Neural Networks 2.0
Neurogenesis

Polymorphic, oligopoly, dynamically adaptive,
Neural Impulse Networks

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The Project on the Internet:

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

Neural Networks 2.0 - Neurogenesis

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Preamble

About the Emergence of this Project

This work started on October 14th, 2018, with an incredible and gorgeous inspiration that led to this elaboration's first two fundamental theorems. Therefore, the GitHub account "Zoltan-X" was created on October 17th, 2018, and the first concepts were published.

This paper presents a set of concepts for creating neural networks that mimic different aspects of human brain behavior, intending to make them as simple as possible. The unique feature of these concepts is the use of spherical neurons, which facilitate the creation of neuronal hubs. The paper also introduces two fundamental theorems about near-field effects for axons, as well as node logic in various forms. The focus of this work is on imitating the brain rather than achieving high performance.

Characteristics of Concepts List:

1. 2 Fundamental Theorems for Axon Neuro-Genesis.
2. Super Germ (Super Seeded) Design.
3. Automatic network maintenance: growth and decay.
4. Self-influencing is the network’s "ways of switching, thinking, and acting.".
5. Interaction of neurons by being active near each other.
6. Independent and logical emergence of new Nodes (Neurons) in the network.
7. New Nodes favor forming informational associative content.
8. It works with different types of neurons that cause different interactions.
9. Nodes are treated as spheres and axons have radial entry-points into them.
10. Nodes process internally through a simplified neurotransmitter concept.
11. It works with impulse potentials as the only form of information inside the network.
12. Nodes are activated through impulses residing in them and cause interactions thereby.
13. Imitation of Nearfield 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 Elements

Super Seed (super germ or primordial germ)

The Super Seed, also known as the Super Germ or Primordial Germ, is a fundamental structure that defines the initial state of the neural network structure at time t_0. It serves as the basis for all further development of the AI-powered assistant and contains only Axon and Node definitions in its initial state. The Sensors that induce Impulse Signals and Action Handlers define the outermost nodes that characterize the AI-powered 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 node's state to activate and emit an electromagnetic field. To simplify calculations, we only determine impulse positions at nodes with reduced calculation costs. We differentiate between independent node types and impulse types as if they relay a specific neurotransmitter in a node. The calculation costs for impulses are related to the renewal of structures. If axons and nodes are not structurally strengthened or renewed by a through-passing impulse, they degenerate.

Axons

They act as conduits for the transport of electrical impulses between nodes, and they are not necessarily unidirectional. The area for receptor conduction 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 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 emerge instantly between simultaneously active and closely positioned nodes. Ideally, they should grow along EM-Field lines, but for simplicity, we can consider them as straight or direct lines that immediately emerge completely. However, during the neurogenesis of nodes, the involved axons must cross between active nodes and form an axon knot from which a node emerges. This can be a problem because if we calculate axons straight and not on EM-field lines, they would never become crossed axons. Therefore, other calculations are presented in Chapter 5: The Neurogenesis.

One of the key features of axons is that they have to renew their structure by carrying impulses. This is necessary to prevent their structure from degenerating over time. If an axon doesn't transport impulses between nodes for a given duration, its structure will weaken and degenerate until it eventually disappears.

Nodes

play a crucial role in the functioning of the nervous system. They divide an axon into two and require an axon to emerge usefully. Without an axon, a node would be rendered useless as it can't be reached from any impulse. Thus, when nodes lose their last connection, they should be considered lost and removed immediately. Nodes emerge from a crossed axon knot, and while they generally need to have a shape for in this work implied concepts, they are simplified as spheres. This allows them to become oligopoly nodes. When axons transmit a neurotransmitter-type specific impulse, they enter the sphere of the node. On the outside of the sphere's surface, a circular area around the entry point is set to the incoming neurotransmitter type, which is on the inside of the sphere. Existing types are not changed, so overlapping areas mix different transmitter types depending on their entry point element Data Types.

Element Data Types

Impulse

The data type of the information - an Impulse - can be described best as a signal representing a dynamic scalar- or boolean blob or parts of them.

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 about vitality that this Record here implies

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 Dataset consisting of	
ID:	Integer
TranmitterType:	Set of types
ReceptorType:	Set of types
Polar Coordinates:	origin
	Angle² 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 Dataset 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 (	Angle² 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 fundamental theorem, a protein that orients itself to electromagnetic fields is derived. In this context, isolated CREB-1 proteins are relevant in various studies. Therefore, in the following, this effect is attributed to CREB-1 proteins as a proxy. For reasons of computational complexity, we avoid CREB-1 calculations, except for a possible fictive growth measure in the form of distance reached per time.

