

Basic Logic of Brain Nerves, Consciousness, and Artificial General Intelligence

Taiwei Song*

Shanghai Riyue New Energy Co., Ltd., China

*Corresponding Author

Taiwei Song, Shanghai Riyue New Energy Co., Ltd., China.

Submitted: 2025, Dec 30; Accepted: 2026, Jan 10; Published: 2026, Feb 12

Citation: Song, T. (2026). Basic Logic of Brain Nerves, Consciousness, and Artificial General Intelligence. *Adv Neur Neur Sci*, 9(1), 01-08.

Abstract

This paper redefines the concepts of information space and consciousness space, establishing that consciousness and the space-time dynamic information tensor of brain nervous system movements and changes are in a mutual mapping relationship, and presents the relational formula between them. It holds that the brain is the connection point and ordered converter between the consciousness space and the material world. A 0/1 signal code representation method for the set of human consciousness space is established, based on which the intrinsic attribute relationships of the space-time information tensor space (i.e., the movements and changes of the brain nervous system) are characterized and analyzed. The visual space generated by light-induced transformations in natural space-time space is defined, and the space-time transformation matrix equation is derived. Based on these theories, the essential logic of AI agents and solutions to related problems are also discussed.

1. Introduction

Currently, the AI technology industry represented by Large models (LMs) and humanoid robots is developing rapidly with ever-changing innovations. Large models seem to be omnipotent, and the technological iteration speed of humanoid robots is equally astonishing. Humanity may soon enter the era of AGI (Artificial General Intelligence). While looking forward to this, people cannot help but wonder: Where are the boundaries of AI's capabilities? What is the logical foundation for the accelerated interaction and integration between AI and humans? Where exactly is human society heading? The author of this paper attempts to answer these questions from a broader perspective and based on the most fundamental physical and mathematical logic. This is mainly based on the author's decades of research and exploration on related issues, including the insights "emerged" from in-depth thinking triggered by the rapid changes in human society driven by AI in recent years.

2. Related Basic Physical and Mathematical Concepts and Fundamental Logical Relationships

The human body, as a life organism, is an integrated holographic self-organizing system that is orderly and self-consistent at all levels or arbitrary scales. Structural units at various levels such as molecules, macromolecules, cells, tissues, and organs, under the

unified coordination and command of the brain nervous system, undergo a life cycle characterized by embryogenesis, development, growth, maturity, and aging in an extremely complex, orderly, and hierarchically self-consistent cooperative manner. The same applies to nature and human society [1-7].

Previous classical quantitative analysis studies have mainly focused on the space-time changes of the motion of individuals (or local parts) or the interrelationships between individuals with definite physical boundaries at any scale. For complex systems, more attention has been paid to probabilistic statistical analysis or macro-quantum effect phase transition analysis. For self-organization phenomena in complex systems, most are described in words or simple quantitative analysis, or simply classified as random fluctuation "emergence" of a large number of nonlinear interaction units in thermodynamic systems [8].

For objects such as the human body, human society, and the Earth's ecology as dynamic wholes, their own laws of change over time and the evolution of all relevant properties and phenomena such as the morphology, structure, and correlation relationships at all levels are mainly determined by their own complex but hierarchically orderly and self-consistent dynamic cooperative structural relationships. Therefore, the corresponding more "abstract" and universal basic

physical and mathematical logic should be established on the objective phenomenon of holistic holographic, orderly, and self-consistent space-time structural relationships. Obviously, the use of random statistical logic is almost the opposite in perspective. The current holistic holographic, orderly, and self-consistent relationships of the research objects exist objectively, rather than thermodynamic emergence of random systems.

The author's lifelong original work "Geometry of Space-time Structures" is a motion geometry established on a quasi-4D natural space-time space (coordinate form: (x, y, z, ict), abbreviated as (r, ict)) [1-4]. Time t flies unidirectionally at the speed of light c and serves as the main variable (time action is denoted by T, which is a matrix tensor in geometric space). Points in space, or any structures composed of points, are open sets with certain physical properties and sizes, but there are no absolute straight lines or planes. Length, curved surface area, spatial volume, morphology, structure, and internal relationships are all measures and manifestations of matter and energy. This holographic structural relationship state can be characterized by a set of generalized state functions $\Psi(r, t)$, where $\Psi(r, t)$ can represent a single particle, a local or hierarchical structure, or the entire system. In summary, $\Psi(r, t)$ characterizes all information of the research object, which is also the basis for information to be quantitatively analyzed as a function variable. The significance of open sets precisely reflects the changing attributes of the aggregation, dispersion, and correlation between substances in nature.

The space-time coordinate system (r, ict), its corresponding momentum-energy coordinate system (P, iE/c), and wave vector-frequency coordinate system (K, i ω /c) are in an equivalent mapping relationship, and the coordinate transformation is Fourier transformation, which is the basis of visual image and signal analysis.

