

# Digital Preservation of Indigenous Knowledge Through Artificial Neural Network: A Study

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## Abstract:-

### ➤ Purpose:

The aim of this study is to conserve the primordial knowledge for the reason that the binaries of indigenous knowledge are either orally-transmitted or transmitted through imitation and demonstration. Writing it down (with their equal graphical relevance) changes some of its fundamental properties, because indigenous knowledge is orally monopolized. The paradox is that, even in contemporary automated epistemology, the indigenous knowledge shuns any form of preservation through libraries or in raw manuscripts. Thus, it means that there are no formal mechanisms or no vital area to preserve this knowledge. In the phase of drowning resources scientists, researchers, practitioners (engrossed to unearth the value of indigenous stigmata) have no path to manage the things back to their ontological trace; they always need some guidance about how the things can be resolved, and this changes the chronological documentation. However, in the 21<sup>st</sup> century, due to the ascendancy of data centric technicity, there seems to be a way to preserve the orally commuted knowledge system through Artificial Neural Networking (ANN).

### ➤ Design/ Methodology/ Approach:

The design of this study frames out the preservation methods and the process of preservation where the researcher can identify the way to protect the primordial knowledge in view of the fact that the Artificial Neural Network is a set of Algorithms which deals with pattern recognition, image identification, and machine translation. But, its centrality lies in its assimilation of data-processing which mirrors the information processing of the human brain. Just as the human brain follows neuronal probing for its acquiring of new stimuli and the deletion of the old ones; the ANN also modifies itself by counting the variables and their practical usability. The Encoding of data in the neurons (nodes) according to which the processing of information performed by the different algorithms with distinct functioning or implementation of techniques will regulate the working and incremental data received.

### ➤ Findings:

This paper explains how to preserve the Indigenous knowledge in a digital manner with the help of the Artificial Neural Network (ANN). The applicability of ANN is not wholly developed and is still in progress. Therefore, by coming away from traditional normative

translation of oral words into written form - the essence of Indigenous knowledge must be preserved through some other means. The Preservation of this knowledge will help to secure the ancient property with the help of technology through which we are able to secure our future.

### ➤ Originality:

This paper will present its mechanisms of 'data-preservations' ranging from clustering to feedback algorithms; which will be crucial in the approach of indigenous knowledge preservation. The preserved knowledge, as it is dynamically opposed to the traditional mode of preservations through physical manner – can be accessed to a wide era of civilization, contributing to the creation of an equal hemisphere with rich data sets.

### ➤ Research Limitation/ Implication:

The main limitation of this study is that it focuses the application of the Artificial Neural Network (ANN), but this study is not limited to the theoretical analysis of this mechanism. Therefore, the future implication of this study direct towards a clear practical view of this study which helps many researchers, scientists and the practitioners to change the reality.

**Keywords:-** Primordial Knowledge, Artificial Neural Network, Digital Sustainability, Digital Preservation, Artificial Intelligence.

## I. INTRODUCTION

In the phase of knowledge erosion and the rapid disappearance of cultural tradition, the comprehension of indigenous knowledge must be protected, which is unique in its accompaniment for development and 'right'. The Focus on Indigenous Knowledge (IK), and the essential elements of knowledge are considered as the vital factors in any country's knowledge system. In the decades since WWII, the eloquence of development has gone through several stages – from its clear focus on economic development, to growth with impartiality, to basic needs, to collaborative expansion, and to sustainable growth. In the current scenario the Indigenous Knowledge is seen as the very crucial above all the discussions done on sustainable development of resources and balanced development. This orientation is in stark contrast to the views of many earlier theorists, who saw traditional knowledge and institutions as obstacles to development. It reflects the shift away from the preoccupation with the centralized, technically oriented

solutions of the past decades, which failed to improve the prospects of most of the world's peasants and small farmers. To ignore people's knowledge is almost to ensure failure in development. Since, Indigenous Knowledge is essential to development, it is often suggested that it must be gathered and documented and preserved in such a manner which can be used for long term betterment of society and our future.

