with it, and this is due to the limitations of the philosophical reduction system of mathematics modeling with such large data having complex factors. The result is that world circumstances are now surprisingly unpredictable. Because neither biological experiments can clarify the scope of the crisis, nor can rigorous mathematics be able to predict and describe it. Even for learning systems and artificial intelligence there is nothing to learn at this macro level. It seems that we are facing the collapse of reduction systems and need to redefine the system.

6. Redefining Cartesian Reduction with an Intermediate View of Rationalism and Empiricism

The necessity for redefining Cartesian reduction is rooted in the weakness of this system in its preliminary definition; where Descartes reduced the world to a machine. Because a machine-level reduction in the Cartesian reduction system required the answer to only one question: Is the reduced phenomenon computable? But now, in the new era, the problem of the complexity of this reduction is also raised, because the amount of time to solve such a complex problem is also a priority for us. So the next question in a new reduction system is like this: now that the phenomenon is computable, is its computational complexity workable? That is, how much time and memory will be needed during such reduction to be conducted?

In other words, if the reduced phenomenon under any types of modeling (whether modeling based on classical physics or modeling based on quantum physics) due to reduction, has a high computational complexity, basically the answer to the first question in the Cartesian reduction system will be "no". There are difficulties in discovering an effective drug for the treatment of COVID-19; it is entirely related to the second question we proposed for the new reduction system. Because despite the effective medications for diseases closely related to COVID-19 in terms of genome, finding a new compound that can affect the COVID-19 genome has exponential complexity and today's computers are not able to solve it in the short term. Even the help of quantum computers has not been effective so far. But why haven't researchers used artificial intelligence and machine learning to make the required medication? The answer lies in the amount of error these systems have, and if the error is related to human lives, it can probably be very catastrophic. Therefore, the making of the medication for COVID-19 is basically in the category of critical systems, and here we cannot look for approximations of functions or the use of an efficient heuristic model. Rather, we demand a deterministic system that responds to us in the shortest possible time with the appropriate computational complexity.

But to redefine Cartesian reduction the model used by learning systems and artificial intelligence can be utilized. In learning and artificial intelligence systems by approximating the function via optimizing the weights of the function, which is called the learning algorithm, the reduced phenomenon is detected or predicted.

Now, if in a deterministic system where the problem's states space is exponentially expanding, the false search spaces through a learning system are eliminated, could it be hoped that in complex systems a deterministic algorithm would be used for detection or prediction? It seems that the feasibility of this type of reduction requires a search space elimination algorithm. An algorithm that can drastically reduce the problem space immediately after its start off. It does not seem very intuitive when we look at the problem functionally. But through a geometric view this is possible. For example, it can even be intuitively accepted that in the Mandelbrot set - because the Mandelbrot set is a set of dots on a combined sheet that make up a fractal - we see a reduction in processing time and computational complexity (Mamta Rani, 2004:279-291). But the Mandelbrot set is inherently a learning system that can identify the starting points of any self-reduced phenomenon or predict the future of the reduced phenomenon. The Mandelbrot set provides a deterministic answer to the reduced phenomenon in terms of diagnosis and prediction, which if we were to create it with a machine learning algorithm, we would certainly always have to suffer from some amount of inevitable error, and as mentioned before in critical systems any amount of error is not acceptable.

Naturally, not every phenomenon can be reduced to a Mandelbrot set. Of course, in the diagnosis of cancerous tumors there are studies that have been able to show that the fractal number and pathological grade of a tumor are completely and definitively related. Thus, through the fractal number and the pathological grade of a cancerous tumor can be predicted in a certain period.

Therefore, by redefining Cartesian reduction based on the elimination of search space through a learning system, it may be possible to reduce the space of problems in NP class or higher to P class. However, reducing the problem from NP space to P space does not necessarily mean P = NP, which is not the subject of the present study. But there is a history of reducing from NP to P space especially in quantum algorithms such as the Shor's Algorithm.

7. Conclusion

Recently, one of the sciences that has faced the problem of computational complexity after mathematical modeling is computational biology. Computational biology, which encompasses various aspects, is the science of using biological data for development of or models to understand biological systems and relationships. Until recently, biologists did not have access to large amounts of data. This type of data is now commonplace, especially in molecular biology and Genomics. Existing computers take centuries to solve problems in the NP class and above. However, the existence of innovative and approximate algorithms greatly reduces the time to solve some of these problems to some extent. But the problem of complexity remains the most complex problem concerning the mathematical modeling of phenomena, especially biological phenomena.

Computational modeling of biological phenomena sometimes leads us to problems that, due to their complexity, cannot be solved efficiently with today's computers. Finding a cure for COVID-19 is one of them. In the present study, we considered the deficiency in definition of the reduction of phenomena to a mathematically sound system as the reason for a large group of biological problems, and therefore we came to redefine the Cartesian reduction of phenomena by removing the search space through a learning system. In this definition, it is possible to reduce the NP problem's space to P space without using a quantum algorithm that requires a quantum computer for implementation.

The reduction of complexity through redefining the Cartesian reduction is presented in the form of the following theorem and its proof requires further research because it puts the prerequisites of mathematics and computational sciences in the field of computability and complexity sciences. Therefore, we will suffice to mention the theorem.