The natural space-time space in "Geometry of Space-time Structures" is a metric space, and the distance differential dS is defined as:

$$dS^2 = n_x^2 dx^2 + n_y^2 dy^2 + n_z^2 dz^2 - c^2 dt^2 = dr^2 - c^2 dt^2 \quad (1)$$

where n(x, y, z) is the generalized refractive index tensor of the spatial medium. When dt = 0, dS is the optical path differential of the isochronous 3D natural space.

The geometric scale range of the research objects in "Geometry of Space-time Structures" is [0, ∞), and physical laws exhibit obvious scale characteristics. The following briefly discusses several basic concepts and fundamental logic relationships related to this paper.

2.1. Holographic State Function $\Psi(r,t)$ – Space-time Full Information Tensor, and Quantifiable Information Concept

For complex but holographic, orderly, and self-consistent systems, when regarded as a whole, the relevant space-time material interaction relationship attributes from atomic and molecular

and detailed units to hierarchical substructures and then to the entire system can be characterized by a state function $\Psi(r, t)$ in a full-scale "transparent" manner, which is the holographic state function of the system. The entire system "exists" in the 3D natural space, and its dynamic holographic analyzing over time is (or maps to) a holographic state function $\Psi(r, t)$, which is actually a three-dimensional spatial information quantification array, and can be called the space-time full information tensor of the system. This integrated spatial array, where each position point unit characterizes the physical properties and information content from all perspectives. The spatial size and information connotation dimension of the point are determined by the research objectives. In the static state, the holographic state function $\Psi(r, t)$ can be divided and split.

The change of the overall state of an isolated system over time is the result of time t acting as the only independent variable. If adjacent time segments are denoted as t_i, t_{i+1}, t_{i+2} , respectively, the corresponding actions are denoted as T_i, T_{i+1}, T_{i+2} , respectively, and the corresponding states are denoted as $\Psi_i \square \Psi_{i+1} \square \Psi_{i+2}$, respectively, then, $T_{i+2} * T_{i+1} \Psi_i = T_{i+2} \Psi_{i+1} = \Psi_{i+2}$. For the self-organization process (irreversible), T_i is a unidirectional sequence with fixed positions, and adjacent ones are non-commutative, i.e., $[T_{i+2}, T_{i+1}] \neq 0$. The relationship between the initial state Ψ_0 and the final state Ψ_n of the system can be expressed as:

$$\Psi_n = \prod_{i=1}^{n-1} T_i \Psi_0 = T \Psi_0, \quad T = \prod_{i=1}^{n-1} T_i \quad (2)$$

Time action T is a topological transformation. If the system is a microscopic quantum, equation (2) becomes a quantum matrix equation. Time transformation is generally a continuous transformation, forming a Lie group.

Information is a broad and polysemous term. To be quantifiable, or to determine its value, a specific quantifiable concept of information must be defined. Different people can define different quantifiable information concepts.

Shannon's information theory is based on the probability distribution of random events, defining the relationship between the information amount I_i of a certain probability event a_i and the probability P_i as: $I_i = -\log_b P_i$, where b can be 2, e, 10 (or others). The amount of information is proportional to the uncertainty of the event, and the information amount of a certain event is $I = 0$.

Information entropy H is defined as $H = \sum_i^n P_i I_i = -\sum_i^n P_i \log_b P_i$, which is the average value of the information amount of probability events. The theoretical basis of Shannon's information theory has nothing to do with natural physical logic. When b = 2, Shannon's information amount can correspond to the scene content described by computer language based on 0 and 1 as the basic units, and the size of the information amount can evaluate the information value of program symbols or database packages, which is exactly the value of its application in data compression, channel coding, language models, etc.

The quantifiable information concept defined in this paper is not a function of probability variables; on the contrary, it is a set of definite material attribute relationships, that is, the space-time information set containing all material properties and internal relationships of the holographic state function $\Psi(r, t)$ of a complex ordered system. It is another representation method of the holographic material state of the system. The information amount I_i of a certain physical property or relationship of the system is related to the corresponding physical quantity W_i and the corresponding conversion coefficient χ_i as: $I_i = \chi_i W_i$ (which can be a tensor operation relationship). The relationship between the total information I of all physical attribute relationships in the system and its total material-energy E is:

$$I = \chi E = \sum_i I_i = \sum_i \chi_i W_i \quad (3)$$

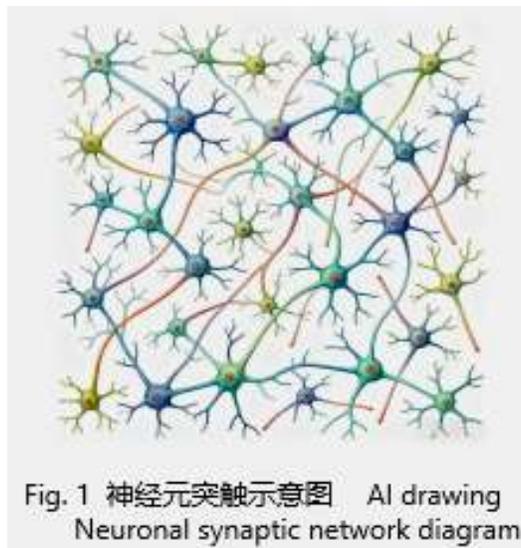
Equation (3) clearly shows that information (including consciousness and inheriting spirit) corresponds to and is unified with matter. As can be seen from Section 2.2, the brain is the connection point and ordered converter between the consciousness space (a subspace of the information space) and the material world.

2.2. Space-time Information Tensor Space Corresponding to the Brain Nervous System

— Ordered Neural Network Structure, and Consciousness Space

In the practical application of the holographic state function $\Psi(r, t)$, it is necessary to reduce the content and form of the space-time full information tensor of the system, based on the factors that determine the characteristic attributes of the specific research object.

The brain nervous system is composed of 86 billion neurons orderly divided by functional modules. Each neuron has one axon and hundreds or even more dendrites. Neurons are interconnected and transmit information through synaptic connections. A single neuron in the central nervous system usually has thousands or even tens of thousands of synaptic connections. Compared with chips, in addition to neurons being organic living organisms, this is also a huge difference between the two. Figure 1 is a schematic diagram of the brain neuron synaptic connection network produced by AI. Nerve cells in various functional areas of the brain form a complex and orderly three-dimensional network connection structure in 3D space through directional synaptic connections. Signal transmission between similar neurons is unidirectional, that is, from the axon of the previous neuron to the dendrite of the next neuron. Of course, numerous adjacent synaptic connections between similar neurons can also form closed loops, which can strengthen and prolong similar signals, facilitating thinking and memory. Synaptic connection loops between different types and levels of neurons have a feedback effect, i.e., control instruction transmission \rightleftharpoons action result feedback.



Thus, the reduced space-time full information tensor $\Psi(t)$ of the brain nervous system is the 3D network relationship structure of signal coupling conduction and synaptic connections of all neurons changing over time – the information tensor. The information amount of each neuron is summarized as the on (or off) state, the number of adjacent connections, and the connection direction, which can be expressed as $\Psi_{mno}^{FL}(t)$, where m, n, o mark the position of the neuron as a tensor element, F marks the function of the neuron, and L marks the level of the neuron. Let:

$$\Psi(t) = \{ \Psi_{mno}^{FL} \}_{mno}(t) \equiv \{ \Psi_{mno}^{FL}(t) \} \quad (4)$$

Obviously, the set of space-time information tensors $\Psi(t)$ of the brain nervous system, $\Psi = \{ \{ \Psi_{mno}^{FL}(t) \}, 0 \leq t < \infty \}$, can form a topological space. Each information tensor $\Psi(t)$ is a memory and logical relationship information set of the brain nervous system at time t , and it can also be decomposed into more subsets. Social organizations, the Internet, AI chips in use, etc., can all be

characterized and described similarly. A network tensor Ψ without signal transmission and communication is only its initial state set $\Psi(0)$.

The concept of consciousness is also broad and polysemous [13]. The quantifiable consciousness defined in this paper is a timeliness information set (denoted by $C(t)$) generated by the brain nervous system and perceptible to the individual's physical and mental state, and is a (globally describable) mapping of the space-time full information tensor $\Psi(t)$. Let T_c denote this $\Psi(t) \rightarrow C(t)$ transformation, and T_c^{-1} denote the inverse transformation, i.e.:

$$C(t) = T_c \Psi(t), \quad \Psi(t) = T_c^{-1} C(t) \quad (5)$$

The human consciousness defined in this way, including the subconscious, is an information flow generated by the brain nervous system associated with the entire body of the individual, a non-embodied manifestation of a living life, with the sense of mission of life and the initiative driven by goals. Consciousness that can be accurately described generally manifests as continuously output language and text over time, which can be regarded as a stream of consciousness. The active consciousness of the brain nerves (not necessarily purely initiated by the prefrontal cortex) can be regarded as an inverse transformation acting on itself, representing the essential attribute of active consciousness driven by time sequence. Life is an irreversible self-organization process driven by time. As for the state change $\Psi(t+\delta t)$ caused by the external stimulus w , using equation (5), $C(t+\delta t) = T_c \Psi(t+\delta t)$, $\Psi(t+\delta t) = T_c^{-1} C(t+\delta t)$, then:

$$\Psi(t) \xrightarrow{w} \Psi(t+\delta t) = w \Psi(t) = w T_c^{-1} C(t), \quad C(t+\delta t) = T_c w T_c^{-1} C(t) \quad (6)$$

Since human consciousness $C(t)$ and the material movements and changes of the brain nervous system – the dynamic information tensor $\Psi(t)$ – are in a mutual mapping relationship logically, and human consciousness can perceive and analyze itself, the basic logical relationships of the corresponding brain nervous system can be fully analyzed by studying the logical laws of the consciousness space $C \equiv \{C(t), 0 \leq t < \infty\}$.