All of the aforementioned criticism boils down to one point, the preservation of human memory. However, the preservation of human memory is a debatable phenomenon. For this purpose, the ANN matrix employs applications like clustering, pattern recognition, feedback algorithms, training networks, back propagation algorithms, etc. This preservation will help as a sustainable approach, which will impact as a non-ending process where the conservancy of this knowledge in the long term effect. Now-a-days the credence of humanoids on technology or its utilization depicts that the functionality of the future is completely directed by artificial intelligence or the robotics. As per the appearance of digital sustainability, it introduces the 4 pillars of inclusion: Human, Social, Economic and Environmental sustainability. They explain about the maintenance and improvement of human capital, perseverance of social capital by investing and creating services that constitute the framework of our society.

#### ➤ *Conceptual Background:*

##### • *Artificial Neural Network*

Artificial Neural Networks, or ANNs, are computer programs influenced by biology that mimic the human brain's information processing. Instead of programming, ANNs learn (or are trained) through experience, gaining knowledge by recognizing data patterns and relationships. Hundreds of single units, which are referred to as artificial neurons or processing elements (PE), are coupled by coefficients (weights) in the neural structure, which is organized into layers. The power of brain calculations comes from the network of connections that connect neurons. A weighted input, a single output, and a transfer function make up each PE. A neural network's behavior is influenced by the design, the learning rule, and the transfer functions of its neurons. A neural network is a parameterized system in this sense because the variables that can be changed are the weights. The weighted sum of the inputs results in the neuron's activation. The activation signal is transferred via a transfer function to produce a single neuron output. The transfer function makes the network non-linear.

During training, the connections between units in the network are adjusted until the error in predictions is minimized. Once the network is trained and tested, it can be given new input information to predict the output. There are many different types of neural networks, all of which are described by their transfer function, learning rule, and connection formula.

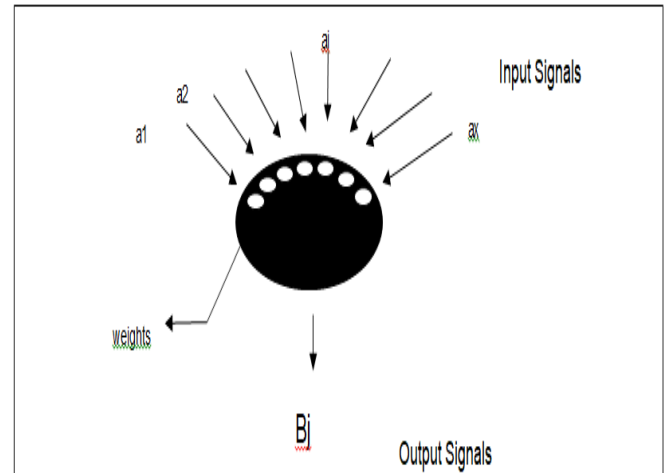


Fig 1 Artificial neuron, The basic mathematical technique indicated by the circle that resembles the neuron's cell body creates one output signal  $B_j$  from a group of input signals represented by the multivariate vector  $a$ .

It is assumed that the brain acquires its "knowledge" by ongoing synaptic adaptation to various input signals that result in better and better output signals, i.e., to such signals that would result in the right bodily responses. The outcomes are continuously used as new inputs. By iteratively adapting between the actually received outputs  $B_j$  and desired replies or targets  $t_j$ , artificial neurons attempt to emulate the adaptation of synaptic strengths in the real brain.

##### • *Indigenous Knowledge*

Indigenous knowledge is frequently thought to exist locally, attached to a certain social group in a specific environment at a specific time. Scholarly debates over the last few years have identified indigenous knowledge as a crucial resource for growth. This article questions the notion of indigenous knowledge and the methods put forth by its proponents to advance development. According to the essay, how indigenous knowledge is currently understood poses problems for both its meaning and its contribution to development. We must move past the opposition between indigenous and scientific knowledge and endeavor to provide "indigenous" peoples more authority in order to effectively incorporate indigenous knowledge into development. Access to collections and content is the core goal of all information management operations. In a theory, asserts that relevant knowledge access issues are not sufficiently addressed by libraries and information services. Given that the indigenous data gathered thus far is poorly organized in terms of indexing and abstracting, it is understandable why access to it is very constrained. This helps to explain why Indigenous Knowledge isn't used as much in development projects. The low level of IK utilization may also be attributed to a lack of marketing plans. Information experts have a long history and have accumulated vast expertise about how to organize it.

