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Theoretical Proof That Nodes Arranged In Mesh Topological Ordered Neural Network Might Be Able To Replicate Biological Neural Network Of Humans

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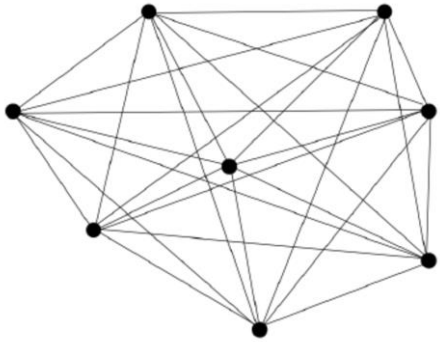

Abstract:
This research paper explores the theoretical foundation supporting the proposition that neural networks organized in a mesh topological order can potentially replicate or even improve upon the results achieved by the human brain. Our analysis suggests that this organization could lead to more efficient information processing, enhanced learning capabilities, and improved performance in various cognitive tasks.

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I. Mesh Topology:

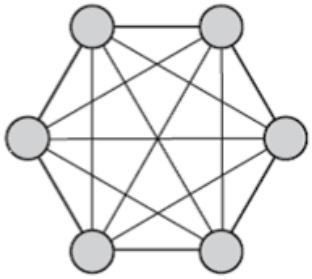
Mesh Topology suggests system in which all units of the particular system are connected to every other unit in system by direct link(connection).

Suppose we have 4 computers connected by LAN and each computer is connected with other 3 computer than the system is in mesh topological order.

There are several benefits of mesh topology

- Its highly connected network makes communication expeditious.
- Any complication in one unit or connection does not affect other parts of system.
- New unit addition does not affect the data transmission

As we can see in graphical representation of mesh topology where there are 6 units and each one is connected to other 5 units by a direct connection, so the fill mesh topology provides us with ability to connect our elements directly



fully connected mesh

[*figure 1.1*]

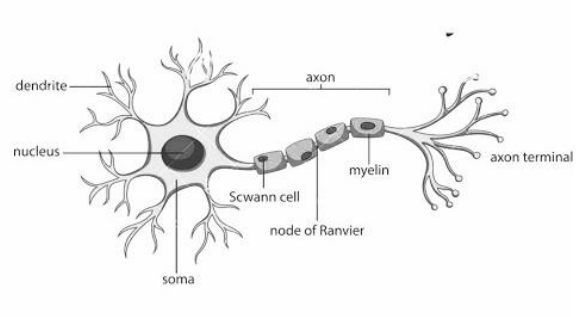
Without any joint(s) in between them so unlike any other structure mesh topology sure is the unbudgeable.

Parallel Processing and Efficiency:

Human have some most significant aspects two of which are parallel processing and efficiency Mesh topological ordering facilitates inherent parallelism by enabling nodes to process information independently while maintaining localized connections. This arrangement mimics the brain's distributed processing, thereby enhancing computational efficiency.

Parallel processing:

The word parallel processing suggests ability of human brain to work on more than one process at a time, according to google human brain have 2500 to 3300 thoughts per hour in order to neural network to reach at that point, it requires firm and rapid data structure along with tremendous amount of data training.



Efficiency:

As humans we learn 24/7 which makes most efficient creature to take action according to environment around us and in rapidly changing circumstances which is quite hard to implement in a non-living system.

Learning and Adaptability:

The brain's exceptional learning and adaptability stem from its plasticity, which enables the strengthening or weakening of synapses based on experience. A mesh topology could provide a suitable framework for implementing dynamic synapse strength adjustments, enhancing a network's ability to adapt to new information and improve its performance over time.

Human neural network:

There are 85 billion neurons in human brain, a single neuron looks like this:

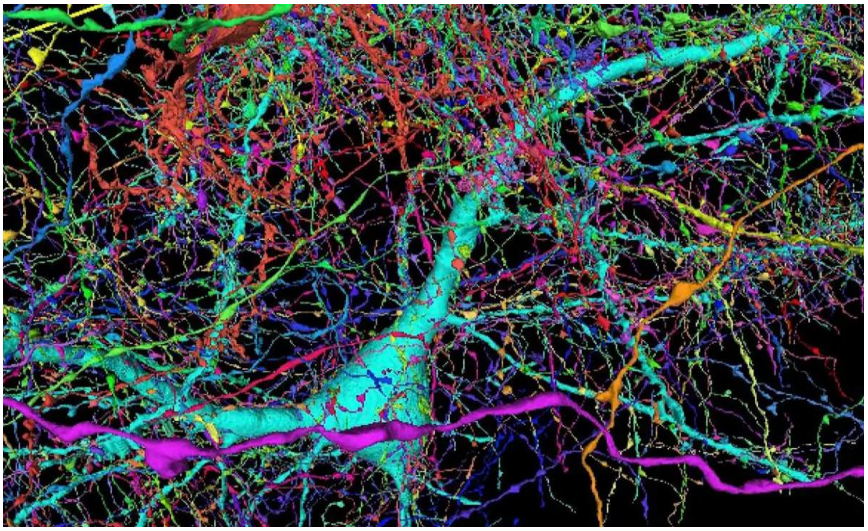
Now as one ages neurons starts to make connection with other neurons by their dendrite and axon terminals passing signals and receiving them and they form a strong and complex network which is known as "neural network"

