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Neural Networks 2.0 Neurogenesis

Polymorphic, oligopolistic, dynamically adaptive, neural impulse networks

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The project on the Internet:

https://github.com/Zoltan-X/Neurogenesis

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Preamble

About the genesis of this project

This work began on October 14, 2018 with an incredible and great inspiration that led to the first two basic theorems of this elaboration. Therefore, on October 17, 2018, the GitHub account "Zoltan-X" was created and the first concepts were published.

This paper presents a set of concepts for the creation of neural networks that mimic various aspects of the human brain and are intended to be as simple as possible. The special feature of these concepts is the use of spherical neurons that facilitate the formation of neuronal nodes. In addition, two basic theorems on near-field effects for axons and nodal logic in various forms are presented. The focus of this work is on mimicking the brain rather than achieving high performance.

Characteristics of Concepts List:

1. 2 Basic theorems for the neurogenesis of axons.

2. Super Germ (Super Seed) design.

3. Automatic network maintenance: growth and decay.

4. Self-influence is the "way in which the network switches, thinks and acts".

5. Interaction of neurons that are active and in close proximity.

6. Independent and logical creation of new nodes (neurons) in the network.

7. New nodes promote the formation of informative associated content.

8. It works with different types of neurons that cause different interactions.

9. Nodes are treated as spheres where axons form radial entry points.

10. Nodes process internally through a simplified neurotransmitter concept.

11. Pulse potentials are used as the only form of information within the network.

12. The nodes are activated by the impulses they contain, thereby triggering interactions.

13. Imitation of near-field effects.

14. Simplified EM field aspects

15. The network shape is defined as 3D + time (spatial with time), at least 2D + time

16. Quantization and recovery of information in the network.

Chapter 1: Elements

Definition of the elements

Super Seed (super germ or primordial germ)

The super seed, also known as the super term or primordial term, is a basic structure that defines the initial state of the structure of the neural network at the time (t_0). It serves as the basis for all further developments of the AI-controlled assistant and only contains axon and node definitions in its initial state. The sensors and action handlers define the outermost nodes that characterize the AI-controlled assistant.

Impulses

Within the neural network, impulses are electrical energy potentials that occur at specific points and transmit information to and from nodes via axons. When impulses are present at nodes, they trigger a change in the state of the node so that it is activated and emits an electromagnetic field. To simplify the calculations, we only determine the pulse positions at nodes with reduced computational effort. We distinguish between independent node types and impulse types as if they transmit a specific neurotransmitter in a node. The path cost calculation for impulses is related to the renewal of structures. If axons and nodes are not structurally strengthened or renewed by a passing impulse, they degenerate.

Axons

They serve as conductors for the transport of electrical impulses between the nodes and are not necessarily unidirectional. The area for transmitter binding is defined as the input of the axon and the output of the node. In bidirectional axons, this means that receptors and transmitters are present in the input zone of a node, which also serves as the exit site from the node into the associated axon. This phenomenon results from the primary rule of axon neurogenesis, which designates axons as unidirectional, although the direction formed can expand to bidirectional, even with 2 different neurotransmitters, depending on the behavior in the node. These connections form immediately between simultaneously active nodes that are close to each other. Ideally, they should grow along EM field lines, but for the sake of simplicity we can consider them as straight or direct lines that fully form immediately. However, during neurogenesis of nodes, the axons involved must cross between active nodes and form axon nodes, which give rise to neuronal nodes. This can be a problem because if we compute axons straight and not on EM field lines, they would never become crossed axons. Therefore, other calculations are presented in Chapter 5: Neurogenesis.

One of the most important characteristics of axons is that they have to renew their structure by transmitting impulses. This is necessary to prevent their structure from degenerating over time. If an axon does not transmit impulses between the nodes for a certain period of time, its structure weakens and degenerates until it eventually disappears.

Neuronal nodes

play a crucial role in the functioning of the nervous system. They divide an axon into two parts and require an axon to function properly. Without an axon, a node would be useless as it cannot be reached by any impulse. So if nodes lose their last connection, they should be considered lost and removed immediately. Nodes arise from a crossed axon node, and although they must generally have a shape for the concepts implicit in this work, they are simplified as spheres. This allows them to become oligopol nodes. When axons transmit a neurotransmitter type-specific impulse, they enter the node simplified as spherical. On the outside of the spherical surface, a circular region around the entry point is placed on the incoming neurotransmitter type, which is located on the inside of the sphere. Existing types are not changed so that overlapping areas mix different transmitter types depending on their entry point Element Data Types.

Element Data Types

Impulses

The data type of the information - a pulse - is best described as a signal that represents a dynamic scalar or Boolean blob or parts thereof.

