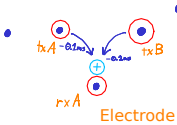
RPT Correlation Computation

Software Algorithm Flow



- Limited electrode sites recieving from a large number of physical neurons may be precisely analyzed as logical neurons in which a significant number of physical neurons must all emit a TX event (which may correlate as an RPT event).

Electrode Sites
(or logical aggregations thereof)

Beware, simple covariance testing may NOT distinguish between two neurons both simply responding to some degree to various other stimuli (as with classic neuroscience experiements), as contrasted with an actual specific temporal more indicative of the cause and effect between TX and RPT events.

Discarding low-confidence RPT correlations (weak synapses) may be highly beneficial.

A neuron participating in real-time processing in the recorded data should always have a strong correlation, such that negligible time would be required to be received by other real-time processing neurons. Synaptic weights (ie. memories) of non-default magnitude never used in real-time may have nonsignificant influence on modeling or motor output (aka. thoughts or behavior).

Confidence interval between RPT and ambient noise (~50Hz, individual neuron specific) TX event rates may be high if a synapse actually exists. Meaningful neural communication may require both a high S/N ratio and sufficient 'fire together wire together' not to 'fire out of sync lose their link'.

ES - Electrode Site number.
CK - Clock microseconds.

LI - List. All measurements (ME) from ADC, with increasing details annotated (eg. NR/PA/DA). Must be serializable to human-readable. Yes, these are expected to be exportable in real-time as huge text files containing every ADC data point (at least if CK is specified), though mostly not written out in practice.
LU - Lump 14bit. Integer precision and memory bandwidth optimized list fragment.

ME - Measurement (voltage/amplitude).
NR - Neuron.

PA - Phase (center/rise of Action Potential).
DA - Duration (center/fall of Action Potential), or center+(fall-rise) timings.

GR - Gradient.

HS - High Sampling
LS - Low Sampling

ES_000_000_000_000_000_001
CK_000_000_000_000_000_001
CK_000_001 ES_001 TX
CK_000_002 ES_001 TX

Underscores are human readable only, filtered out of algorithm processing.

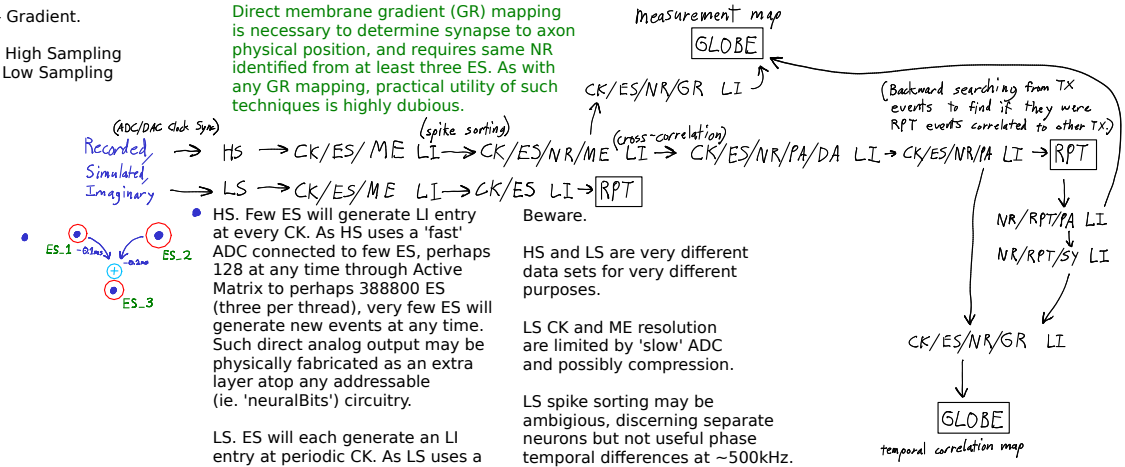
Lumps are stated as fields in serialized data, and perhaps as separate 'objects' in memory.

Expect crude neural network simulation functions - correlating the connectome and synaptic weights of simplistic Artificial Neural Network (ANN) models - will be necessary.

All metaEngine multi-pipeline characteristics, coordinate grids, IPC (especially to high-speed USB streams and simulated data stream programs) are exactly ideally suited for entirety of all these tasks.

Artificial neural network and GNU Octave covariance testing may be useful.

Direct membrane gradient (GR) mapping is necessary to determine synapse to axon physical position, and requires same NR identified from at least three ES. As with any GR mapping, practical utility of such techniques is highly dubious.



- HS. Few ES will generate LI entry at every CK. As HS uses a 'fast' ADC connected to few ES, perhaps 128 at any time through Active Matrix to perhaps 388800 ES (three per thread), very few ES will generate new events at any time. Such direct analog output may be physically fabricated as an extra layer atop any addressable (ie. 'neuralBits') circuitry.

LS. ES will each generate an LI entry at periodic CK. As LS uses a 'slow' ADC, a new LI entry will not appear at every CK 1us cycle.

PA. HS may use cross-correlation to determine center/rise of Action Potential.

