

Understanding Deep Learning by Methodology in the Dialectics of Nature

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ABSTRACT

In this paper, deep learning is discussed which is considered a branch in the modern AI subject with fastest development. First of all, the history of the deep learning is reviewed and then the nature of the black-box in the deep learning is pointed out. With the nature of the black-box (a device, system or object which can be viewed in terms of its inputs and outputs, without any knowledge of its internal workings) in the deep learning at center, from the view of the methodology in the dialectics of nature, two aspects, repetitiveness and interpretability, are analyzed in the paper. In the modern deep learning theory system, repetitiveness and interpretability are most needed to be explored and complemented. On this basis, the insufficiency of the spirit of seeking truth from facts is discussed across the whole practical process from subject selection to application in the deep learning. Finally, based on the above discussions, it can be concluded that though facing many shortcomings with regard to methodology, the above mentioned obstacles can be removed with help of the deep learning, thus contributing greatly to the development of the AI which is always the constant objective of human by unremitting efforts over time.

Keywords: *AI, Deep Learning, Methodology*

1. INTRODUCTION

AI has been always a hot research subject focused by human. The interest and study on AI can be tracked back to thousands of years ago. In the modern context, the research upsurge initially in the first AI conference held in Dartmouth College in 1955 marked the beginning of the intelligence or AI. [3] The research development gave birth to three great branches in the AI subject, i.e. symbolism, connectionism and actionism. The symbolism is the mainstream of the AI research. In the 1980s, the AI research under the guidance of symbolism confronted many difficulties, and the pilot value of the symbolism gradually weakened. At the first period, the AI was born on the theory crisis and the theory selection. And it mainly stressed the researches to the symbolism and formed many philosophical disputes and reflections on the base of the AI researches.

As reviewed by the sages, even if the principles about the AI are simple, human is also incompetent to understand quickly and rightly the principles about the human cognition for the simplicity of the self-intelligence. Admittedly, relying on the self-intelligence to study the self-intelligence is such an issue as faces essential difficulty because the human will deconstruct and even break through the self-intelligence. After understanding such a limitation, some AI researchers turned to embrace the connectionism. The researchers who favor the connectionism hold the following opinion. Compared with

using the symbolism to deconstruct the self-intelligence, it is better to consider the self-intelligence as a black box and put the limited energy into exploring what will be outputted while the "intelligence" receives different inputs and then promoting the research about self-intelligence. At present, there are two methods to measure the depth of the black box.[4] The deep learning is such a method as born in such a context to consider the human intelligence as the black box or the like black box to study and test.

2. PROBLEM-ORIENTATION--- SEEKING TRUTH FROM FACTS OR NOT

"The core difficulty is not the answer but the problem itself" Karl Marx said.[2] Such a judgment is very useful for the researches about AI and especially deep learning. Because the deep learning models the human intelligence as the black box, the first step of the research is to determine what input will be given to the black box. After reviewing the history of deep learning, it is easy to select the empiricism thinking, which indicates that the science embodies the accumulative results. It is developed by the fusion of many theories. Once the old theory is admitted, it will not be abandoned and always be replaced by the more advanced conversion theory. With the reception of the new achievement, the past performances have enlarged and increased.[1] Obviously, this is a linear development concept which is too simple. When this idea is compared with the history of the AI development, first of all, the AI represents the accumulation of the theory, experience and

practice ability. This is opposite to most philosophies of science refusing the logical positivism. There is a trend, which does not abandon the theory which has been confirmed successfully. Secondary, in terms of the strong empirical confirmation, there is not sign to verify the comprehensiveness of the theory. People even may study the concept about the development of the linear concept. The open logic theory created by the researchers and many other theories clearly show that it follows the dynamic way to deal with the openness, misrepresentation, conjecture, refutation, assumption and recombination. Last but not least, When viewing from a micro angle, the method to forge the data and its evolution knowledge is of significant methodology meaning to build certain know-how logic theory (e.g. automated theorem proving and automated theorem finding). From the macro perspective, i.e. while we survey the whole development history of AI, the thing will become more complicated. Under such context, the researchers are prone to trying to build the black box from the start point of the artificial neuron, which is the most basic part of the human intelligence, and apply the visual information, which is the most main one to be processed by the human brain, to explore the principles of the black box.