A neural network can be projected as below

As we can see they are very well connected to each other like in mesh topology.

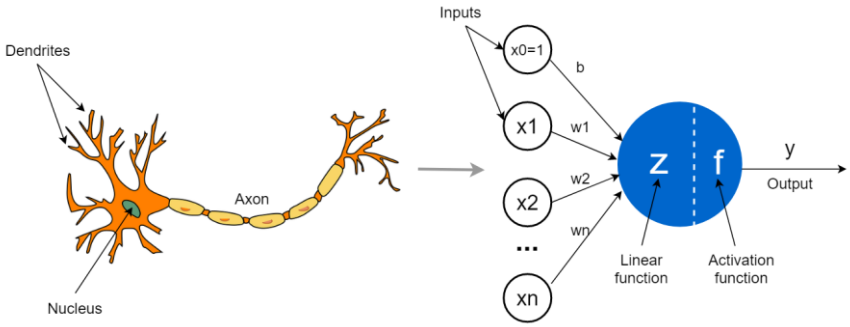
"High number of complexities in neural network suggest an intelligent individual ".

Google recently published a map of an actual human neural network:

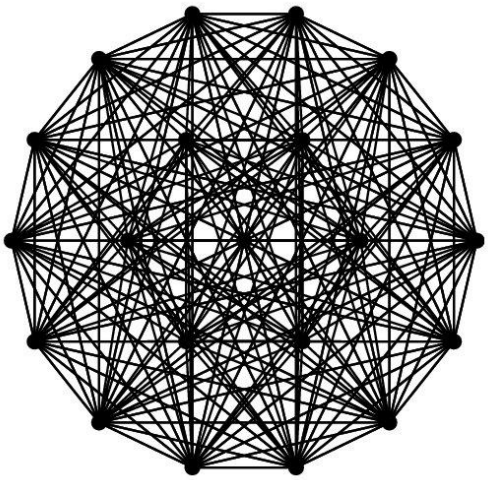


Artificial neural network:

As we know human brain have some limits not all neuron can connect with each of other neuron but if we construct a node which acts like a neuron and has similar structure than we can form even more complex and more effective neural network.



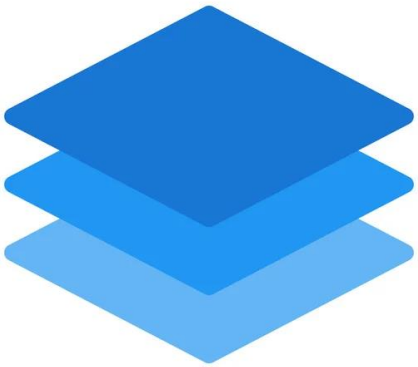
Above image displays a neuron next to a node which have multiple adapters and also has ability to have input up to n numbers.



[2d interpretation of highly connected neural network]

But a single node cannot replicate an actual human brain, so we can form a neural network which is highly connected in mesh topological order for this example we take 6 nodes