## II. HUMAN MEMORY CONSOLIDATION PROCESS

Since the 1940s many scientists conjectured that human memories are held within neuron groups or nerve cells which are called Cell Assemblies. All these interconnected cells fire as a group in response to a specific stimulus, as if plenty of neurons fire together at a moment the interconnection of cells strengthens. In this way, this working process of nerves we express as a memory. So, for a short term memory to make a long-term memory, it must be built-up for long-term storage. Thus, a process is called Memory Consolidation. In human brain memories are stored as the microscopic change in the connection between the established neurons. Likewise, when a human being wants to think of something, they must have to retrieve the information from the part of the brain where it is stored. And this Retrieval process can be obstructed by the distractions to encode the information correctly in the first place. From the very pin level, human memories are stored as microscopic chemical changes at the connecting point between neurons in the brain (such specialized cells which transmit signals from the nerves).

The description about the memory, It is just a fusion of electrochemical components (neurons) or storage of non-physical entities in an abstract mental space. Basically there is no single place where memories are stored itself, different-different parts of the human brain stored different kinds of memories. These memories are described as: the memory related to the emotional responses are stored in **Amygdala**, while memories dealing with analytics and skills are stored in **Strabrium**. **The Hippocampus** deals with the retaining and recalling of declarative memories. Thus, in this manner the memory is a reactivation of a certain group of neurons. As the paraphrasing of the entire concept starts from the **Sensory Memory** which takes information from the environment through the human senses, it takes information and is stored for a very short time. **The Working Memory** deals with human thinking and in this people are able to handle a very short amount of information at one time because its storing time is about 5 to 20 seconds so, for the active remembrance people need to repeat the information again. The last one is the **Long-Term Memory** where the human being holds all memories so that it can be used for later. Although we have a lot of rooms to store memories, the memories that are stored are not a perfect representation of the outside world.

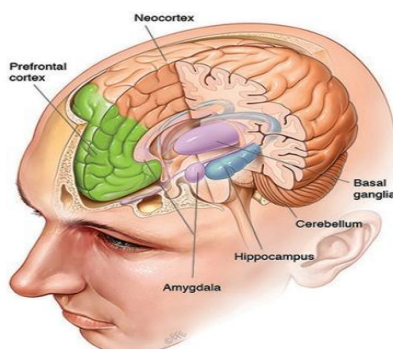


Fig 2 Description of the Human Brain

This long term memory is relatively permanent but for easy access memory needs to retrieve that information on a regular basis, which depends on a process of Encoding, Storing and Recalling. Where in **Encoding** the input messages are processed in a suitable electrochemical form to the long term memory. Then, **Storing** takes place as filling the brain's cabinet, which is easier to find out from the organized fashion of the brain. After that, the **Retrieving** which takes out the information from long term memory into conscious memory so that it can be changed or remembered as the human behavior needed. In other words, Neurons receive signals from 5 human senses and the brain assembles these input signals in a meaningful way, so that it can have a perception of the outer world. As per the figure.2, **The Cerebrum** works as the short term memory or just input the message from the environment with the help of sensory organs. Which goes to the **Prefrontal Cortex** region and the **Hippocampus** in the middle region of the brain and are responsible for storing memory. The hippocampus stores the memory by changing the neural wiring, that is making new connections between the neurons and synapses by receiving the short term memories from the prefrontal cortex.

## III. ARTIFICIAL NEURAL NETWORK PROCESS

To understand the process of ANN, one needs to focus on the Neural Network, the base of deep learning which is the subfield of machine learning algorithms and completely inspired by the structure of the human brain. The neural networks input the data to train themselves and to recognize the patterns of the input data and then predict the outputs for a new set of similar datasets. Basically, neural networks are a combination of neuron layers and these neurons are the core processing units of the network. Similarly, as the brains input the data through the sensory organs, The neurons of the neural network input the data into the input layer and the output layer predicts the output in between the hidden layers which performs most of the computations required by the network. In the processing of the neural network each layer of neurons is connected with one another layer of neurons which means as step by step they increase the weight of inputs. These inputs are multiplied to the corresponding weights and their sum is sent as input to the neurons in the hidden layer and each of these neurons are associated with a numerical value called the **Bias** which is added to the input sum. These things are passed through a threshold function which is called the **Activation Function**. The result of the activation function declares if the particular neuron will get activated or not, because activated neurons transmit data to other neurons over the channels. In this manner data is propagated through the network and this method is called the **Forward Propagation**.