ID	Number
Electrical Potential	Number
InformationType	Set of Types
Position	spatial coords (x,y,z)
Timestamp last update	DateTime in micro secs

Elements VitalityData

Axons and nodes have common data on vitality, which this data set implies here

ID	Number
Timestamp last update	DateTime in micro secs
Strength	Number
Diameter	Number
Renewal rate	(Strength+change) as Number
Decay rate	(Strength-change) as Number

Axon

An axon is a data set consisting of

ID:	Integer
TranmitterType:	Set of types
ReceptorType:	Set of types
Polar Coordinates:	origin Angle^2 with radius (Vector to a destination point)
Spatial Coordinates:	origin(x,y,z) destination(x,y,z)
IDs:	From Node ID To Node ID
Vitality:	OwnVitality

Node

A node is a data set consisting of

ID:	Integer
NodeType:	Set of types
EM-Field-Strength	(sum of residing Impulse potentials) Number
Spatial Coordinates	origin(x,y,z)
IDs:	Set (ConnectedAxon, Entry Point Angle^{2}from the center of the sphere, Radius on the surface), Set of Types)
Vitality:	OwnVitality

Chapter 2: Near-field effects

The CREB-1 dilemma

For the first main theorem, a protein is derived that is oriented towards electromagnetic fields. In this context, isolated CREB-1 proteins are relevant in various studies. Therefore, this effect is attributed to CREB-1 proteins in the following. For reasons of computational complexity, we avoid CREB-1 calculations, except for a possible fictitious growth rate in terms of time per distance reached.

The dendrite theory

The dendrite theory states that the growth of branched structures is predetermined by genetics and is a slow process. Although this approach does not seem to be relevant for the formation of information by structural mapping during the learning process, it makes sense in the context of the growth of super germs. Structural mapping in the context of information formation can be challenging if we try to include all information within a given time. However, we can reduce computations by abandoning them altogether or by defining axon growth as part of structure maintenance by momentum currents. We can also reduce computation by introducing constraints, such as limiting the range of computation or reducing it altogether.

The magic of linking closely spaced nodes

The nodes are connected to each other by axons and form a structure for information mapping. This structure can be reactivated by impulses. However, this effect must be limited in order to prevent everything from becoming hopelessly interconnected. Fortunately, any unused structure degenerates and counteracts this effect. The range of possible connections is dynamically determined by the electrical potentials in the individual nodes, and correct scaling promotes accurate information mapping. The "magic" of a well-scaled interconnection area is that it allows complex connections to be made in a meaningful way. An incorrectly scaled interconnection area of nodes can lead to a total interconnection that defines a natural boundary. However, the degeneration of unused axons and nodes creates a release effect that works against reaching this limit, leading to the polymorphic behavior of this type of network.

Chapter 3: The foundations of the original ideas

Precondition: Impulses in nodes activate them

1. If a node has at least one pulse, it is considered active.

2. Only active nodes emit an EM field of pulses inside them.

Neighboring and simultaneously active nodes generate new axons that connect them to each other. They also influence each other in their choice of further paths through the network. In addition to the spatial dimensions, the fourth dimension in this context is time.

It follows from this that impulses must be present simultaneously in neurons that are spatially close to each other so that a mutual interaction can take place in 2 forms:

The 2 fundamental theorems

1. (EM near field + cerebrospinal fluid see: Abstract on magnetic field affinity of CREB-1). ***Nodes connect with new axons in different forms.***

2. (receptor and neurotransmitter logic) ***Impulses branch out through mutual influence according to various defined cases.***

An example of a minimalist AI assistant in the form of an Auto Actor model is discussed in the next chapter.

Chapter 4: Example of an auto-actuator model

Use case description

This example concerns a simple form of existence. The AI will feed itself and evolve to stop eating in order to prevent the consequences of overeating.

1. A simple pulse transport along an axon "Axon 1" from a sensor "Sensor 1" to an action "Action 1" with a node "Axon 1-Node 1-Type A".

2. Pulses are continuously generated by the "Sensor 1" sensor and transmitted to "Axon 1 - Action" via the "Axon 1" line and the "Axon 1 - Node 1 - Type A" node.

3. The second axon appears. "Axon 2" is supplied with pulses from "Sensor 2". "Axon 2" also has a node "Axon 2 node 1 type B", which is located near "Axon 1 node 1 type A". The "Axon 2" ends in "Axon 2-Action 2".

4. Sensor 1" and "Sensor 2" continuously send pulses via the "Axon 1" and "Axon 2" lines to "Axon 1-Action 1" and "Axon 2-Action 2".

5. This is repeated until two impulses are applied simultaneously to "Axon 1 - Node 1 - Type A" and "Axon 2 - Node 1 - Type B" and a bridge axon is formed.

6. The behavior then changes so that the impulses in "Axon 1 - Node 1 - Type A" are conditionally redirected via the newly formed bridge to "Axon 2 - Node 1 - Type B" and from there to "Axon 2 - Action 2".