If the space-time scene described by consciousness (or information) is corresponding to the real natural space-time space (x, y, z, ict) , it can be characterized by the (ix, iy, iz, ct) coordinate system. In this way, the logical relationships in (x, y, z, ict) can be applied. The 2D and 3D dynamic virtual scenes of computers can be regarded as implementation templates of the (ix, iy, ct) or (ix, iy, iz, ct) space.

2.3. Visual Space of the Natural World

For any observer, the scene of the natural world is the observed image, which is an image that is naturally reduced or detected through magnification [3]. The image observed or detected by the observer is denoted as P' , the actual natural scene is denoted as P , and $P \rightarrow P'$ is a one-to-one space-time transformation. The set of images P' observed by the observer is the visual space of the natural world. Assuming the coordinates of an arbitrary object

point in the 3D natural space (referred to as "P space") are (x, y, z) , and its coordinates in the visual space (referred to as "P' space") are (x', y', z') , then $(x, y, z) \rightarrow (x', y', z')$ is a one-to-one light-induced transformation. The P' coordinate system still maintains orthogonality, but the unit length decreases as the coordinate value increases; only the distance differential dS' in a small space still has a vector operation logic similar to dS .

Generally speaking, the transformation T from the distance differential dS or (dx, dy, dz, ict) to the distance differential dS' or (dx', dy', dz', ict') is represented by a 4×4 matrix $T_{4 \times 4}$. Since the visual image P' of the observer at any time is simultaneous ($dt'=0$), the space-time transformation of $P \rightarrow P'$ is essentially a space-time transformation from the quasi-4D space-time space (x, y, z, ict) to the 3D space (x', y', z') , and the transformation matrix is simplified to a 3×4 matrix. The 3D visual image presents a dynamic natural scene. For any point (x, y, z) in the P space at a distance S from the observer, the corresponding time is $t=0 - S/c = -S/c$, and its 4D coordinates are $(x, y, z, -iS)$. Therefore:

$$\begin{pmatrix} dx' \\ dy' \\ dz' \\ ict' \end{pmatrix} = \begin{pmatrix} T_{11} & 0 & 0 & T_{14} \\ 0 & T_{22} & 0 & T_{24} \\ 0 & 0 & T_{33} & T_{34} \\ 0 & 0 & 0 & T_{44} \end{pmatrix} \begin{pmatrix} dx \\ dy \\ dz \\ ict \end{pmatrix} = \begin{pmatrix} T_{11} & 0 & 0 & T_{14} \\ 0 & T_{22} & 0 & T_{24} \\ 0 & 0 & T_{33} & T_{34} \end{pmatrix} \begin{pmatrix} dx \\ dy \\ dz \\ -ids \end{pmatrix} \quad (7)$$

Among them, the matrix elements that are zero are determined by the mutual relationships of the orthogonal coordinate components corresponding to the space-time transformation; T_{14} is proportional to $\frac{\partial x'_i}{\partial t}$, and $T_{44}=0$.

According to the Geometry of Space-time Structures, the geometric distance differential dS^2 of the quasi-4D natural space-time space characterizes matter and energy, with light as the propagation medium, the corresponding quantity observed by the observer is $dS'^2 \propto dS^2/S^2$. That is, $dS'^2 = \lambda^2 dS^2/S^2$, where S is the optical path and λ is constant. Using formula (1), setting $dt' = 0$, the fixed time differential element $-ids = 0$, and letting $\lambda = 1$, equation (6) becomes:

$$\begin{pmatrix} dx' \\ dy' \\ dz' \end{pmatrix} = \frac{1}{S} \begin{pmatrix} n_x & 0 & 0 & T_{14} \\ 0 & n_y & 0 & T_{24} \\ 0 & 0 & n_z & T_{34} \end{pmatrix} \begin{pmatrix} dx \\ dy \\ dz \\ 0 \end{pmatrix} \quad (8)$$

Equation (8) is the space-time transformation differential equation from the real scene of the natural world to the image in the visual space, which can be applied to AI 3D dynamic recognition algorithms such as autonomous driving. Through repeated training and learning using a large amount of actual scene data, a relatively accurate and complete set of visual matrices for different physical states at different times can be obtained.