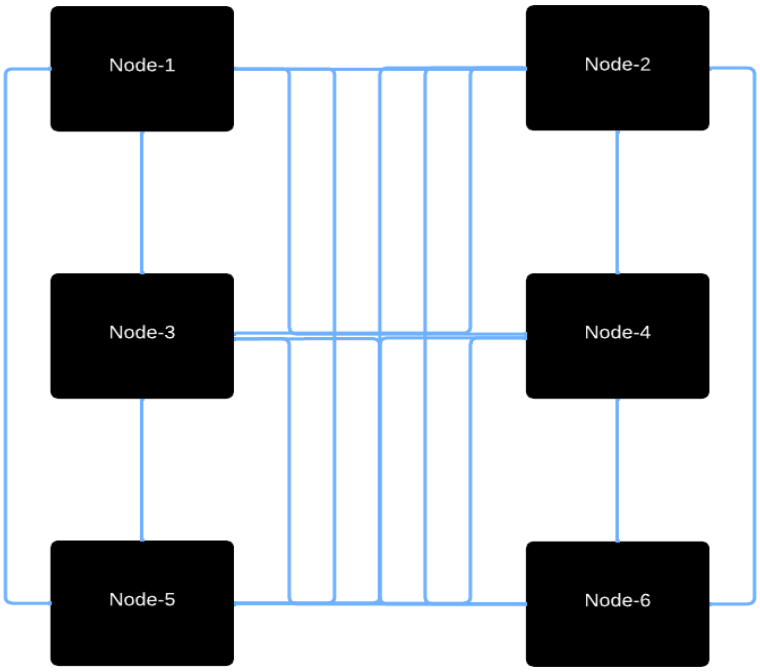
Now as we increase the number of nodes the network will be more complex here is an interpretation of neural network consisting of 21 nodes:



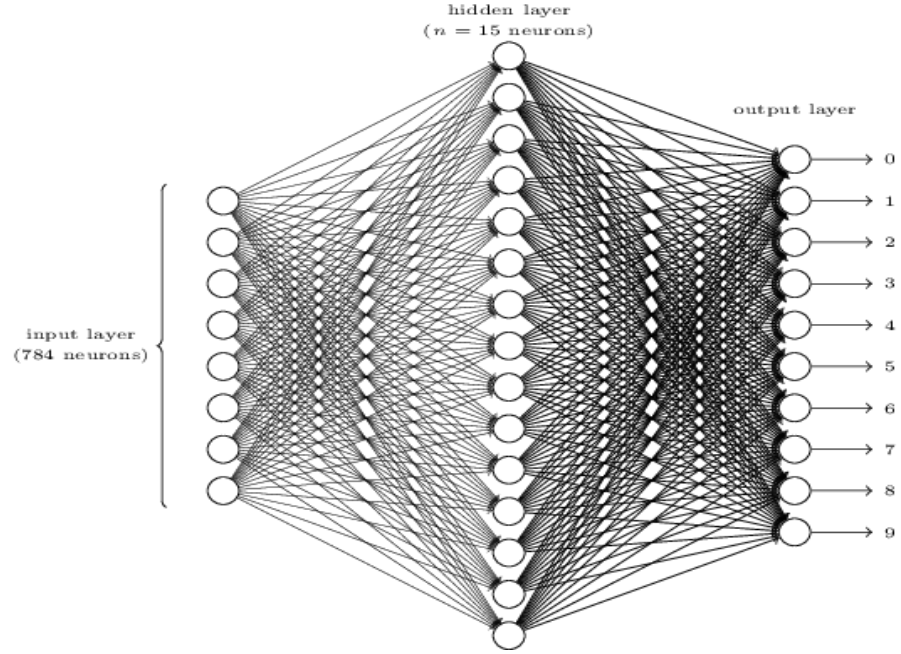
As we can see this structure looks more complex and critical than the first one.

Making entire network in one or two dimensions can increase volume of server's work volume tremendously So, in order to make it realistic we can create multiple dimensions(layers) which may decrease speed of network to some extent

We can set one layer on top of another like in given diagram:



By arranging layers this way, we can decrease server's work volume by very high degree.
So, the layered interpretation looks like this:



We can easily count number of connections by number of nodes by formula: [{n(n-1)}/2].
Example for network having 5 nodes
Let number of nodes be n
Therefor n = 5
By using formula:
Number of connections = {5(5-1)/2}
= (5*4)/2
= 10
[Therefor number of connections = 10]

Why didn't we form such network already?
As for now we are just as far to make neural network little similar to an actual human neural network why?

Because it is comparatively easy to form a neural network than making nodes actually work and act like neurons, neurons do much more than just passing data we are yet too far to construct a model that can really surpass the human brain because of limitation in data training methodology, time, resources and technology of our time, we sure are advance in neural network but still behind to duplicate an actual human brain we have much much more to do before we actually create a brain which is more intelligent than us for now we can create a structure that holds ability to behold the power of the brain.

II. Conclusion:

While the exploration of mesh topological ordering in neural networks is in its infancy, the theoretical arguments presented in this paper lay the groundwork for further research into this innovative architecture. Replicating or surpassing human brain performance remains a significant challenge, but the potential benefits offered by mesh topology warrant deeper investigation. As advancements in both computational neuroscience and machine learning continue, we remain optimistic about the prospects of designing neural networks capable of emulating and enhancing the brain's remarkable capabilities.