The Dendrite Theory

The dendrite theory suggests that the growth of branched structures is predetermined by genetics and is a slow process. While this approach may not seem relevant to the formation of information through structural mapping during the learning process, it does make sense in the context of super germ growth. Structural mapping in the context of information formation can be challenging when we try to incorporate all the information within a given time. However, we can reduce computations by abandoning them altogether or by defining axon growth as part of structural maintenance through impulse flows. We can also reduce computations by implementing constraints such as limiting the range of computation or reducing it altogether.

The magic of concatenating closely spaced Nodes

Nodes are linked to each other through axons, forming a structure for information mapping. This structure can be reactivated by impulses. However, this effect needs to be limited to prevent everything from becoming hopelessly connected. 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 proper scaling promotes accurate information mapping. The "magic" of a well-scaled connection range is that it allows for meaningful complex contexts to be connected. A misdesigned scope for cross-linking of nodes can lead to a total cross-linking, which defines a natural limit. However, the degeneration of unused axons and nodes creates a releasing effect that counteracts reaching this limit, resulting in the polymorphic behavior of these types of networks.

Chapter 3: The Foundations of the Original Ideas

Precondition: Impulses in Nodes activate them

1.	When a Node has at least one Impulse, it is considered active.
2.	Only active Nodes emit an EM field of the Impulses within them.

Neighboring and simultaneously active Nodes generate new Axons that connect them. Furthermore, they interact with each other by mutual influence in choosing the further path through the network. Beyond the spatial dimensions, the 4th dimension in this context is time.

It follows from this that Impulses must be present at the same time, in spatially neighboring neurons, for a mutual interaction to occur in 2 forms:

The 2 Fundamental Theorems

1.	(EM near field + brain liquor see: abstract on magnetic field affinity of CREB-1). ***Nodes connect with new Axons in different expressions.***
2.	(Receptor and neuro-transmitter Logic) ***Impulses branch by mutual influence according to various defined cases.***

An example of a minimalist AI assistant, in the form of an auto-actor model, will be discussed in the upcoming chapter.

Chapter 4: An Example of an Auto-Actor-Model

Use-Case Description

This example concerns a simple Form of Existence. The AI will feed and evolve to stop eating to prevent the consequences of excessive eating.

1. A simple Impulse transport along an Axon "Axon 1" from a sensor "Sensor 1" to an action "Action 1" with one Node "Axon 1-Node 1-type A".

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

3. the second Axon appears. "Axon 2" is supplied with Impulses by "Sensor 2". "Axon 2" also has a Node "Axon 2-Node 1-Type B", which is close to "Axon 1-Node 1-Type A". The 'Axon 2' ends in 'Axon 2-Action 2'.

4. 'Sensor 1' and 'Sensor 2' continuously send Impulses via the 'Axon 1' and 'Axon 2' lines to 'Axon 1-Action 1' and 'Axon 2-Action 2'.

5. That repeats until two Impulses are simultaneously present at 'Axon 1 - Node 1 - Type A' and 'Axon 2 - Node 1 - Type B', creating a bridging Axon.

6. Then the behavior changes so that the Impulses in 'Axon 1-Node 1 type A' are conditionally redirected across the newly formed bridge to 'Axon 2-Node 1 type B' and from there to 'Axon 2-action 2'.

Process of evolving

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

<u>Legend:</u>

A1 => Axon 1

N1 => Node 1

A1-N1-A => ‘Axon 1’ at ‘Node 1’ with ‘type A’

A1-S => Sensor as Transmitter Signal generator or Impulse generator on Axon 1

A1-A => Action on ‘Axon 1’

$I_{i,x}$ = (t_j, "A1-S") => Impulse number I on Axon x, here on the Axon at a transmitter point at time tj.

The 1st fundamental theorem leads to the connection of "A1-N1-A" and "A2-N1-B" and thereby a new Axon. The 2nd fundamental theorem consequently causes a redirection of the Impulse flow from Node type A to B.