Theorem1 (reducing the computational complexity by change in abstraction (or reduction) of a problem):

If P1 is an NP problem with computational complexity of T (χ) modeled with the abstraction ξ, and if P2 is an NP problem with computational complexity of T (χ) - T (K) modeled with the abstraction ζ, and we have $P\zeta \leq P\xi$, then $P\xi$ has a reducible space in the abstraction ζ which in the abstraction ξ it is not possible to reduce the computational space for the problem.

The proof of above mentioned theorem is expected to yield the following results:

1. The first conclusion to be drawn by proving this theorem is that different abstractions create different computational complexity for a problem.

2. Proof of this theorem also shows that at least one abstraction for a problem has the least computational complexity for the same problem.

3. Finally, it is important to conclude that changing the abstraction of a problem can reduce its computational complexity.

Notes:

1. Computational biology encompasses development and application of theoretical and data-analytical methods, mathematical modeling, and computational simulation techniques for studying biological, behavioral and social systems. The field has been extensively defined and includes fundamental principles in biology, functional mathematics, statistics, biochemistry, chemistry, biophysics, molecular biology, genetics, genomics, computer sciences and evolution. Computational biology is different from biological computation which is a branch of computer science and engineering through the utilization of biological engineering and biology to build up computers. But it is similar to bioinformatics that is a cross-sectional science making use of the computer to process and save biological data.
2. The answer to the question P = NP will determine whether the solution to problems such as the sum of the members of the subset is simply the examination of the validity of their answers. If P ≠ NP is proved, then it can be concluded that there are some problems that are inherently "harder" to find the answer than to properly investigate the validity of the answer.

References:

- Cohen, E. D. (1984) "Reason and Experience in Locke's Epistemology" *Philosophy and Phenomenological Research*, 45(1), 71–85. https://doi.org/10.2307/2107327
- Detlefsen M. (1986). *The Philosophical Fundamentals of Hilbert's Program*. In: Hilbert's Program. Synthese Library (Studies in Epistemology, Logic, ethodology, and Philosophy of Science), vol 182.p1-44 Springer, Dordrecht.

- Duschinsky, R. (2012). “Tabula Rasa” and Human Nature. Philosophy, 87(342), 509–529. http://www.jstor.org/stable/41682980
- Dilworth, C. (1990). "Empricism vs Realism: the High Points in the Debate During the Past 150 Years. Stud. Hist. Phil. Sci, 21, N0. 3, 431-462.
- Grosholz, Emily R. (1991). *Cartesian Method and the Problem of Reduction*. Oxford University Press. pp, 1-14.
- Kennedy, J. (2018). *Kurt Gödel and the mechanization of mathematics*. Times Literary Supplement: The leading international weekly for literary culture.
- Kolekar, P. &.-K. (2011). Molecular Evolution & Phylogeny: What, When, Why & How?. Computational Biology and Applied Bioinformatics , 10.13140/2.1.4929.6322.
- Kwiatkowska, M., & Thachuk, C. (2014). *Probabilistic model checking for biology. In Software Systems Safety* (pp. 165-189). IOS Press.
- Lucas, J. (1996). *Minds, machines and Gödel: A retrospect, Machines and thought : The legacy of Alan Turing.* (P. Milican, & A. Clark, Eds.) Oxford University Press.pp,24-103
- Mamta Rani, V. K. (2004). Superior Mandelbrot Set. *Journal of the Korea Society of Matchematical Education* SERIES d, 279-291.
- Mitchell, M. (2009). *Complexity: A Guided Tour*. Oxford University Press. pp,1-94.
- Newton, I. (1687). *Philosophiae naturalis principia mathematica*. Jussu Societatis Regiae ac Typis Josephi Streater. Prostat apud plures bibliopolas. Retrieved from https://doi.org/10.5479/sil.52126.39088015628399
- Organization (WHO), W. H. (2020). Novel Coronavirus(2019-nCoV) Situation Report. World Health Organization: https://www.who.int/docs/default-source/coronaviruse N.
- Rockmore, Tom, (1995) *Heidgger and French philosophy*, New York, Routledge.
- Sievert, D. (1975). Descartes’s Self-Doubt. *The Philosophical Review*, 84(1), 51–69. https://doi.org/10.2307/2184080
- Sipser, M. (1996). *Introduction to the Theory of Computation*. ACM Sigact News, 27(1), 27-29.
- Skiena, S. S. (2012). *The Algorithm Design Manual.* New York: Springer.pp,3-30.
- Tavakoli, A., Vahdat, K., & Keshavarz, M. (2020). Novel coronavirus disease 2019 (COVID-19): an emerging infectious disease in the 21st century. ISMJ, 22(6), 432-450. (in Persian)
- Weinberg, S. (2001). *Reductionism Redux*. New York Review of Books.
- William J. Cook, W. H. (1998). *Compbinational Optimazation*. New Yourk: A Wiley - Interscience Publication.pp,1-8.
- Zahavi, D. (2003). *Husserl's phenomenology*. Stanford University Press.