## IV. STORAGE OF INDIGENOUS KNOWLEDGE

According to most theorists, the prime strategy for conserving IK is through the Ex Situ Conservation i.e., Isolation, Documentation, and storage in International, Regional and National Archives. With the advent of

technology, there are plenty of methods which are helpful in preserving the documents in a digital manner. But the preservation of solitary memory is not only enough in the digital manner, or can be preserved through the functions of the Artificial Neural Network. Come to the main concept which focuses on the storing of human memory on neural network explain that as per the researchers a human brain has billion of electromagnetic interconnections of the biological neural networks which sends their input from the **Dendrite**, performing a nonlinear function for passing the input to the nucleus. Whereas, neural networks directly pass their input to the neurons. For input the memory signals in the neurons, needed to focus of that the frequency of the brain waves must be lies in average proportion i.e. **Alpha ( $\alpha$ )** having a speed limit of 8-12 Hz where the situation of the human brain is in relaxing mode with passive attention. The neurons have a continuous set of inputs to pass in the hidden layer and if the encoding of information is in the average frequency, the probability of optimum output will be maximized. Because researchers suggest that the passing of information through temporal encoding is important to receive by the impulses for the next proceedings. For learning any terminology of human brain speed it requires to proceed with the backpropagation methods through which the brain signals can actively participate. This process requires the **Habbian Learning** for increasing the learning efficiency. Clarifying the memory clustering methods can be applied when the inputs are in the hidden layer, it includes the pattern recognition, image sensation and the mining of the data which in return scrutinizes the memory system so that whatever is needed can be stored or taken up as the output. Thus, the whole operation inspired about the storing of human memory in the visuals of Artificial Neural Network.

## V. HOW ARTIFICIAL NEURAL NETWORK STORES INDIGENOUS KNOWLEDGE

In the case of preserving the memory of the human brain (specifically the IK) with the help of ANN, the Learning Algorithms will play a vital role. Because in the functions of Neural Networks various architectures are available to approximate any nonlinear function and these different types of architecture allows for generations of functions with different complexities and power like as: Feedback Network, Feedforward Network and Lateral Network. In Feedforward network neural networks having 3 kinds of layers that are: **Input Layer** consists of a passive layer which takes part as signal modification but it transmits only the signals to the following layer. Next layer is the **Hidden Layer**, in neural networks there are arbitrary no. of layers and arbitrary neurons which work to modify the signals. Hence, they are the **Active Layer** of the neural networks. And the last one defined as the **Output Layer**, which corresponds to the number of output layers, also works as the Active layer.

According to the workings of these layers the flow of accurate knowledge should be in a continuous mode and it takes place from one layer to another layer in forward direction. This phase will explain the **Pattern Recognition**

where the neurons of the human brain linked with the neural network. Within the coupling of these neurons the **learning algorithms** of Artificial Neural Network takes place through the optimized weight values. This phase explains the production of output when the corresponding input is presented in the neural network. With the updated optimal weight the trained neural network should be able to produce the output with the desired accuracy corresponding to an input pattern and this algorithm deals with 3 types of learning which gives a shape to the defined Data.

In the context of Indigenous Knowledge with supervised learning, it will be set up by the specific instruction from the human brain. The phase of unsupervised learning discovers the pattern or features in the input data with no instructions. Basically, it performs the clustering of input space. This is completely about arranging and learning the patterns by itself. It helps neurons in neural networks to assemble and remember the specific tasks and patterns of the memory. From the stored pattern of the knowledge, similar sort of incomplete or spatial patterns can be recognized.