As reviewed by the Marxist theory, the human's knowing the things is of helix development. Its application to the research method about deep learning is embodied at the change of the problems on which the deep learning focuses. At the early stage of the deep learning, as described above, the research mainly focused on utilizing the deep learning to solve the problems concerning the processing of the visual information in the AI. With the research going deep, people feel that the progress at the vision issues lags behind the expectation. Many problems that seem obviously simple and do not need to be thought deep are unable to be solved in the machine in any case. Then, the researchers begin trying to use the input beyond the visual information to stimulate the deep learning black box for new progress. When the AI is created first, in terms of the results of these predictions, most receives the reaction (forgery) of the practice (experiment). Facing such great misrepresentation, the swimming pool opinion will loose give up the whole AI theory. However, AI is still "existent". Many basic principles and methods of its are widely accumulated. Though facing such a prediction that is distorted completely, the misrepresentation method is not so effective as considered theoretically. The real condition may be exactly opposite: people often respond more acute than under the natural status. The cause is that the temporary modification to all the variants (theoretical revision) and all the forms of the deep method opposition theory is very important. For example, in the AI, in the tradition of the symbology, from the heuristic method to the program used to solve the ordinary problems, to the appearance of the expert system and the knowledge engineering, from the logic about the traditional knowledge to the non-monotonic logic research about the commonsense knowledge in the knowledge engineering, the research shows that AI keeps on experiencing a great number of theoretical transformation and special

amendment. The above amendment are not made at random. It is governed by the cognition attribute of the theory in the period. Thus, the amendment to the theory during the scientific research is not only existent but also universal. In a sense, it is vital for the science progress. Thus, in the AI, it is better to study and find out the effective range of the theory and practice, than to stress the theoretical validation or falsify the improvement made by this approach. And the analysis of the "field" of the problem solving is more close to the actual history of the science. From this aspect, some of the researches involved into the deep learning have begun the study on the externality of the visual information. The research appears too metaphysical because of the lack of support from the human recognition research. Hence, it is difficult to be applied to the production and life practice. Even as research continues on vision, the foundation of deep learning, there is a tendency to turn to a lack of practical tests to disguise that research is not going as well as expected. Such a trend should be alert.

3. DOUBT ABOUT REPETITIVENESS

At the early stage, the performance of the deep learning is far better than that of the traditional algorithm, though the deep learning research results which could be applied to solve the problems increasing, their proportion relative to the total is low. According to the comment made by Popper, a great philosopher of science, research that lacks practice testification is unable to eliminate the fallacy of conjecture and then able to lead to weakening the research repetitiveness.[11] For a specific mock assumption, people can only put forward some "clean and tidy" examples to forge the AI. [8] A noted example is about the falsification to the repetitiveness of the nerve network course. In the books written by Princeton and Minniski about deep learning, it is obviously "decisive" in the sense of the comment made by Popper. He strictly refused them and make the artificial nerve network successful though it seems has been abandoned completely in the actual application. However, the prosperity of the artificial nerve network, and even the positive development of the artificial nerve network, obviously denies the misrepresentation itself. In addition, though the logical empiricism tries to use the logical analysis to statically describe the scientific structure, Popper utilized the problems and the assumption and excretion to dynamically describe the scientific development, and the two ideal standards are of great significance. To some extent, it is a justification. It is necessary to confirm or refute the assumption in the logical framework. Or, it is to convert the course into a description about the logical relations and ask for logically returning back to assumption. However, what beyond expectation is that these assumptions are very useful in the research, because they are unable to logically translate many assumptions in the AI, e.g. the nerve learning rules and a variety of learning algorithms in the artificial nerve network raised by Hebbian.[5] It is impossible to confirm or forge in the sense of the logical

empiricism and the demand of Popper. Furthermore, the evolutionary epistemology raised by Popper converts the experience-based theory issues about the logical empiricism into the same based on experience choice theory. About the theory experience, the facts prove that the development of the AI, especially the deep learning, is always subject to the theory choice. When the theory is “exhausted”, the new theory that is contradictory to the traditional one will continue to form. Even so, what is selected by the experience and practice, the scientific “forgery” course in the AI, especially the deep learning, still cannot be recognized by the so-called universal value after such selection.