The process of development

This behavior corresponds to the first two fundamental theorems, which cause the following behavior:

Legend:

A1 => Axon 1

N1 => Node 1

A1-N1-A => 'Axon 1' to 'Node 1' with 'type A'

A1-S => Sensor as transmitter Signal generator or pulse generator on axon 1

A1-A => Action on 'Axon 1'

$I_{i,x}$ = (t_j , "A1-S") => Pulses Number I at axon x, here at the axon at a node at time t_j .

The 1st main theorem leads to the connection of "A1-N1-A" and "A2-N1-B" and thus to a new axon. The 2nd main theorem therefore causes a redirection of the impulse current from node type A to B.

In this case, A => B redirection if both nodes are active and the nodes "A1-N1-A" and "A2-N1-B" redirect the pulses from the A1 line to the A2 line.

The pulses of "A1-S" are influenced in such a way that the following then applies::

from: "A1-S" => "A1-A" and "A2-S" => "A2-A"

follows: "A1-S" => "A2-A" and "A2-S" => "A2-A

for F(I1,1) (t1, "A1-S") && F(I1,2) (t1, "A2-S")

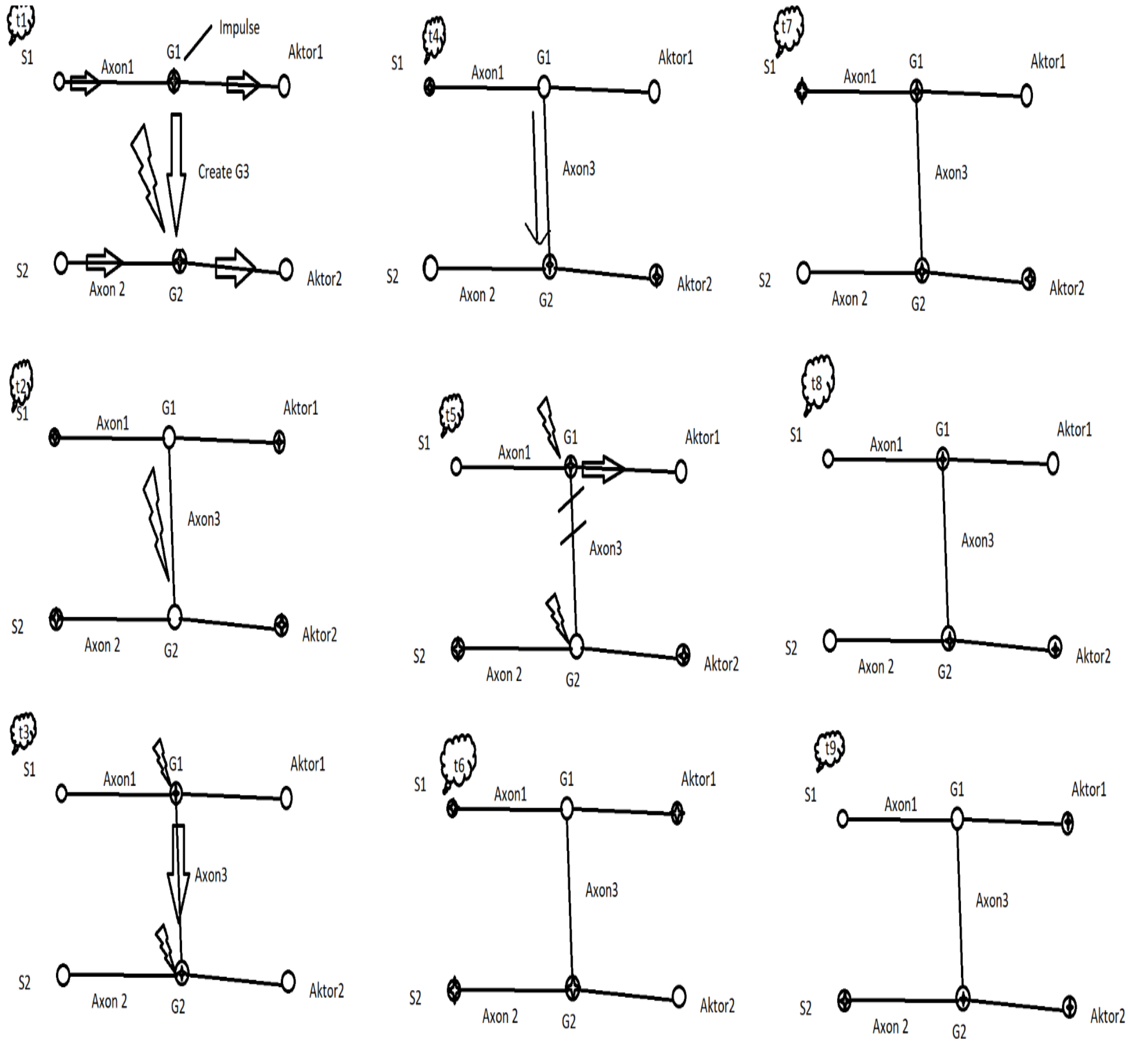
with: F(I1,1) (t2, "A1-N1-A") && F(I1,2) (t2, "A2-N1-B")

follows: Create(A3) with (A1-N1-A => A2-N1-B)

and: F(I1,1) (t3, "A2-N1-B") && F(I2,1) (t3, "A1-N1-A") &&
F(I1,2) (t3, "A2-A") && F(I2,2) (t3, "A2-N1-B") &&

In a figurative sense, this means in comparison to an auto-actuator model
"A1-S" => sends pulses as a hunger signal.
"A2-S" => sends pulses as a satiety signal.
"A1-A" => Eating.
"A2-A" => Satisfies the need for satiety.
"A2-A" => Consumes a double impulse to terminate the satiety behavior and stop eating.