3. Representation and Intrinsic Relationships of Consciousness and Full Information Tensor of the Brain Nervous System

3.1. Unified 0/1 Signal Code Representation of Consciousness Space, and Its Basic Properties and Operational Relationships

In the information society characterized by digitization, various

types of information can be represented as 0/1 binary machine language digital sequence sets according to certain rules. Due to different transformation definitions and algorithmic rules, the 0/1 character sets of various types of information have different meanings and usage scenarios and do not form a unified topological space.

① Several Related Information Spaces Represented by 0/1 Codes
Character text space Z: Various language and text subsets are represented by corresponding 0/1 codes, such as the ASCII system for English (supporting 128 characters or extended 258 characters), the GB2312/GBK/GB18030 systems for Chinese (covering 7445/21886/70244 Chinese characters and symbols respectively), and the Unicode system that includes almost all language characters worldwide (capable of representing 1,114,112 characters). Different 0/1 digital units only represent different characters recognizable by computers and have no physical meaning. By arranging them in an orderly manner according to certain rules and defining specific algorithms, their significance and application value can be expanded. For example, defining token semantic vectors and matrix algorithms can construct various LLMs [14-15].

Photoelectric-acoustic signal information space S: Various photoelectric-acoustic physical signals are converted into 0/1 codes through converters. This is a quasi-physical information space containing characteristic physical quantity information (such as frequency, amplitude, intensity, direction, etc.), a projection transformation (T_s) of the real physical space. S can reproduce the real physical state through inverse transformation (T_s^{-1}). Its elements are actually pulse signals represented by 0/1 codes.

Human consciousness space C: It is a unique human mapping (T_c) of the space-time full information tensor Ψ of the brain nervous system. The space elements include direct sensations such as auditory, visual, tactile, taste, and olfactory sensations, as well as higher-level behavioral mapping sensations such as brain memory, thinking, planning, and instruction decision-making, which can be clearly described in the form of text or images. Its 0/1 codes have definite physical and biochemical meanings. The relationship between elements of the consciousness space and the real physical and biochemical state Ψ is the mapping T_c .

Actual physical and biochemical state space Ψ of the brain: This paper refers to the set of space-time information tensors of the brain nervous system, $\Psi = \{ \Psi_{mno}^{FL}(t) \}, 0 \leq t < \infty$. The meaning of the 0/1 code set of tensor space elements is reduced to the on/off state of neurons and the relationship of the number of adjacent synapses. The on/off characteristics of neurons determine that they are essentially components that execute 0/1 signal logic.

② Representation, Generation, and Intrinsic Attribute Relationships of Consciousness Space

For individuals, consciousness is an immediate signal flow, a "virtual product" of the brain changing over time. The

consciousness space is a complete set (C), including all describable and presentable consciousness "fragment" subsets (C_i) (which can belong to different people). Its element content is the 0/1 codes of text, images, etc., presented or imagined by the brain nervous system, and is a 0/1 physical signal code that can in turn promote further changes in neuron states. For example, for human auditory or visual senses, at most familiar or safe scenarios, the information heard or seen only triggers reactions in relevant sensory neural tissues and does not cause responses in high-energy neurons such as the prefrontal cortex; however, hearing a "scream" or "seeing a loved one" will involve the cochlea, brainstem, thalamus, primary and secondary auditory cortex, parietal lobe, prefrontal cortex, amygdala, peripheral organs, etc., or the retina, thalamus, primary and secondary visual cortex, prefrontal cortex, amygdala, dopamine system, peripheral organs, etc., respectively, triggering a chain of neural reactions. The representation of text or images thought or mapped by consciousness cannot directly use the 0/1 codes of the character and text space Z, but only the 0/1 signal codes of the photoelectric-acoustic signal information space S, which can directly act on the brain nervous system. The 0/1 signal codes of text consciousness are 1-dimensional in time sequence; due to the attention orientation of brain nerves, images and sound images correspond to 2-1 dimensions and 3-1 dimensions respectively. Of course, the elements of the character and text space Z and the photoelectric-acoustic signal information space S can also be converted into each other through corresponding technologies. Information spaces, including consciousness spaces, have timeliness and relative independence in their information content units, and can only have space-time adjacent correlations. Space-time causal relationships can be directly identified by comparing adjacent states, which is actually the "world law" that machines need to recognize, and can be completely realized through iterative learning.

The correlation degree of spatial units can borrow the intuitive action relationship of vector spaces ($\vec{A} \cdot \vec{B}$, dot product), which is exactly the logical basis for the applicability of the attention function in the transformer architecture of large models ($\text{Attention}(Q, K, V) = \text{softmax} \frac{QK^T}{\sqrt{d_k}}V$) [4].

