Research Proposal

Reward Based Evolution on Plastic Neural Network Clusters

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Ideas and definitions

Pulsating

The network grows or shrinks. If a node is optimized very well and performance will not go down even if lower branches are cut down, then the extra redundant nodes are either discarded or reallocated for similar tasks (transferred learning). Each node grows separately and can have interconnections with other nodes for shared calculations and similar tasks (for example how while listening to music, a certain tune might trigger a memory of another song with that tune, etc.), this is to mimic the brain in its developmental stage. The idea is to have extremely high interconnections within a neural cluster and relatively low to moderate interconnections between different clusters.

Plastic Neural Network

The network will change and get complicated over time as information is transferred between neurons and nodes of the subnetworks for best optimization to minimize #of neurons, achieve reasonably high accuracy, etc.

Impact of Reward Signal on Neural Turing Plasticity

Use a binary reward signal with a strength factor (positive/high signal for positive reinforcement or negative/low signal for the opposite effect) instead of gradient descent to train neural networks. The reward signal will be encoded based on output expectations. This will be applied down to individual neurons just like network optimization using gradient descent.

Function Explanation

Resistance Building

Over time, the network will get accustomed/saturated to regular exposure to the same reward signals. This might be done by...

Network Maturation and Active Adaptation

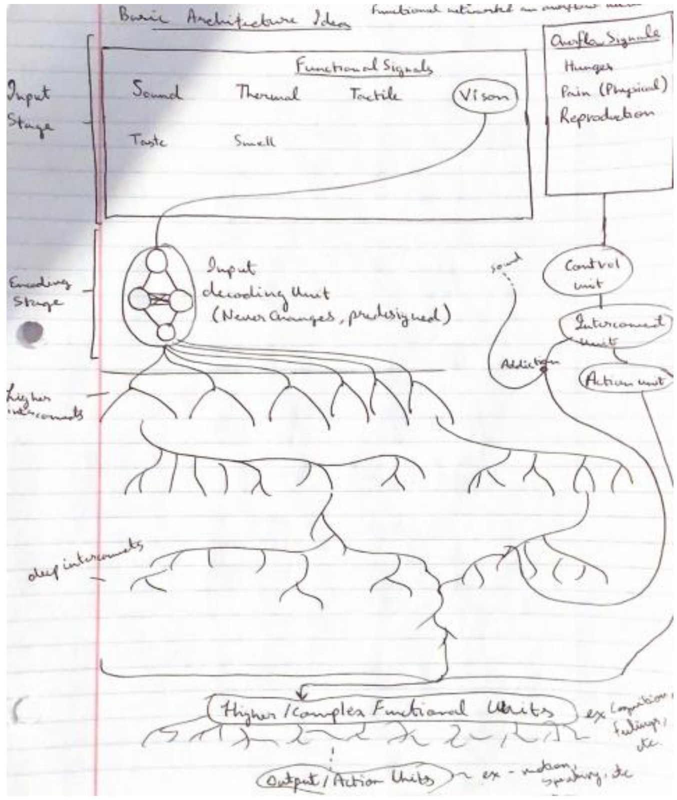
Resistance to reward signals will eventually lead to slowing down of the learning process and in time solidifying the network. The maturation state is calculated by...

- Insert equation to calculate Maturation... (M)
- Plasticity(P) = 1/M
- Plasticity per Neuron = ...

If the network is not used much or at all due to not partaking in the specialized task, over time, the maturation of the network diminishes. So, the network will gain back its ability to learn if left unused.

If a new task comes along that is like the network's specialization, depending on the maturation state, the network will either re-specialize/adapt to the new task or try to reallocate resources by adding more subbranches or updating existing ones (*note that the depth of these subbranches will depend on how similar the task is) to accommodate the new task.

In case the network is left unused for a long period, it will fully regain its plasticity and be available to adapt to new tasks not necessarily like the previous specialization by DISINTEGRATION and REALLOCATION of the network or making itself available for assimilation by other growing branches within that cluster.



NETWORK CLUSTER is a group of speculated networks with VERY HIGH cross interconnection and uses the same base network architecture scheme and source signal for processing.

FUNCTIONAL SIGNALS- Basic input signals that are needed to perform higher complex functions (ex- cognition, emotions, memory, etc.) but need to be deciphered by lower-level networks for information (ex- sound processes, vision processing, etc.).

INPUT-> Functional Signals-> (lower network) -> Higher level data-> (Complex Networks)->output signals-> (output control network)-> action signals-> OUTPUT

OVERFLOW SIGNALS- Key signals for survival. If left unchecked, they will amplify over time until overwhelming the complex networks until the 'craving' is either satisfied or suppressed*.

ADDICTION- Condition when functional signal processing networks develop high interconnection with overflow networks.

Further Reading

- Spiking NN.
- Pruned NN.
- Modular NN.
- RNN.
- Short-circuit NN.
- Neuro-evolution.
- Long Term Memory.
- Short Term Memory.
- Neuro Plasticity.
- Reward-Based Neural Turing Machines.