Graphic explaining the process



Chapter 5: Neurogenesis

Neurogenesis (formation of nerve nodes and axons)

Neurogenesis is the independent formation of new neuronal structures. Under certain conditions, new nodes and axons are automatically formed or degenerate. The aim is to achieve a learning capability of the AI-controlled assistant in free operation mode that produces meaningful results through intelligent learning without human intervention. The structural polymorphism of generated, maintained and degenerated structures through neurogenesis behavior is also the subject of independent improvements of an AI-controlled assistant.

Axon formation

The first of the two fundamental theorems explains how new axons form between two active nodes. Nodes are considered active as long as they contain impulses. If two neighboring nodes become active simultaneously, a connecting axon is immediately formed between them if it does not already exist. However, the growth of this axon is limited to a certain distance, which must be scaled appropriately based on the intensity of the node's electromagnetic field. The slow dendrite formation is ignored in this context. The connectivity region of the axons is related to the electrical potentials in the nodes because of its dynamics and usefulness.

The formation of knots

The position for the origin of new neuronal nodes must be on an axon, otherwise they will never receive impulses. Beyond the supersame at the beginning, where the nodes divide long axons, crossed axons (nodes of axons) are the best place for new neuronal nodes. Therefore, we define new nodes at crossed axons. For simplicity, we calculate axons as a direct connection between 2 nodes, and we need to define a node that cannot be on direct and straight connections.

Axon grew between the nodes

Directly or according to the patterns of electromagnetic fields?

Electromagnetic fields would cause different axons to cross each other and form a node at this point. As a virtualized mimic, this is very complex. In virtualized mimicry, it might be useful to limit the neuro-genesis effect to its range. The neuro-genesis radius is the distance from one node to all other nodes within which axons connect. With a constant neuro-genesis radius, everything within this range that is active at the same time is connected by missing axons. Furthermore, a well-defined area can adapt to differences in dynamic pulse potential intensities. Just as a new node is best formed in the middle between active nodes, it develops an immediate interlocking with the other neuronal nodes.

The calculation of a suitable location for the creation of a node

The use of a spatial center between the EM field potentials of the pulses distorts the space in such a way that $f(_{XRadius})=$ potential/distance defines a simplified calculated, specific location of a new node. The node is located in the spatial center of all enclosed nodes. Depending on the potential, it can also be defined as spatially offset for better location assignment.

A brief explanation:

Due to the spatial distortion of the target position according to the impulse potentials, these nodes have a better information content. Future connections can benefit from the more precisely selected position, as this position contains a more precisely coordinated information link for subsequent information units.

Simple 3D example calculation for the origin of a new node:

The nodes A, B, and C with

A (X, Y, Z) = 0,0,0

B (X, Y, Z) = 3,0,0

C (X, Y, Z) = 3,4,0

3 potentials Au, Bu and Cu with:

Au = 10V,

Bu = 50V,

Cu = 100V

and r as the distance between two nodes

AB:	(A)=r*(Bu/Au+Bu) = 3* 50/ 602.5		=> 2.5, 0.0, 0.0
BA:	(B)=r*(Au/Au+Bu) = 3* 10/ 600.5		
AC:	(A)=r*(Cu/Au+Cu) = 5* 100/110	4.545sin/cos 60°/30°	=> 2.7, 3.6, 0.0
CA:	(C)=r*(Au/Au+Cu) = 5* 10/110	0.454	
BC:	(B)=r*(Cu/Bu+Cu) = 4* 100/150	2.666	=> 3.0, 2.7, 00
CB:	(C)=r*(Bu/Bu+Cu) = 4* 50/150	1.333	

Now the center point is formed

FROM: 2.5, 0.0, 0

BC: 3.0, 2.7

AC: 2.7, 3.6

ABC: f(x) (2.5+2.7+3.0) /3 = (2.7, ?.?.,

f(y) (0.0+3.6+2.7) /3 = (2.7, 2.1, ?)

f(z) (0.0+0.0+0.0) /3 = (2.7, 2.1, 0.0)

The node D is created at the coordinates: f(A, B, C) = (x=2.7, y=2.1, z=0.0)

Chapter 6: Active versatility of oligopoly nodes.