At present, the form of the mapping T_c between elements of the consciousness space and the real biochemical state Ψ is not clear, but from the perspective of information space, if the information content is consistent, the transformation must be isomorphic, and it is appropriate to use 0/1 signal codes as the representation form of the consciousness space. The consciousness states of many people of different ages, fields, experiences, regions, high literacy, and high IQ can be used as templates to generate corresponding 0/1 signal code sets, constructing a unified and approximately complete set of human consciousness space C as a mapping space to analyze and improve the brain nervous system itself.

3.2. Analyzing the Intrinsic Mechanism of the Brain Nervous System from the Consciousness Space – Representation of the Full Information Tensor of the Brain

Based on numerous relatively accurate and complete subset clusters

C_i in the human consciousness space C ($C = \{C_i\}$), through a large number of in vitro safety experiments and combined with clinical practices on specific populations, the structural representations of various subsets Ψ_i ($\Psi_i = \Psi(t)$) of the space-time information tensor set Ψ of the brain nervous system are continuously generated and improved to reveal the intrinsic operational mechanism of the brain nervous system.

The specific approach is to use C_i as external stimuli and active consciousness, and conduct inverse transformation iterative experiments using formulas (5) and (6). Assuming the space-time information tensor of the brain nervous system of a person u is Ψ_u , its personal mapping transformation is T_{cu} , and its personal feature consciousness set is C_u ($C_u = T_{cu}^{-1} \Psi_u$), the initial time is t_0 , a certain determined quantity C_{ij} of C_i is used as the invariant active consciousness acting on Ψ_u , i.e., $C_{ij} \Psi_u(t_0) = \Psi_u(t_0 + \delta t) = T_{cu}^{-1} C_u(t_0 + \delta t) = C_{ij} T_{cu}^{-1} C_u(t_0)$. After conducting this experiment continuously n times, we get:

$$(C_{ij})^n \Psi_u(t_0) = \Psi_u(t_0 + n \delta t) = T_{cu}^{-1} C_u(t_0 + n \delta t) = (C_{ij})^n T_{cu}^{-1} C_u(t_0) \quad (9)$$

Equation (9) is actually a system of n equations, where n can be very large. The $C_u(t_0 + n\delta t)$ of this person is measurable, so the corresponding T_{cu} (local) can be solved; then, different C_{ij} are used to repeat the experiment to improve T_{cu} .

Equation (9) is a vector-tensor equation, which is more suitable for iterative asymptotic solution using computers. Because in the process of a large number of continuous experiments, the IQ of the test person may be greatly improved, and the personal mapping transformation T_{cu} should continue to evolve. The response degree of each person to the external stimulus C_{ij} is also a key factor. With T_{cu} , a relatively accurate set of personal brain nervous system space-time information tensors $\{\Psi_u\}$ can be generated through a large number of inverse operations and combinations, thereby completing a more comprehensive set of human brain nervous system space-time information tensor space Ψ .

The following further discusses how to analyze the intrinsic mechanism of the brain nervous system using the space-time information tensor in combination with specific scenarios.

① Relationship and Intrinsic Mechanism Between the Full Information Tensor of the Brain Nervous System and Consciousness During the Memory Process

Taking the understanding and memory of "To achieve lofty ideals, one must be indifferent to fame and fortune; to reach far-reaching goals, one must keep a peaceful mind" ("淡泊明志, 宁静致远", a famous quote from Zhuge Liang, the most legendary figure in China's Three Kingdoms period 1,800 years ago) as an example. First, driven by the active consciousness of "I want to remember", the central area of the cerebral cortex – the prefrontal cortex neurons responsible for overall command, operational planning, and decision-making instructions – are activated, starting to arouse

and command neurons in various relevant functional areas; the reading, writing, and auditory nerves perceive "淡泊明志, 宁静致远" and convert it into electrical and chemical signals; the hippocampal neurons are activated to accept it, convert it into an orderly "code state" and cache it; under the overall command, memory association, and logical guidance of signals from the prefrontal cortex, the temporal lobe is activated and triggers the excited state of various associated semantic neurons, neural pulses connect the consciousness of "Only by being indifferent to fame and fortune and having no desires can one stay true to one's original aspiration, fulfill one's mission, and realize the value of life; only in a pure and natural environment and a peaceful and relaxed physical and mental state can one have a broad perspective and insight into the true meaning", and the amygdala neuron network responsible for emotions may be highly activated, causing resonant responses including peripheral organs, further strengthening and expanding synaptic connections or even stimulating new synaptic connections, making the memory impression more profound and lasting; and so on. Memory retrieval is simpler: the prefrontal cortex neurons consciously send extraction pulse instructions, activating the coupled response of associated neurons in the entire memory network to form consciousness output. Throughout the memory process, the consciousness vector corresponds one-to-one with the space-time network formed by neurons in various functional areas of the brain in the real physical space. Various memories and thinking of the brain are essentially sets of dynamic connection network states formed by neurons in multiple brain regions.