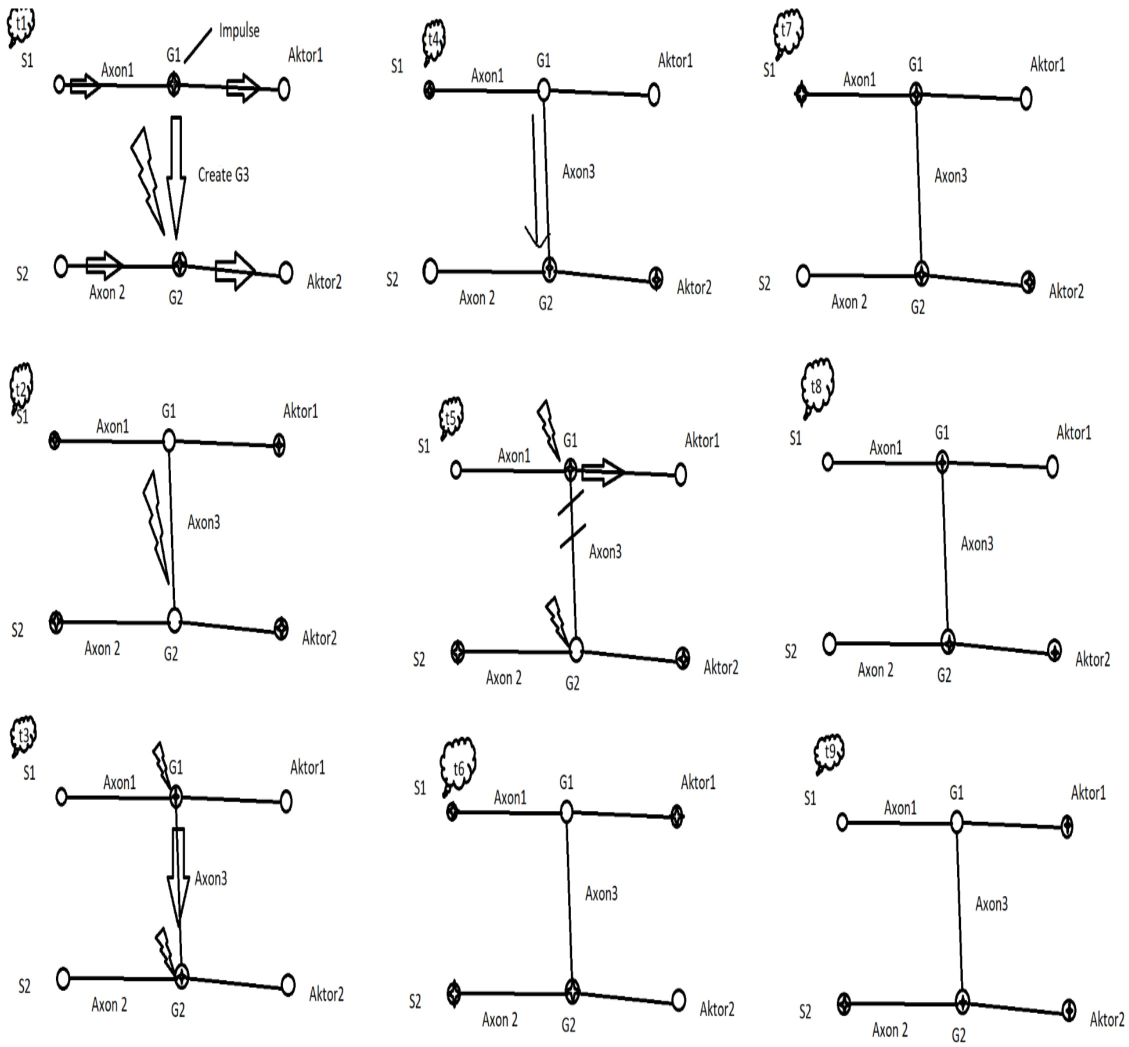
In this case, A => B redirects when both Nodes are active and the Nodes "A1-N1-A" and "A2-N1-B" are diverting the Impulses from the A1 line to the A2 line.