Oligopoly node

It is necessary to distinguish between nodes based on different neuroreceptors and neurotransmitters and their connections. This results in the necessity of oligopol nodes, in which oligopolistic logics of node types develop under certain conditions. This requires the formation of connections of multiple origins through axons.

Here is a list of the node logics to be used:

Differentiation of node types according to

1. Additional (sum up) behavior

2. subtractive (differentiating) behavior

3. Passage limits
a)Time-summarizing behavior (accumulating potentials)
b) Passage threshold for pulses
c)Signal attenuating behavior

4. mirroring behavior

5. Merging and quantifying behavior

The different control logics are defined by different types of nodes, each of which has its own set of receptor and transmitter logics. These logics separate the different areas by something protectively limiting like the meningeal membranes in human brains. The term "variable receptor and transmitter logic" refers to the behavior within a node where incoming impulses activate certain types of transmitters, resulting in a specific response from the node.

Different ways of branching:

1.	A =>	Redirection
2.	A => (A & B)	Mirroring
3.	C => (A & B & ...)	Quantification
4.	(A + B) => C	Additional behavior
5.	(A - B)=> C	Subtractive behavior
6.	(A & B) =>	C-union
7.	(A1 + A2 + ...) =>	Limitation

For pulse transmission modes with a variety of types

1.	A pulse activates all node type-specific interactions, which are specified in the node, together
2.	Node input to node output as node-specific behavior

Premise: `Output type ⇔ Input type`

When a signal enters a node, it does so through a circular area on the surface of a sphere. This can cause the entry point to overlap with other axonal entry points of different neurotransmitter types. Incoming impulses activate all neurotransmitter types within this entry zone. The spherical shape of a node simplifies the processing required due to the naturally complex shape of nodes. The surface of the node may consist of overlapping areas of different neurotransmitter types located on the inner surface of the entry sites. These areas may overlap with zones of different types. When an incoming impulse activates a zone within a node with different transmitter types, the node sends impulses of different types along corresponding axons away from the node.

Internal polarization of an oligopolistic node

An internal polarization of a node generates outwardly directed EM fields that could cause pulse-flux interactions. These could cause a specific change in the output axon. Example:

When a pulse of type "A" reaches the oligopoly node "N1", it can be influenced by the neighboring active node "N2". The EM field strengths of the neighboring active (polarized) nodes can then interfere and change the choice of the output axon. Sometimes a change in the outgoing axon can occur when a pulse bypasses the standard path due to polarized neighboring nodes. For example, "N1 => N3" can change to "N1 => N4". The EM field can affect the transmission path of the node containing the pulses. In addition, there may be a mixture of pulse types, with different types being emitted due to overlaps in the input zone. By changing the receptor types, the subtypes of a transmitter and the overlapping types, further variations can occur.

Further explanation of oligopol nodes in neurogenesis

Oligopole nodes are formed specifically during the processing of information. They are formed through concepts of neurogenesis. For example, crossing axons form between active nodes and turn into neuronal nodes. Active nodes attract further axon connections to other nodes. In these cases, the selection of receptors and neurotransmitters can be determined by

1.	The receptor type corresponds to the neurotransmitter type.
2.	Through entry points and mutual interactions.
3.	Control interactions with other active nodes

There are no rules for the automatic generation of possible oligopoly behaviors.

1.	Depending on the pulse potential, areas are created at the circular entry points, which generate overlaps of the transmitter logics at the entry point
2.	Furthermore, impulses in the axons are necessary to cause regeneration or hardening of the axons and induce node formation by crossed axons

The magnetic field affine CREB-1 proteins should be considered in EM field-induced axon formation and dendrite growth, as it could lead to long concatenations on electromagnetic field lines.

Chapter 7: Types of momentum interactions

The distinction between nodes of different types and the resulting impulse interactions are dealt with here.

Conversion of Impulse Potentials

1.	Impulse Potential addition
2.	Impulse potential subtraction

Enforcement of transmission through a threshold-based node

This may depend on

1.	the individual pulse potential
2.	the number of potentials accumulated in the node of **a)** simultaneous pulses **b)** pulse series within a period.
3.	Similar to transistors, whereby a second transmitter controls the pulse threshold of another transmitter

Differentiated potentials

Explanation of how to generate a differential from a pulse current on one (or more) axon(s):

On an axon A1, in the spatial proximity of two consecutive nodes - A1-N1 and A1-N2, the differential is defined by a connection of these two nodes with another axon A2 and its node A2-N1. The nodes A1-N1 and A1-N2 mirror their impulses at A2-N1 and are converted into a differential by subtraction. The subsequent impulses in axon 1 transform into A2-N1 and are differentiated as a stream of individual values. The result of the subtractive accumulation of the impulses is finally a differential with an iteration size of dx=1.

f'(x) = (dy/dx) * (y1-y2) / (x1-x2)

and with the atomic granulation by dx=1 follows

f'(x) = (pulses A - pulses B) / (x - (x-1)) =
(pulses A - pulses B) / 1 =
(pulses A - pulses B)

This means that a subtractive potential formation is a differentiation of two (consecutive) pulses. It is possible to differentiate without consuming the original pulses by mirroring them for the given operation. The subtraction requires more than two impulse sources (axons at a node) with exactly two types of polarized impulse interpretations involved in this process. The two subtracted potentials arise from two different types of impulses. Subtrahend and minuend form one or more impulses from two different transmitter types (impulses). The subsequent subtraction process generates the stream of differentiated potentials.