In other words, in this working phase the Indigenous Knowledge of the human brain can be retrieved on the same pattern which is saved in neurons and helps to complete the missing knowledge. This process of Neural Network works faster than the delta rule or the Back propagation Algorithms where the rule of learning updates the weight of the inputs to artificial neurons in a single layer neural network. As with the final learning terms of the reinforced learning which only indicates that the computed outcomes are corrected or incorrect. With the context of this reinforced learning the data of Indigenous knowledge is encrypted with the concreteness where the correct patterns are easily identified and producing output. These outputs of preserved indigenous knowledge from the human memory will be secured with the help of microprocessor chips and stored for a long-time, performing a role of digital sustainability of preserving Indigenous Knowledge.

## VI. CONCLUSION

The gathered data-set, then can be inscribed to generate a definite system of knowledge, and as homo-sapiens are knowledge centric, the gathered set of knowledge can be treated as an asset. In this respect, one rudimentary conjecture must be accepted by the human civilization in general: the time period of human evolution has witnessed the paradigmatic shift with the workings of Isaac Newton, Albert Einstein, Stephen Hawking and such other personalities. It is solely due to the lack of ANN's availability that their stimuli are not fully empiricized. Therefore it is high time and also imperative to preserve the indigenous knowledge which is rich in its own applicability.

Due to the wide applicability of ANN, not only indigenous data sets, but also the remaining languages (graphically non-translatable) ranging from tribes to populace can also be preserved and can be used to the



enrichment of society. The enigma of this hypertextual knowledge will not only assist the scientists, researchers but can be equally applied to the institutions dealing with special educational and vocational programs – leading to a transfusion for a future generation.

### REFERENCES

- [1]. Gurney, Kevin. *An Introduction to Neural Networks*. Taylor & Francis, 2004.
- [2]. University, Kumamoto. National University in Japan. *Artificial Neural Network (ANN)*. <http://www.cs.kumamoto-u.ac.jp/epslab/ICinPS/Lecture-2.pdf>
- [3]. Gill, Navdeep Singh. *Artificial Neural Network Applications and Algorithms*. <https://www.xenonstack.com/blog/artificial-neural-network-applications> . 31 August 2022
- [4]. UNESCO. *Local and Indigenous Knowledge Systems (LINKS)*. <https://en.unesco.org/links#:~:text=Local%20and%20indigenous%20knowledge%20refers,day%20to%20day%20life>. Yakub, Hoda. *IK Report(1). Indigenous Knowledge Definitions, Concepts and Applications*. [https://chm.cbd.int/api/v2013/documents/4A27922D-31BC-EEFF-7940-DB40D6DB706B/attachments/209070/Hoda%20Yacoub%20-%20IK%20Report%20\(1\).pdf](https://chm.cbd.int/api/v2013/documents/4A27922D-31BC-EEFF-7940-DB40D6DB706B/attachments/209070/Hoda%20Yacoub%20-%20IK%20Report%20(1).pdf)
- [5]. Senanayake, S.G.J.N.. “Indigenous Knowledge as a Key to Sustainable Development”. *The Journal of Agricultural Sciences*, Vol.2, no.1, 2006.
- [6]. Philip, K.S.. “Indigenous Knowledge: Science and Technology Studies”. *Indigenous Knowledge. Encyclopedia of Food Security and Sustainability*. Science Direct. 2019.
- [7]. “The Four Pillars of Sustainability”. *Future learn* . 2017. Accessed 29 October 2022.
- [8]. Agatonovic-Kustrin, S., and Rosemary Beresford. "Basic concepts of artificial neural network (ANN) modeling and its application in pharmaceutical research." *Journal of pharmaceutical and biomedical analysis* 22.5 (2000): 717-727.
- [9]. Agrawal, Arun. "Indigenous and scientific knowledge: some critical comments." *Antropologi Indonesia* (2014).
- [10]. Ngulube, Patrick. "Managing and preserving indigenous knowledge in the knowledge management era: challenges and opportunities for information professionals." *Information Development* 18.2 (2002): 95-102.
- [11]. Gorjestani, Nicolas. "Indigenous Knowledge for Development: Opportunities and Challenges." (2001).
- [12]. Zupan, Jure. "Introduction to artificial neural network (ANN) methods: what they are and how to use them." *Acta Chimica Slovenica* 41 (1994): 327-327.