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

from:	"A1-S" => "A1-A" and "A2-S" => "A2-A"
follows:	"A1-S" => "A2-A" and "A2-S" => "A2-A
by	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 figurative comparison to an auto-actor model, this means
"A1-S" => sends Impulses as a hungry signal.
"A2-S" => sends Impulses as a digestion full signal.
"A1-A" => Food.
"A2-A" => Satisfaction.
"A2-A" => consumes a double Impulse to end the saturation behavior and stops eating

Graphic explaining the process



Chapter 5: The Neurogenesis

Neuro-Genesis (formation of neural Nodes and Axons)

Neurogenesis is the independent creation of new neural structures. Thus, new Nodes and Axons are automatically created or degenerated under certain conditions. The aim is to achieve a learning capability of the AI-powered Assistant in free operating mode, which produces meaningful results through intelligent learning without human intervention. Also, the structural polymorphism of created, maintained, and degenerated structures through the Neuro-Genesis behavior is the subject of independent improvements of an AI-powered Assistant.

The 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. Whenever two adjacent nodes become active simultaneously, a connecting axon is immediately formed between them, provided it does not already exist. However, the growth of this axon is limited to a certain distance, which needs to be appropriately scaled based on the intensity of the node's electromagnetic field. Slow dendrite formation is ignored in this context. The meshing area of the axons links to the electrical potentials in the nodes for its dynamic and convenient nature.

The Node Formation

The position for the Origins of new neuronal Nodes must be on an Axon, or they will never receive Impulses. Beyond the Super-Seed at the beginning, where Nodes subdivide long Axons, crossed Axons (Nodes of Axons) are the best place for new neuronal Nodes. Therefore, we define new Nodes at crossed Axons. Because of simplicity, we calculate Axons as a direct connection between 2 Nodes, and we have to define a Node that can not be on direct and straight connections.

Axon grew between Nodes

Directly or according to patterns of electromagnetic fields?

Electromagnetic fields would cause different Axons to cross specifically and form a Node at that point. As a virtualized imitation, this is very complex. In virtualized imitation, limiting the Neuro-Genesis effect to its reach could be a convenient approach. The neural genesis radius is the distance from a Node to any other Nodes within which Axons establish a connection. In a constant neuro genesis radius, everything within this range that is simultaneously active will become connected through missing Axons. Furthermore, an accurately defined range can adapt to differences in dynamic Impulse potential intensities. Just as a new Node should best emerge in the middle between active Nodes, it develops an instant meshing with the other neuronal Nodes.

The calculation for an appropriate site for originating a Node

Using a spatial center between EM-Field potentials of the Impulses distorts the space so that $f(X_{Radius})$= potential/distance defines a simplified calculated, specific location of a new Node. The Node is in the spatial center of all included Nodes. According to the potentials, it can also be defined as spatially offset for better location assignment.

A short explanation:

By spatially distorting the target position according to the Impulse potentials, these Nodes have better information content. Future connections can advance from the position selected more precisely. This position contains a more precisely tuned information binding for subsequent information entities.

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:	fx(A)=r*(Bu/Au+Bu) = 3* 50/ 60	= 2.5		=> 2.5, 0.0, 0.0
BA:	fx(B)=r*(Au/Au+Bu) = 3* 10/ 60	= 0.5		
AC:	fx(A)=r*(Cu/Au+Cu) = 5* 100/110	= 4.545	sin/cos 60°/30°	=> 2.7, 3.6, 0.0
CA:	fx(C)=r*(Au/Au+Cu) = 5* 10/110	= 0.454		
BC:	fx(B)=r*(Cu/Bu+Cu) = 4* 100/150	= 2.666		=> 3.0, 2.7, 00
CB:	fx(C)=r*(Bu/Bu+Cu) = 4* 50/150	= 1.333		

Now the center point is formed
AB: = 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)

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

Chapter 6: Oligopoly Nodes Active Versatility.

Oligopoly Nodes

It is necessary to distinguish between Nodes based on different receptors and transmitters, as well as their interconnections. This creates the need for Oligopoly Nodes, where oligopolistic logics of Node types emerge under certain conditions. The formation of multiple origins by axons is necessary to achieve this.

Here is a list of Node logics to use:

Differentiation of Node types according to

1. additive behavior
2. subtractive (differentiating) behavior
3. Culvert boundaries
    - **a)** temporally summarizing behavior (accumulating potentials)
    - **b)** Passage threshold for Impulses
    - **c)** muting behavior
4. mirroring behavior
5. merging and quantizing behavior

The different control logics are defined by various Node types, each with its own set of receptor and transmitter logics. These logics separate the different areas by something protective limiting as the meninges membranes in Human brains. The term "variable receptor and transmitter logic" refers to the behavior inside a Node, where incoming impulses activate specific transmitter types, resulting in a particular response from the Node.