② During Sleep and Dreaming

In the sleep state, first, under the consciousness of physical and mental fatigue, lying down to relax, and the biological clock, the prefrontal cortex forms the conscious instruction of "I want to sleep", and neurons in various cortices enter an inhibited connection state; the thalamus and brainstem nerves are in a low-frequency 0/1 signal state that maintains basic life activities (breathing, pulse, metabolism, etc.), with no signal transmission between the motor cortex and the spinal cord, and inhibiting and filtering interference from messy signals; the sleep state also relatively strengthens the role of the body's immune system and other self-protection functions. During sleep, the limbic system (amygdala, hippocampus) is relatively active. Especially the emotional memory signals such as anxiety accumulated during the day, without the inhibition of frontal nerve consciousness, may stimulate sensory nerves, generate dreams, and even evoke the reproduction of some early highly stimulating scenes. Frequent messy dreams of the elderly in daily life are a sign of cell and physical and mental aging. Young and middle-aged people who often have similar negative dreams may be a hint of certain physical and mental problems (including anxiety and fear).

③ Brain Waves, and the Coupling Between Neuronal Synaptic Connection Networks and External Stimulus Signals

Brain waves are orderly potential fluctuations formed by the synergistic coupling of numerous neurons in the brain neural

network, and are manifestations of certain high-probability set states of subsets of information tensor units. They are divided into δ , θ , α , β , and γ waves in order of increasing frequency and decreasing amplitude. Among them, δ waves (0.5–4 Hz, 20–200 μV) correspond to deep sleep states and brain activities in infancy; β waves (13–30 Hz, 5–30 μV) correspond to normal waking behavioral states; γ waves (30–100 Hz, $<20 \mu\text{V}$) mainly correspond to decision-making and action states led by the prefrontal cortex with the linkage of multiple functional areas. Brain capacity and efficiency are positively correlated with brain wave frequency. Specific personal consciousness content is the result of coupled discharge reactions between neurons at certain space-time determined positions in the complex neural network. It is difficult to reproduce by adding electrodes on the scalp, and it is impossible for built-in chips to achieve dynamic coupling regulation of 10^{10} neurons. To achieve effective human response to external stimulus signals C_{ij} , the auditory system may be the most effective linear interface. However, rationally speaking, a faster and more efficient way to improve human intelligence should be to enable everyone to use better intelligent tools.

4. Models, Computing Power, and Embodied Intelligence

Seeking intrinsic laws from the colorful world and artificially generating a "real" world from scratch are two completely different logical processes. The former is from concrete to abstract and from complex to simple, while the latter is from concrete to concrete and from simple to complex. The latter does not require advanced abstract thinking or profound mathematical and physical knowledge; it only needs to continuously do it simply and tirelessly according to personal experience and imitating real scenes. This is the real reason why a three-year-old child is smarter than a humanoid robot with super computing power and massive knowledge. For a robot to do housework, it should be like an ordinary person, fundamentally not needing to use "Newtonian mechanics or vector analysis" or know why the world is the way it is. This is a misunderstanding of AGI.

Realistic scenes are images of various objects growing and

arranging and combining over time. To reproduce such scenes, in addition to simple direct shooting and copying, as long as the short-range relationships of various objects in time and space dimensions are known (physically, it is the rate of change; visually, it is an intuitive change amount that can be realized through simple and direct algorithmic iteration), they can also be "generated" step by step. In other words, all models and embodied intelligence can generate scenes and complete actions in this "way that children learn, imitate, and understand".

The evolution of human society is an irreversible self-organization process. Learning and progress are one of the essential attributes of life. The brain neural network fully reflects this natural attribute. Therefore, intelligent agents based on neural networks as the logical foundation (including models, embodied agents, and even chips) will naturally exhibit human-like intelligence through learning. The figure on the right is a schematic diagram of the neural network of a large model (Michael Nielsen) [12]. Using this feedforward neural network, combined with appropriate iterative optimization constraints, the results will always "converge". If the model parameters and training volume are sufficiently large, "emergence" will definitely occur [19-21]. The introduction of token long-range correlation by Transformers has significantly improved the efficiency of accurate generation of long sentences. However, the global value correlation attention function algorithm of Transformers not only logically limits the possibility of large models (LMs) becoming world models (WMs) but also causes them to have the defects of wasting a lot of computing power and being dependent on computing power.

The computing power limit of a single center lies in the integration degree of the chip itself and the number of chip server clusters. The chip process node is already very close to the thermodynamic limit (1nm+). Below 2nm, electroacoustic random effects such as heat generation and tunneling will gradually replace the dominant position of artificial order; the upper limit of a large number of server clusters depends on data exchange efficiency and energy consumption.