Quantization of pulses: Summarized potentials.

Information aggregation combines several pulses into a single one. The pulse potential, together with its exact position in the network, contains the aggregated information. At the fusion point, the network pattern is designed to facilitate information recovery by reversing direction. The counteraction required for this reversal is the quantization of impulses. The reversal of the aggregated impulses would then lead to information retrieval. This information originates from the input, i.e. the pattern of impulses in a network, and can be consciously compiled, addressed and retrieved to varying degrees. The input effect summarizes the information, while the reverse effect quantifies it. The retrieval of a summarized set of information, which represents a pulse pattern in a network, is the result of a single pulse and the quantization process. The process of information quantization and recovery can also depend on a specific neurotransmitter, allowing selective preservation and recovery of parts of the information associated with the node.

Quantize: Many simultaneous outgoing pulses are generated from one incoming pulse at the node.

Reproduced summarized and quantized pulse potential

1. During quantization, the information is broken down into atomic parts (quanta) and distributed from a single node to several axons

2. The mirroring process involves a precise transfer of impulse potentials.

Polarization and its interactions with different types of elements.

Several orientations were considered:

Different interactions are required for different node types and polarizations. The attraction and repulsion of neurotransmitters can influence the effect of impulses through electromagnetic polarization. Limitations in the thresholds of neurons can alter or influence each successive action. In such cases, the information may have been sent to a different axon instead. Quantizations work on a "one-in, all-out" basis, where all axons of a given node type receive the same incoming impulse, which is then distributed to the corresponding axons in the node.

Influencing the Impulse flow according to the EM-Field:

1. As selection of the outgoing axon at the dendrite.
 a.) Change of the transmitter type behavior (counter polarization of the transmission)
 b.) Influencing the internal behavior by external polarization
 - transitivity
 -a spatial drift over the axon to be selected

2. Increase or decrease in pulse potentials

3. Increase or decrease of a transmission threshold

4. Attraction or repulsion of neighboring impulses

5. Only polarization to influence the surrounding neurons

6. No effect on individual transmitter types (not polarization sensitive)

Influencing axon formation:

1. Increased field strength extends the range of axon formation

2. Change in the electromagnetic field lines

All-In & All-Out

Simply put, if we restrict ourselves to Boolean signals, the networks differ little from conventional neural networks. However, in order to implement the concepts of neurogenesis, such as

1. Formation and degeneration of axons and nodes,
2. several types of nodes,
3. Neuron shape,
4. transmitter,
5. Entry angle and zones of the axon.

It therefore makes sense to reduce these 2.0 networks to classic networks, unless we include some of these concepts in the implementation. The all-in concept could be part of a typed, controlled all-out. It is one way of integrating this to treat information as a type-specific all-out. In any case, the all-in construct is an aggregation and the all-out is a quantization process.

Chapter 8: Transitive dependencies

Translation of information

Explicit transitivity and controlled transitivity (pass-through)

1. Explicit transitivity: All types of pulse potential transformations (additional, subtractive, attenuating, amplifying, and possibly more)
2. Controlled transitivity is the process by which pulses that arrive simultaneously or successively over a short period of time, or those that accumulate with a time-dependent loss of their potentials, are combined to form a uniform pulse. This happens when a threshold for further flow is reached, which is defined by the strength of the node. The strength of the nodes could serve as the level of thresholds for impulse transmission to an outgoing axon.

Usability of pulse-controlled pass-through stages

In various correlations, pulses with their transported potentials must disappear or be weakened. A subtractive potential conversion alone could be overwhelming. Even derivation in actions could only achieve this to a limited extent. Enrichment with quantized or amplified impulse patterns would lead to more overdriven and disturbing patterns. Transitive reduction with a passband threshold or direct potential reduction could normalize this clipping. So the solution is to use transitive behavior. The potential scaling can:

1. Selectively reduce or eliminate excessive impulse potentials
2. Amplifying impulses to actively keep information stable.

These conditions control the amount of simultaneous pulse information. The necessary control of the pulse threshold (transitivity logic) and the pulse amplification describe the above behavior. In this way, the transitive control can attenuate or amplify output signals in a targeted and precise manner. Output signals are amplified or attenuated by the accumulation of several pulses and their correct scaling.