Different ways of branching:

1.	A => B	Redirection
2.	A => (A & B)	Mirroring
3.	C => (A & B & …)	Quantization
4.	(A + B) => C	Additive behavior
5.	(A - B) => C	Subtractive behavior
6.	(A & B) => C	Merge
7.	(A1 + A2 + …) => A	Threshold

For Impulse Transmission modes with a variety of types

1. One Impulse Activates all Node type-specific interactions given 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 region on the surface of a sphere. This can cause the entry point to overlap with other axon entry points of different neurotransmitter types. Incoming impulses will activate all neurotransmitter types within this entry zone. The spherical shape of a Node simplifies the processing required because of the naturally complex grown shape of nodes. The surface of the node consists of overlapping areas of different neurotransmitter types, that are located on the inner surface of the entry points. These areas may overlap with zones of different types. When an incoming impulse activates a zone within a node with different types of transmitters, the node sends out impulses of different types along corresponding axons away from the node.

Inner Polarization of an Oligopoly Node

An internal Node polarization generates outward EM fields, which could cause impulse-flow interactions. These could cause a targeted change in the output Axon. An Example:

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

Further clarification of Oligopoly Nodes in Neuro-Genesis

Oligopoly nodes form specifically in the processing of information. They emerge through neuro-genesis concepts. For example, crossing axons form between active nodes and transform 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 equals the neurotransmitter type.
2. By entry points and mutual Interactions.
3. Regulating interactions with other active Nodes

Rules about auto-generating possible Oligopoly behaviors are missing.

1. Depending on the Impulse potential, areas emerge at the spherical entry points, which create overlaps of the transmitter-type logic in this area 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 CREB-1 protein should be considered with EM field-induced axon formation and dendrite growth because it could lead to long concatenations on electromagnetic field lines.

Chapter 7: Modes of Impulse Interactions

The distinction between Nodes of different types and the resulting Impulse interactions are covered here.

Conversion of Impulse Potentials

1. Impulse Potential addition
2. Impulse Potential subtraction

Enforcement of the transfer through a threshold-based Node

This can depend on

1. the individual Impulse potential
2. the number of potentials accumulated in the Node of
  a) simultaneous Impulses
  b) Impulses Series within a period.
3. Similar to transistors, with a second transmitter controlling the impulse threshold of another transmitter.

Differentiated Potentials

Explanation of how to create a differential from an Impulse stream on one (or more) Axon(s):

On an axon A1, in the spatial proximity of two successive nodes - A1-N1 and A1-N2, the differential is defined by a connection of these two nodes to another axon A2 and its' node A2-N1. Nodes A1-N1 and A1-N2 mirror their impulses to A2-N1 and are transformed into a differential by subtraction. The following impulses in Axon1 transform in A2-N1 and are differentiated as a stream of single values. Finally, the result of the subtractive accumulation of the impulses is 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) = (Impulse A - Impulse B) / (x - (x-1)) =
(Impulse A - Impulse B) / 1 =
(Impulse A - Impulse B)

That means a subtractive potential accumulation is a differentiation of two (subsequent) Impulses. It is possible to differentiate without consuming the original Impulses by mirroring them for the given operation. Subtracting needs more than two sources of Impulses (Axons at a Node) with exactly two types of polarised Impulse interpretations involved in this process. The two summed Potentials arise from two distinct Impulsetypes. Subtrahend and Minuend form one or more Impulses from two different types of transmitters (Impulse). The subsequent subtraction process produces the stream of differentiated potentials.

Quantization of Impulses: Summarized potentials.

The information aggregation process combines multiple impulses into a single one. The impulse potential, along with its precise location in the network, contains the aggregated information. At the merge position, the network pattern is designed to facilitate information recovery through direction reversal. The counteraction required for this reversal is the quantization of impulses. Reversing the condensed impulses would then lead to information recovery. This information originates from input, which is the pattern of impulses in a network and can be consciously assembled, addressed, and retrieved to varying degrees. The input effect summarizes the information, while the reverse effect quantizes it. Retrieving a summarized set of information, which is an impulse pattern in a network, is the result of a single impulse and the quantization process. The process of information quantization and recovery can also depend on a specific neurotransmitter, allowing for selective preservation and restoration of parts of the information associated with the node.

Quantizing: From one incoming Impulse at the Node, creating many outgoing.

Reproduced summarized and quantized Impulse potential

1. Quantization involves dividing information into atomic pieces (quanta) and distributing them to multiple axons from a single node.
2. The mirroring process involves a precise transmission of Impulse potentials.