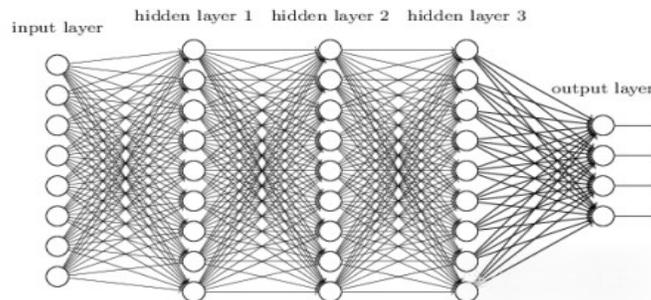


Fig. 2 LLM neural network, Michael Nielsen, Neural Networks and Deep Learning[12]

Embodied intelligence is mainly a software and hardware issue of programs such as recognition, decision-making, action, and adjustment. The difficulty of humanoid robots in household environments lies in how to perform simple actions like humans. It does not need to understand the intrinsic laws of related things,

only to learn to perceive and act like a child. In addition to hardware, the software must be dynamic like the human brain, with decisions changing in real time with space-time changes. The learning algorithm itself and its iteration speed must be premised on adapting to training in a large number of application scenarios,

rather than being developed in isolation.

Machine actions in autonomous driving basically only include standardized actions within the vehicle such as braking, accelerating, and steering, etc., the technical difficulty lies in accurate and rapid recognition and decision-making, and its application also faces the problem of public acceptance. After all, car accidents are major issues related to life. The visual space logic of the Geometry of Space-time Structures is the direct light sensation transformation relationship of humans over time, and is a natural training iterative algorithm.

5. Discussion

Brain science and artificial intelligence are integrated with each other and both have narrative attributes. Creating and generating a new world is a time process in which new things are continuously generated and increased. Advanced AI technology is eliminating language barriers and intelligence differences among people. As long as one is sufficiently diligent, they can find a desirable place in the new world. If AI agents soon replace manual labor, humanity may really enter an era of free and ideal spiritual civilization. But when various robots, especially humanoid robots, follow humans like shadows and everyone, or many people, become "superhumans", how should humans define themselves? It is certain that the natural environment and human society are undergoing tremendous changes, and AI and brain science are accelerating this process.

Acknowledgments

The author would like to thank Mr. Song Yecheng (AI agent application development engineer) for his strong support! Mr. Song often communicates and discusses issues related to AI and the brain with the author, which is very helpful for broadening the author's research ideas on related issues. The author also specially thanks his family for their long-term understanding and strong support.

References

1. Tai Wei Song. (2024) Physical Foundations and Mathematical Logic of the Natural World.

2. Song Taiwei. (2014). The Nature of Thermal Motion and Self-Organization - Space-Time Statistical Thermodynamics.
3. Taiwei Song. (2024) Space Warp, Space-Time Transformation, and Cosmic Redshift: The Application of the Geometry of Space-Time Structures on Large Spatial Scales.
4. Taiwei Song. 2020. Strong Correlation Function between Particles in the Low Dimension Structures.
5. Wang Zhengxing. (2008). Modern Physics, Peking University Press.
6. Mark Fox. (2010). Quantum Optics: An Introduction, Peking University Press.
7. Jin Lu et al. (2016) Advanced Mathematics, Higher Education Press, 4th Edition.
8. G. Nicolis, I. Prigogine. (2010). Exploring Complexity: An Introduction, Sichuan Publishing Group.
9. Zhai Zhonghe et al. (2020). Cell Biology, Higher Education Press.
10. Wu Xiangyu et al. (2023) General Biology, Higher Education Press.
11. Cai Zixing et al. (2020) Artificial Intelligence and Its Applications, Tsinghua University Press.
12. Michael Nielsen. (2023) Neural Networks and Deep Learning.
13. Zihan Ding et al. (2023) Survey of Consciousness Theory from Computational Perspective At the Dawn of Artificial General Intelligence.
14. Ashish Vaswani, et al. (2023). Attention Is All You Need.
15. Tongtong Feng, Xin Wang, et al. (2025). Embodied AI: From LLMs to World Models.
16. David Ha, Jürgen Schmidhuber. (2018) World Models.
17. Abby O'Neill, Abdul Rehman, et al., Open X-Embodiment: Robotic Learning Datasets and RT-X Models.
18. S.B.O. Team, et al. (2024). OpenVLA: An Open-Source Vision-Language-Action Model for Robotic Manipulation.
19. Zdeborová, L. (2024) The Physics of Deep Learning and Large-Scale Models, Nature.
20. Jelassi, S., Li, Y., et al., (2024) A Mathematical Perspective on Transformers.
21. Tianhong Li, (2025). Kaiming He, Back to Basics: Let Denoising Generative Models Denoise.

Copyright: ©2026 Taiwei Song. This is an open-access article distributed under the terms of the Creative Commons Attribution License, which permits unrestricted use, distribution, and reproduction in any medium, provided the original author and source are credited.