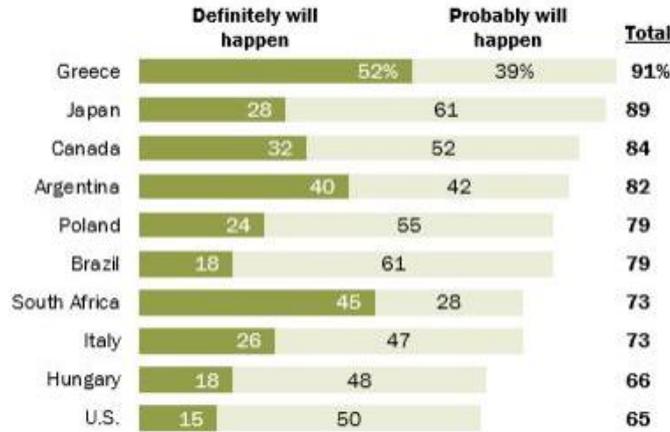
4. Challenge from interpretability

Considering the semi-black box characteristic of the deep learning research, the interpretability, which is the most basic principle of the deep learning, has been always the shortcoming which the scholars who criticize the deep learning denounce most. It is also one of the most main factors which limit the depth and span of the integration of the deep learning in the application scenes which demand relatively high reliability (e.g. law, medicine, etc.). Thus, trying to promote the interpretability of the deep learning and holding an expectation to transform a semi-black box into a grey box and further to be able to completely explain and control the function of each hyperparameter in the deep learning, which has been always one of the most important aspects in the deep learning research.

The property of black box of deep learning mainly originates from its high nonlinear property. Each neuron is achieved by the linear combination of upper story plus a nonlinear function. It is impossible to understand the meaning of the parameters in the nerve network and their significance and fluctuation range by very solid statistically basic assumption just like the understanding for the parameters about the linear regression. However, in fact, we know the material value of these parameters and the whole training course. Therefore, the nerve network model itself is actually not a black box. Its property of black box lies in that it is impossible to understand the material meaning and behavior of the model with such a way as able to be understood by human. Thus, the misrepresentation made to the actual scientific research includes the innovation, which means the deviation from

the old theory, the maturity of the mathematical theory, the support to the technique tools, the then new assumption and the domination position and a series of rather complicated factors, e.g. the conviction conflict constituted by the scientist’s position. In theory, this strong misrepresentation mode is of high attraction, while it is too ideal in the actual operation. Therefore, in the history of the real science, it is nearly impossible to put forward the requirements. In addition, the verification and misrepresentation of the science history is a very complicated and an interactive process. These processes are isolated and excessively simple. It is unable to absorb the real scientific development. Thus, in terms of the whole development of the deep learning, the pure logical empiricism and the forgery made by Popper could only approach to the actual scientific process at some aspects. However, in the other aspects, the obvious deviation and twisting are even existent. Those who blindly favor the deep learning in defiance of interpretability face the history, but they do not fall into the static analysis. And these analyses do not really catch it in the history concept, or, they have fall into the dynamic crankiness. Thus, for a rising science, too strict verification requirements and too optional and high critical rationality are still very adverse. Therefore, as a kind of method, the development of the deep learning which is the new field in the AI faces significant limitation. Broadly speaking, human’s demands for the interpretability mainly originate from the lack of sufficient understanding for the problems and tasks. [6][7][9][10] Especially to the deep learning/machine learning field, just like the problems in the multiple-layer nerve network mentioned above, though the high nonlinearity gives the multiple-layer nerve network very high model expression ability, and after the parameter adjustment technique which could be called as the modern alchemy is applied, it may perform surprisingly in many issues. If people pay attention to the headline news about the AI, the latest magical breakthrough at the machine learning and nerve network will even give them the fear and delusion that the AI can replace human very soon. If a model cannot be explained completely, its application in many fields will be restricted because there is no approach to give more reliable information. Because of this, large number of people are still prone to apply the traditional statistical model with high interpretability.

How likely do you think it is that in the next 50 years, robots and computers will do much of the work currently done by humans?



Note: U.S. data from survey conducted June 10-July 12, 2015.
Source: Spring 2018 Global Attitudes Survey, Q80.

Figure 1 Most Think Robots and Computers will take over many jobs now done by humans

5. CONCLUSION

The relation between human and nature has been always the hot topic that is discussed by the human. It can be said that it is the thinking and discussion that gives birth to the discipline of dialectics of nature. From this angle, the AI may be considered as the efforts paid by the human to explore the relation between the human and the nature. The artificial part is based on the human, and the intelligence refers to the intelligence existent in the nature. The range covered by AI is very wide. Considering the limited length of the paper, the paper only discusses using the methodology in the dialectics of nature to discuss the deep learning that is considered as such a branch with fastest development in the AI field.

At the early stage of its development, the deep learning was almost a complete black box model. Due to its nature as the black box model, the repetitiveness and interpretability is always insufficient to somewhat when it acts as the methodology. The paper discussed respectively the two aspects. Moreover, while standing at the angle of Seeking truth from facts advocated by Marxism, there is still a long march to go in terms of subject selection and application realization for the deep learning.

Indeed, the deep learning is still rather green in terms of methodology. However, one flaw cannot obscure the splendor of the jade. The contribution made by the deep learning in the fields of computer vision, human translation and knowledge discovery is obvious to all. With the premise to follow the methodology of Marxism, the deep learning will certainly make historic contribution to the development of the AI over time.

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