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Recovering Past via Artificial Intelligence

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Abstract: Recovering past has always been a challenge for mankind on this earth. Human being has always been surrounded by "When","What","How","Where" and last "Why" questions. Discovery of past has been undergoing since ages. Ancient texts, scripts, techniques, lifestyle all have been discovered and deciphered by experts due to the advent of technology. Science has developed to the extent that nothing is beyond its scope. Computer Science has broaden the scope and reach of mankind to the infinity. Artificial Intelligence is the field of computer science in which research is done involving human reactions and cognitive environment. This paper includes the contribution of this science of Artificial Intelligence in recognizing the 4000 years old Indus script. Neural Network has played an important role in this work. Markov model and deep learning algorithm had been at the background to recognize the symbols in the Indus script. This algorithm is used in self-driving cars and auto completion work of Google. The process involves three stages: Extracting the symbol, Selective Search for the grapheme is done and lastly Region Grouping is done.

Keywords: Artificial intelligence, Indus script, Neural network, Deep learning algorithm.

I. INTRODUCTION

Since the ages mankind has been involved in unfolding the mysteries of past. This becomes easy if technology proves to be helpful. Bilingual text and scripts can easily be deciphered while the scripts which contain only symbols is hard to hit the true meaning. Graphemes, the smallest unit of any language play very important role in understanding the large words. Neural networks and Artificial Intelligence together solve many hardships in the process of deciphering the 4000 years old Indus script. Indus script is the language of Harappa period. Nearly 400 symbols were discovered and were tried to be deciphered. Only 100 of them could be found out by the researchers. While, there was no regular pattern discovered in the symbols, it had been difficult enough for the scientists to recognize the meaning behind the symbols. In order to decode the writings behind the Indus artefacts, "deep learning algorithm". This algorithm had been proved successful in its objective. There is a class of algorithms in Artificial Intelligence, called "deep neural network" which have been a major player behind the development of self-driving cars and Go-playing bots that surpass the human beings performance too.

II. ARTIFICIAL INTELLIGENCE

The theory with which machines can perform human reactions towards any stimuli. It is the concept of adding human behaviour to gadgets. Humanly behavior like speech recognition, translation, decision making, visual perception are being added to the computer systems and necessary programming is done in order to make the computer system efficient to act accordingly as per the situation. While thinking for the reason behind development of Artificial Intelligence, the major outcome that comes is "Mind in the Machine" [1]. The study involves studying how human brain thinks, work and accomplish a certain work.

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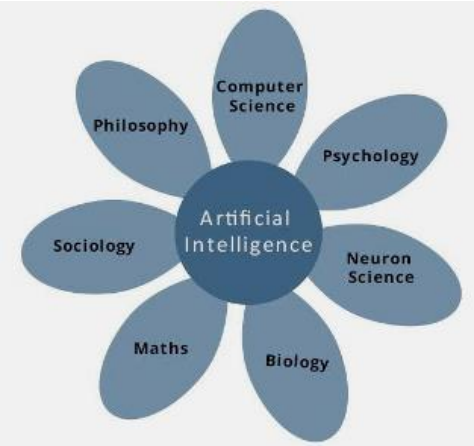

Figure 1: Contributors of artificial intelligence**.**

Artificial Intelligence [2] is the science where machines and systems are developed to give solutions for problem solving, reasoning, diagnosis, learning and being ahead of human mind. In order to win over all sorts of problem, study from various disciplines is required in Figure 1. Biology helps in detecting disease, Sociology and Psychology together enables machine to act like human beings. Computer science, Neuron Science and Maths brings to the scientists the knowledge and techniques to develop self-driven machines. Nowadays, Artificial Intelligence is regarded as narrow Artificial Intelligence (or weak Artificial Intelligence). The fact behind this is its limitation to the specific tasks. It can outperform human being in the dedicated tasks like playing chess, voice recognition, speech recognition or solving puzzles. However, the long term goal should be to develop General Artificial Intelligence or strong Artificial Intelligence [3]. This development will broaden the aspect and reach of machines. Cognitive tasks will also come into its ambit. The newly developed machines will be able to do the general specified task as well as the cognitive tasks. Thereby, machines will outperform in specific task along with cognitive task.

III. NEED OF DECIPHERING OF INDS SCRIPT

Indus civilization is one of the oldest civilizations of the world. Digs at various sites have shown that people in ancient Indus civilization lived in sophisticated, well-built society, there roads were developed in grid system and good sanitation system was also prevalent at that time. There is a lot to know about the one of the oldest civilization on this earth. To know about any particular area, the language is one of the best options. Similarly, Indus script is also one of the tools with which we can know and explore the writings and their administration of Indus Valley Civilization.

3.1. Indus Script

It is a boustrophedon script. The script is written from right to left. It is a pictographic script. There are many symbols and pictures that are engraved on seals. Since, these symbols do not follow a regular pattern, therefore they were difficult to be deciphered. Bilingual inscriptions prove to be very helpful in the decipherment of scripts. Since, there is no evidence of bilingual inscriptions in Indus script; it makes it more difficult to uncover the meaning enshrined in the script [4].

Figure 2: Indus seal impression**.**

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Figure 3: Indus seal at British museum.