Polarization and its interactions with distinct Element types.

Several considered orientations:

Distinct interactions are required for different node types and polarizations in the nervous system. The attraction and rejection of neurotransmitters can influence the actions of impulses through electromagnetic polarization. Limitations in neuron thresholds may alter or affect any consecutive act. In such cases, information could have been sent to a different axon instead. Quantizations operate on a one-in, all-out basis, where all axons of a particular node type share the same incoming impulse, and in the node, it is quantized to the corresponding axons.

Influencing the Impulse flow according to the EM-Field:

1. As a choice of the outgoing Axon at the dendrite.
  a.) change of transmitter type behavior (counter polarization of transmission)
  b.) influence internal behavior through external Polarization
    - transitivity
    - a spatial drift about to be chosen axon

2. Increase or decrease of Impulse potentials

3. Increase or decrease of a potential threshold

4. Attraction or adjection of neighboring Impulses

5. Only polarization to influence the surrounding Neurons

6. No effects on individual transmitter types (not susceptible to polarization)

Influencing Axon formation:

1. Increased field strength extends the range of Axon formation

2. Change of electromagnetic field lines

All-In & All-Out

To put it simply, if we limit our work to Boolean signals, then networks would be no different from traditional neural networks. However, to implement neuro-genesis concepts such as

1. axon and node generation and degeneration,
2. multiple types of nodes,
3. shapes,
4. transmitters,
5. axon entry angles and zones.

Therefore, reducing those 2.0 networks to classical networks unless we include some of these concepts in the implementation is useful. The All-In concept could be part of a type-based controlled all-out as a possibility for integrating this to handle things as a type-distinct all-out. Anyways the All-In construct is an aggregation and the All-out a quantization process.

Chapter 8: Transitive dependencies

Translation of information

Explicit transitivity and pass-through controlled transitivity

1. Explicit transitivity: All kinds of Impulse potential transformations (additive, subtractive, attenuated, amplifying, and possibly more)
2. Controlled transitivity refers to the process by which impulses arriving simultaneously or successively over a short period of time, or those that accumulate with a time-dependent loss of their potentials, are combined to emit a unified impulse. This occurs when a breakthrough potential, which is defined by node strength, is reached. Heavy nodes may indicate high thresholds for impulse transduction to an outgoing axon..

Usability of Impulses-controlled passage levels

In various correlations, Impulses with their transported potentials must disappear or be attenuated. A subtractive potential conversion alone could be overwhelming. Also, the derivation into actions might only be able to do this to a limited extent. Enrichment with quantized or amplified Impulse patterns would result in more overdriven and interfering patterns. The transitive reduction with a passband threshold or direct Impulse reduction could normalize this excess. Thus, the solution is to use transitive behavior. The potential scaling can:

1. Selectively reduce or eliminate excessive Impulse potentials
2. Reinforce Impulses to keep information actively stable.

These conditions control the amount of simultaneous Impulse information. The necessary control of the Impulse threshold (transitivity logic) and the Impulse reinforcement describe the behavior above. Thus, transitive control can reduce or amplify output signals in a targeted and precise manner. By accumulating several Impulses and scaling them correctly, output signals are amplified or attenuated.

Chapter 9: Neural Demarcation, Vitality, and Pain

Demarcation of Different Dedicated Areas

A Demarcation of dedicated areas isolates the chaotic, complex interactions and allows meaningful processing in a demarcated network area. These demarcated areas prevent independent or unrelated information from being associated too early. They could be influenced in a mutually disturbing way by foreign Impulse potentials in the vicinity. Thus, a closed or demarcated processing area offers meaningful processing for information of a given independent context. That includes information processing of all kinds and at all levels.

Vitality, strength, degeneration, and Renewal

Considering a given vitality of Axons and Nodes with specific potentials of Impulses, the effects on Nodes and Axons result in a regenerative, degenerative, or even damaging behavior. Different characteristics are possible:

1. Immediate and sustained change in behavior and network due to pain and trauma constructs that result from excessively elevated intensities of Impulse potentials with detrimental effects.
2. Forgetfulness due to structural degeneration (caused by lack of structure renewal).
3. Reinforcement of information structures by repeated imprinting.
4. Increased transitive accumulation and passage threshold in heavy Nodes.