Chapter 9: Demarcation, vitality and pain

Demarcation of various dedicated areas

A delimitation of special areas isolates the chaotic, complex interactions and enables meaningful processing in a delimited network area. These demarcated areas prevent independent or unrelated information from being associated too early. They could influence potentials in the vicinity in a mutually disruptive way due to extraneous impulses. A closed or delimited processing area therefore provides meaningful processing for information from a given independent context. This includes information processing of all kinds and at all levels.

Vitality, strength, decay and renewal

For a given vitality of axons and nodes with specific impulse potentials, the effects on nodes and axons lead to regenerative, degenerative or even damaging behavior. Various manifestations are possible:

1. Immediate and persistent change in behavior and network due to pain and trauma constructs resulting from excessively high intensities of impulse potentials with deleterious effects.
2. Structural degeneration (caused by a lack of structural renewal), for structural degradation, due to decay of faulty structures.
3. Reinforcement of information structures through repeated memorization.
4. Increased transitive accumulation and transit threshold in heavy nodes.

Pain

The onset of pain can lead to immediate and permanent changes in the neural structure, resulting in new situational assessments. Although it may seem strange to implement the behavior of pain, in this case there are several possible applications to control the behavior of an AI. To mimic this process, the impulses must be overexposed potentials that are interpreted as noxious signals. As a result, the changes in the network consist of axons that behave as if burned, depending on the potentials and vitality values. This includes the axon vitality effect, which plays a role in the calculation of the minimum path costs. Pain signals also strengthen the axon, but with excessive strength values, which are to be regarded as burnt conduction, as their internal resistance only allows excessive potentials to pass through. This means that the surface of the node is massively occupied by the entry point of such an axon, which increases its vitality immensely. This causes the sphere to grow, resulting in a larger sphere with a scaled ratio of strength to radius of the sphere. This increases the threshold values for the functionality of such a node. With these disproportionate elements in the network, an accumulative node with an increased threshold will send out damaging intense impulse potentials as signals and cause repeated pain. This is intended to mimic a possible traumatic brain injury in humans.

There are various considerations about the necessary counter-effects and more, but possible use cases have not yet been discussed. Firstly, these stimuli need to be derived. This can be done by:

1. transport to the action handler
2. Subtractive transformation of different types of neurotransmitters,
3. Time and threshold values
4. a pain-relieving effect by flooding certain, spatially affected areas with a fictitious anesthetic.

These counter-effects cause a reduction in the number and the impulse potential in the nodes and thus a switch-off by reducing the impulses between the emitter and the action layer. By selectively determining possible sources of pain signals, the neuronal structural transformation of the AI can be adjusted in such a way that certain behaviors or actions are avoided, e.g. those that result in self-harm.

In addition, the effect of pain, the covalent effect in nature, has pleasure. This results in a preference system for actions. Technically speaking, pleasure is regarded as a self-assessment of success and happiness. If two successive impulses of a process are compared, the graph from this evaluation must increase exponentially in order to define joy as a positively evaluated circumstance. Joy could therefore be regarded as the second derivative of a positively evaluated circumstance.

Addendum: Recapitulation/table of formulas

1. basic theorems in this paper

Precondition: Impulses in nodes activate them

1. If there is at least one pulse in a node, it is considered active.
2. Only active nodes emit an EM field.

Rules for impulse interactions

1. Nodes connect with new axons in various forms.
2. The pulses branch out through mutual influence according to various defined cases.

Neurogenesis rules

1. Axons are formed as lines between active and closely neighboring nodes.
2. Axons are not necessarily unidirectional.
3. Bidirectional axons have receptors and transmitters at both axon junctions.
4. Nodes divide the axons into meaningful lengths.
5. Nodes are formed on crossing axons either
   a. immediately,
   b. with a period of formation,
   c. during resting periods, or
   d. by repeated impulse currents
6. Axons between nodes are always defined so that the output type is the same as the input type.
7. Depending on the typing of the oligopoly nodes, there are type changes in the impulses in the nodes due to internal polarization, passage restrictions and overlapping of transmitter and receptor types (subtypes)
8. Passage restrictions can be reduced or increased by EM sensitivity
9. Depending on the momentum potential, radial surfaces are created at the entry points on the sphere. They are scaled in relation to their impulse potentials, which define the radius on the surface. These can generate overlaps of the transmitter logic in the sphere by partially overlapping the entry points.
10. Node type conditional polarization: According to different criteria for joint interaction.
11. Nodal properties affecting vitality, strength and maintenance **a.** Pain and trauma: Immediate and persistent alteration of network processes.
    b. Structural decay, of faulty structures
    c. Strengthening of structures by repeated renewal through impulse transports.
    d. Transitive behavior, node strength to impulse potentials

2. characteristics of axons, nodes, pulses and EM fields

Axons

1.	Transport Impulse.
2.	Arise between 2 active nodes on electromagnetic field lines.
3.	Axons become stronger through renewal from use as impulse channels
4.	Axons would constantly lose strength and resilience if they did not renew themselves structurally through repeated use.
5.	Nodes form at crossing axons.
6.	Axons are not necessarily unidirectional.