The above seal in Figure 2 shows an "Indus script" on which five characters are inscribed. This feature makes it tough for the researchers to decipher this script, since every symbol is different and there is no regular pattern followed in it. Similarly, in Figure 3 [5] three different seals are placed in British museum. No common feature can be detected from these seals. Symbols include mostly the picture of animals; some of them have a proto-Shiva inscribed on them.

IV. ARTIFICIAL INTELLIGENCE AND INDUS SCRIPT

Though, there have been no bilingual texts found in Indus script, scientists found a sequence in this script. They formalized it and arranged them in a way such that it can help in communication. The methods involved in Artificial Intelligence are good at pattern recognition and the application of this method to understand the human communication is termed as Natural Language Processing [6]. It is similar to the Google's Autocomplete mechanism in Figure 4.

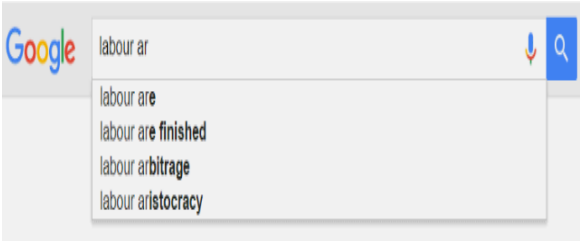

Figure 4: Auto-complete in Google search engine.

4.1. Conditional Entropy

Researchers found that in most linguistic systems, words and symbols follow each other in a semi-predictable manner. This semi-predictability is known as Conditional Entropy by them [7].

4.2. Markov Model

It is studied under Probability theory. It is a stochastic model. In this, it is assumed that the future state or the next upcoming state depends only on the present or the current state and not on the events that occurred before [8]. Several research was done using this model, unfortunately it could not help in getting clue about any of the Indus script. After a lot of observations and research, the scientists switched to Image processing technique to understand the missing interpretations from some of the already known symbols. This technique also failed to decipher the Indus script [8].

V. ARTIFICIAL INTELLIGENCE CRACKS INDUS SCRIPT

There is a class of algorithms in Artificial Intelligence called "Deep Neural Networks". These algorithms work like conventional neural networks which mimics the working of the mammalian visual cortex. It breaks the field into overlapping regions. The various features found in different regions are then hierarchically combined by the network to build a good and firm understanding of the whole picture.

5.1. Deep-Learning Algorithm

This algorithm has been developed by Ronojoy Adhikari of The Institute of Mathematical Sciences and Satish Palaniappan, who is at Sri Sivasubramaniya Nadar College of Engineering [9] .This, involves a three step procedure.

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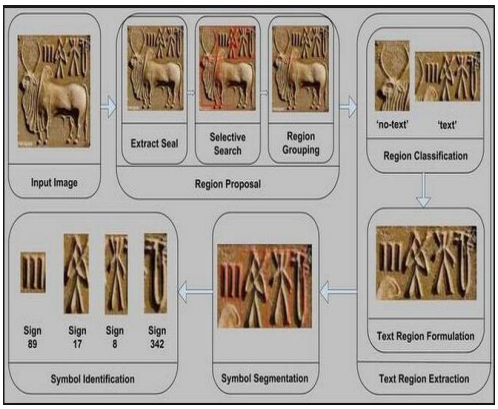

Figure 5: Step by step procedure of deciphering the Indus script using deep learning algorithm.

It has successfully interpreted the symbols on seals and artefacts in Indus script Figure 5. The process undergoes: selection of image→breaking of images into graphemes→ Region classification→Text region Formulation→Decipher the Indus script [10]. The process involves three phases: In the first phase, the input image is broken into sub-images that contain graphemes only; the areas that do not have graphemes are trimmed out. The obtained grapheme areas are further trimmed into single grapheme pieces. At last stage, every single grapheme is classified to match one of the 417 symbols Figure 6 discovered so far in the Indus script [11].

Figure 6: Indus signs**.**

VI. CONCLUSION

Deep learning algorithm helped in deciphering the million year's old Indus script. The Indus people had left many good concepts to learn. With this accomplishment, there are new possibilities with which cognitive machines can be developed. Deep learning algorithm is the future technology. It is hierarchical Feature Learning. The hierarchy of concepts allows the computer to learn complicated concepts by building them out of simpler ones Figure 7.

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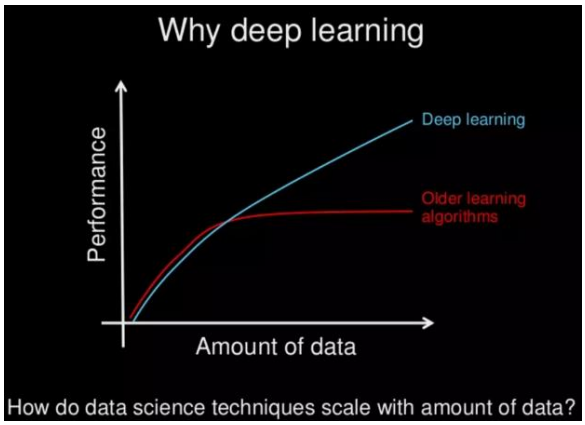

Figure 7: Deep learning algorithm v/s older learning algorithm.

Perhaps, now is the time to put human mind into the machines. It is the beginning to the new era of Strong Artificial Intelligence [12].

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