Pain

Implementing pain can lead to immediate and lasting changes in neural structure, resulting in new situational evaluations. While it may seem strange to implement the behavior of pain, there are several possible applications in this case to control the behavior of an AI. To mimic this process, impulses must be over-exposed potentials that are interpreted as painfully intense signals. As a result, changes in the network consist of axons that behave as if they have been burned, depending on the impulse potential and vitality values. This includes the axon vitality effect involved in minimum path cost calculations. Pain signals amplify the axon with this disproportion, marking it as burned by excessive strength values, but also causing a huge impulse drain from such a large axon. This means that the surface of the knot 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 designed ratio of strength to radius of the sphere. This increases any threshold functionality values of such a node, so with these over-proportional elements in the network, an accumulative node with an increased threshold will emit painfully intense impulse potentials as signals, repeatedly inducing pain. This would mimic traumatic behavior in humans.

There are various considerations for needed countereffects and more, but possible use cases haven't been discussed till now. Firstly, there is a need to derivate those impulses. This can be done by

1. transporting them to action,
2. subtracting impulse potentials by types,
3. time, and thresholds
4. a pain-muting effect through flooding spatially affected specific areas like a painkiller.

This propagation effect causes a lowering of impulse potential in nodes and thus, a shutdown effect by diminishing impulses between the emitter and action layer. The AI's neural structure transformation can be adjusted by the sources of pain signals to omit specific behaviors or actions that for example are causing self-damage as consequences.

Furthermore, the effect of pain has a countereffect in nature, which is joy. Technically, joy is considered a self-assessment for success and luck. By comparing two subsequent Impulses of a process, there has to be an upward bending of the graph from this evaluation to define joy as a positively asserted circumstance. Thus, joy could be seen as the second derivation of a positively evaluated circumstance.

Addendum: Recapitulation / Formulary

1. Fundamental Theorems in this elaboration

Precondition: Impulses in Nodes activate them

1. When at least one Impulse resides in a Node it is considered active.
2. Only active Nodes emit an EM field of the Impulses within them.

Impulse Interactions Rules

1. Nodes connect with new Axons in different expressions.
2. Impulses branch by mutual influence according to different defined cases.

Neuro-Genesis Rules

1. Axons arise as conduits between active, and nearby neighboring Nodes.
2. Axons are not necessarily unidirectional.
3. Bidirectional Axons have receptors and transmitters at their connection point at node
4. Nodes subdivide Axons into meaningful lengths.
5. Nodes arise at crossing Axons.
6. Nodes are formed either
   a. immediately,
   b. with a period of formation,
   c. during periods of rest, or
   d. by gating with Impulses
7. Axons between Nodes are always defined as output type equals input type
8. Depending on the typing in Oligopoly Nodes, type changes of the Impulses in the Nodes occur due to internal polarization, passage limitations, and overlapping of transmitter and receptor types (subtypes)
9. Passage limitations can be reduced or increased by EM sensitivity
10. Depending on the Impulse potential, radial surfaces emerge at the entry points on the sphere. They are scaled related to their impulse potentials defining the radius on the surface. These can generate superpositions of the transmitter-type logic in the sphere, by partial overlapping of entry-point areas.
11. Node type conditional polarization: According to different criteria for joint interaction.
12. The vitality, strength, and conservation influencing Node properties
    a. Pain and trauma: Immediate and sustained changing of the network operations.
    b. Forgetting due to structural degeneration caused by lack of stress in the area.
    c. Strengthening structures by repeated renewal through Impulse transports.
    d. Transitive behavior, Nodes strength to Impulse potentials

2. Characteristics of Axons, Nodes, Impulses, and EM fields

Axons

1.	Transport Impulses.
2.	Arise between 2 active Nodes on electromagnetic field lines.
3.	Axons become stronger through renewal from usage as Impulse conduits
4.	Axons would constantly degenerate in 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.

Nodes

1.	Nodes subdivide Axons into meaningful lengths.
2.	New Nodes emerge at crossing Axons.
3.	Oligopoly Nodes harbor different transmitter types in their inner.
4.	Accumulating, limiting, and scaling Potentials of Impulses.
5.	The transmitter types are on the inner side of the sphere surface and represent the Node shape.
6.	They follow the premise: Output- equals Input-Transmitter.
7.	The entry point zone will include the transmitter types of the own and foreign axon entry points that overlap. These specific overlapping areas will trigger all transmitters from this area upon arriving Impulses and vice versa for receptors
8.	Nodes are activated when an Impulse resides inside the Node.
9.	Active Nodes influence each other.
10.	The Impulse paths occur influenced by internal and external EM fields.