Node

1.	Nodes divide the axes into meaningful lengths.
2.	New nodes develop at crossing axons.
3.	Oligopole nodes house different types of transmitters inside them.
4.	Implementation of pulse accumulation, pass-through limitations and scaling of the potentials.
5.	The transmitter types are located on the inside of the spherical surface and represent the node shape.
6.	They follow the premise: Output transmitter equals input transmitter.
7.	The input zone includes the transmitter types of the own and can overlap with foreign axon entry points. These specific overlapping areas trigger all transmitters from this area when impulses arrive and vice versa for receptors
8.	Nodes are activated when there is a pulse within the node.
9.	Active nodes influence each other.
10.	The impulse paths are created under the influence of internal and external EM fields.

Impulses

1.	transport an electrical potential
2.	polarize and activate nodes when they arrive there
3.	influence and shape the EM field
4.	on the maintenance, strengthening and growth of axons and junctions.

EM fields

1. Pulses generate the EM fields
2. The meninges shield the individual EM field areas from each other
3. EM fields polarize the nodes to control the path of the pulse
4. EM fields determine the formation of new axons
5. EM fields influence the neurotransmitter actions in the nodes and change the impulse flows by attracting or repelling neurotransmitters
6. The EM field lines determine the spatial arrangement of the axons away from the shortest connection and allow the axons to cross each other
7. EM field lines are difficult to compute, but would lead to the development of neural structures with maximum precision. For simplicity, we drastically reduce such computations to mimic what is necessary with minimal affordability and only compute effects within static regions of active nodes as a function of momentum potentials.

3. pulse interaction rules

Conversion of pulse potentials

1. Impulse Potential addition
2. Impulse Potential subtraction

Enforcement of transmission through a threshold-based node

1. the individual pulse potential
2. the number of
   potentials accumulated in the node of
   a) simultaneous pulses
   b) pulse series within a period of time.

Reproduced and quantized pulse potential

1. During quantization, the information is broken down into atomic parts (quanta) and distributed from a single node to several axons.
2. Mirroring is about the precise transmission of impulse potentials.

Polarization and common interactions of the individual node types.

Influencing the pulse flow through the EM field:

1. As selection of the outgoing axon at the dendrite.
a.) Change of the transmitter type behavior (counteracting polarization of the transmission)
b.) Influence of the internal behavior by external polarization
- Transitivity
-a spatial drift over the axon to be selected

2. Increase or decrease in pulse potentials

3. Increase or decrease of a potential threshold

4. Attraction or repulsion of neighboring impulses

5. Only polarization to influence the surrounding neurons

6. No effect on individual transmitter types (not polarization sensitive)

Influence on the formation of axons:

1. Increasing the field strength and thus the range of axon formation

2. Electromagnetic field lines

4. oligopoly node

Differentiation of node types according to

1. Additional behavior

2. subtractive (differentiating) behavior

3. Thresholds and limitations
a) Time-combining behavior (accumulating potentials)
b) Threshold value for the passage of pulses
c) Potentials damping behavior

4. Mirroring behavior

5. merging and quantizing behavior

Different ways of branching:

1.	A => B	Diversion
2.	A => (A & B)	Mirroring
3.	C => (A & B & ...)	Quantification
4.	(A + B) => C	behavior
5.	(A - B) => C	Subtractive behavior
6.	(A & B) => C	Union
7.	(A1 + A2 + ...) => A	Threshold value

For pulse transmission modes with a variety of types

1. One In => All Out

2. Output type <=> Input type

5. transitive dependencies

Explicit transitivity and controlled transitivity

1. Explicit transitivity:
All types of impulse potential transformations
. additive,
b. subtractive,
c. attenuating,
d. amplifying

2. Controlled transitivity:
Controlled transitivity refers to a process in which impulses
. arrive simultaneously
b. one after the other within a short period of time
c. Lossy accumulation of potentials per time
They are combined to produce an aggregated pulse once a breakthrough potential is reached. Strong nodes can have high thresholds for impulse transmission to an outgoing axon.

Usability of pulse-controlled passage levels

1. Selectively reduce or eliminate excessive pulse potentials

2. Reinforce impulses to keep information actively stable.

6 Neuronal vitality and pain

Behavioral characteristics of the parameters influencing vitality

1. Immediate and persistent change in behavior and network due to pain and trauma constructs resulting from excessively high intensities of impulse potentials with harmful effects.
2. Degradation of non-target-oriented structure through degeneration (caused by lack of structural renewal)
3. Reinforcement of information structures through repeated memorization.
4. Increased transitive accumulation and transit threshold at stronger nodes.

Against effects for pain

1. Derivation of impulses in action,
2. Subtraction of pulse potentials by type,
3. Thresholds by time,
4. Imitation of the analgesic effect by flooding certain, spatially affected areas with an analgesic.