Impulses

1.	are transporting an electrical potential
2.	polarize and activate Nodes when they arrive there
3.	influence and shape the EM field
4.	affect maintaining, strengthening, and growing Axons and Nodes.

EM fields

1. Impulses 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 impulse
4. EM fields determine the formation of new Axons
5. EM fields influence the neurotransmitter actions in Nodes and change Impulse flows as they attract or repel neurotransmitters
6. The EM field lines establish the spatial formation of Axons away from the shortest connection and allow Axons to cross each other
7. EM-Field Lines are tough to calculate but would lead to neural structure development with maximal precision. For simplicity, we drastically reduce such calculations to mimic the necessary with minimum affordance and calculate only Effects within static ranges from active Nodes depending on impulse potentials.

3. Impulsinteraction rules

Conversion of Impulse Potentials

1. Impulse Potential addition
2. Impulse Potential subtraction

Enforcement of the transfer through a threshold-based Node

1. the individual Impulse potential
2. the number of potentials accumulated in the Node of
   a) simultaneous Impulses
   b) Impulses Series within a period.

Reproduced and quantized Impulse potential

1. Quantization involves dividing information into atomic pieces (quanta) and distributing them to multiple axons from a single node.
2. Mirroring involves the accurate transmission of Impulse potentials.

Polarization and common interactions of individual Node types.

Influencing the Impulse flow according to the EM-Field:

1. As a choice of the outgoing Axon at the dendrite.
   a.) change of transmitter type behavior (counter polarization of transmission)
   b.) influence internal behavior through external Polarization
      - transitivity
      - a spatial drift about to be chosen axon
2. Increase or decrease of Impulse potentials
3. Increase or decrease of a potential threshold
4. Attraction or rejection of neighboring Impulses
5. Only polarization to influence the surrounding Neurons
6. No effects on individual transmitter types (not susceptible to polarization)

Influence on Axon formation:

1. Increased field strength and thus the range of Axon formation
2. Change of electromagnetic field lines

4. Oligopoly nodes

Differentiation of Node types according to

1.	additive behavior
2.	subtractive (differentiating) behavior
3.	Culvert boundaries **a)** temporally summarizing behavior (accumulating potentials) **b)** Passage threshold for Impulses **c)** muting behavior
4.	mirroring behavior
5.	merging and quantizing behavior

Different ways of branching:

1.	A => B	Redirection
2.	A => (A & B)	Mirroring
3.	C => (A & B & …)	Quantization
4.	(A + B) => C	Additive behavior
5.	(A - B) => C	Subtractive behavior
6.	(A & B) => C	Merge
7.	(A1 + A2 + …) => A	Threshold

For Impulse Transmission modes with a variety of types

1.	One Impulse Activates all Node type-specific interactions given in the Node together
2.	Output Type <=> Input Type

5. Transitive dependencies

Explicit transitivity and pass-through controlled transitivity

1. **Explicit transitivity:**
   All kinds of Impulse potential transformations
   - **a.** additive,
   - **b.** subtractive,
   - **c.** attenuating,
   - **d.** amplifying

2. **Controlled transitivity:**
   Controlled transitivity refers to a process where impulses
   a. arrive simultaneously
   b. subsequent within a short period
   c. gradually accumulate with a time-dependent loss of their potential.
   They are combined to produce an aggregated impulse once a breakthrough potential, defined by node strength, is reached. Strong nodes may have high thresholds for impulse transduction to an outgoing axon.

Usability of Impulses-controlled passage levels

1. Selectively reduce or eliminate excessive Impulse potentials

2. Reinforce Impulses to keep information actively stable.

6. Neural Vitality and Pain

Behavioral Characteristics of Vitality Affecting Parameters

1. Immediate and sustained change in behavior and network due to pain and trauma constructs that result from excessively elevated intensities of Impulse potentials with detrimental effects.
2. Forgetfulness due to structural degeneration (caused by lack of structure renewal).
3. Reinforcement of information structures by repeated imprinting.
4. Increased transitive accumulation and passage threshold at stronger Nodes.

Counter Effects for Pain

1. derivation of Impulses into action,
2. subtracting impulse potentials by types,
3. thresholds by time,
4. pain-muting effect imitated as flooding spatially affected specific areas with a painkiller.