DA. HS multiple cross-correlation to different waveforms may discern 1us Action Potential duration timing.

Beware.

HS and LS are very different data sets for very different purposes.

LS CK and ME resolution are limited by 'slow' ADC and possibly compression.

LS spike sorting may be ambigious, discerning separate neurons but not useful phase temporal differences at ~500kHz.

LS ES positions may drift long-term with not sufficient information to correlate back to previous RTP events.

LS temporal resolution may be less than phase difference between independent TX/RPT events.

Better LS performance specifications may be available in practice. Apparently the ADCs may operate at >20kHz (claimed 10x neuron spike duration based sampling rate) with full prorammable FIR neuron spike 'shape' cross-correlation on device within '900ns apparently claimed for Neuralink demo CNET coverage Aug28 .

SY = Synergy between two synapses. Synaptic weight of two TX events in most complex (perhaps also highest confidence) RTP event, minus weakest synaptic weight from RTP event in which just one of those two TX events did not happen (ultimately combined synaptic weight of both synapses minus synaptic weight of weakest of those two).

Synergy is essentially when two TX events happening are much more likely to cause RPT than the combined weights of either TX event alone.

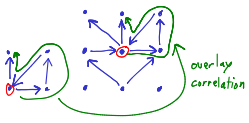
Synergy also presents a very rapid test of whether membrane voltage gradients are important in biological nerual network information processing. No synergy found, no importance. Such would be shockingly unexpected.

Ability to measure RPT patterns implies ability to present stimuli which change these RPT patterns (most efficiently by high-resolution direct neural stimulation). Erasure may exploit 'out of sync lose their link'. Writing may exploit 'fire together wire together'.

Communication directly between biological neural networks may effect a similar result in practice - transfer of memories. Filtering only TX events which activate very large groups of neurons (ie. logical neurons), especially in the motor cortex, may limit memory transfer to voluntary only.

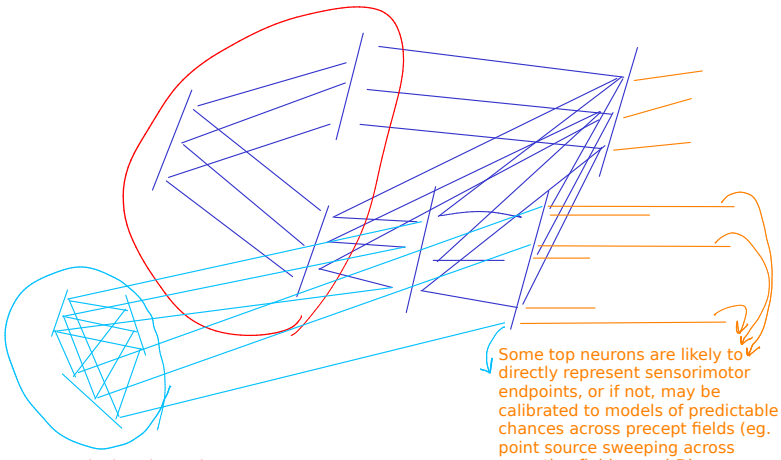
Overlay of biological neural networks - direct electrical connection - may be arranged based on spatial arrangement of RPT events as neuroanatomical 'landmarks'. Some confidence may result from uniqueness of spatial arrangement.

Memory extraction may be possible if RPT events are correlated to associated sensory precepts (eg. visual images) when a 'neural decoder' determines these occur (either as external stimuli or spontaneously internally).



Topographic Mapping from RPT Correlation

Software Algorithm Flow



Some top neurons are likely to directly represent sensorimotor endpoints, or if not, may be calibrated to models of predictable chances across precept fields (eg. point source sweeping across receptive fields, mechDive measured force/position motor outputs) (aka. 'neural decoder').

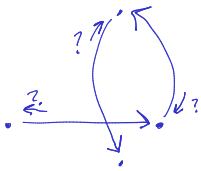
Iteratively solve red.

Find sensorimotor I/O (PNS) entry.

From orange. Action potentials may overlap with only small spike phase or duration differences.

Read only! Algorithm must NOT require arbitrary stimulation, which should only supplement recording data.

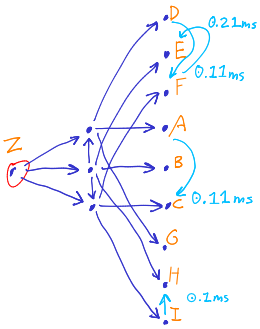
High temporal resolution and oversampled spatial resolution may be required and are feasible, constrained by SerDes bandwidth.



Low temporal resolution correlations may reveal topographic mappings, but without clearly defining the typical directionality, or possibility of bidirectional feedback, only showing both topographic maps were simultaneously activated.

Deep topographic mapping may require high temporal resolution (telodendria ~50kHz?), neuroanatomical overlay (spatial position of electrode), and/or tracing the order of RPT events by RPT correlation of RPT events themselves.

Absence of any spatial position and temporal resolution less than 10x sample rate of minimum temporal difference may increase risk of requiring more solving by more computationally expensive genetic/ANN model iteration.

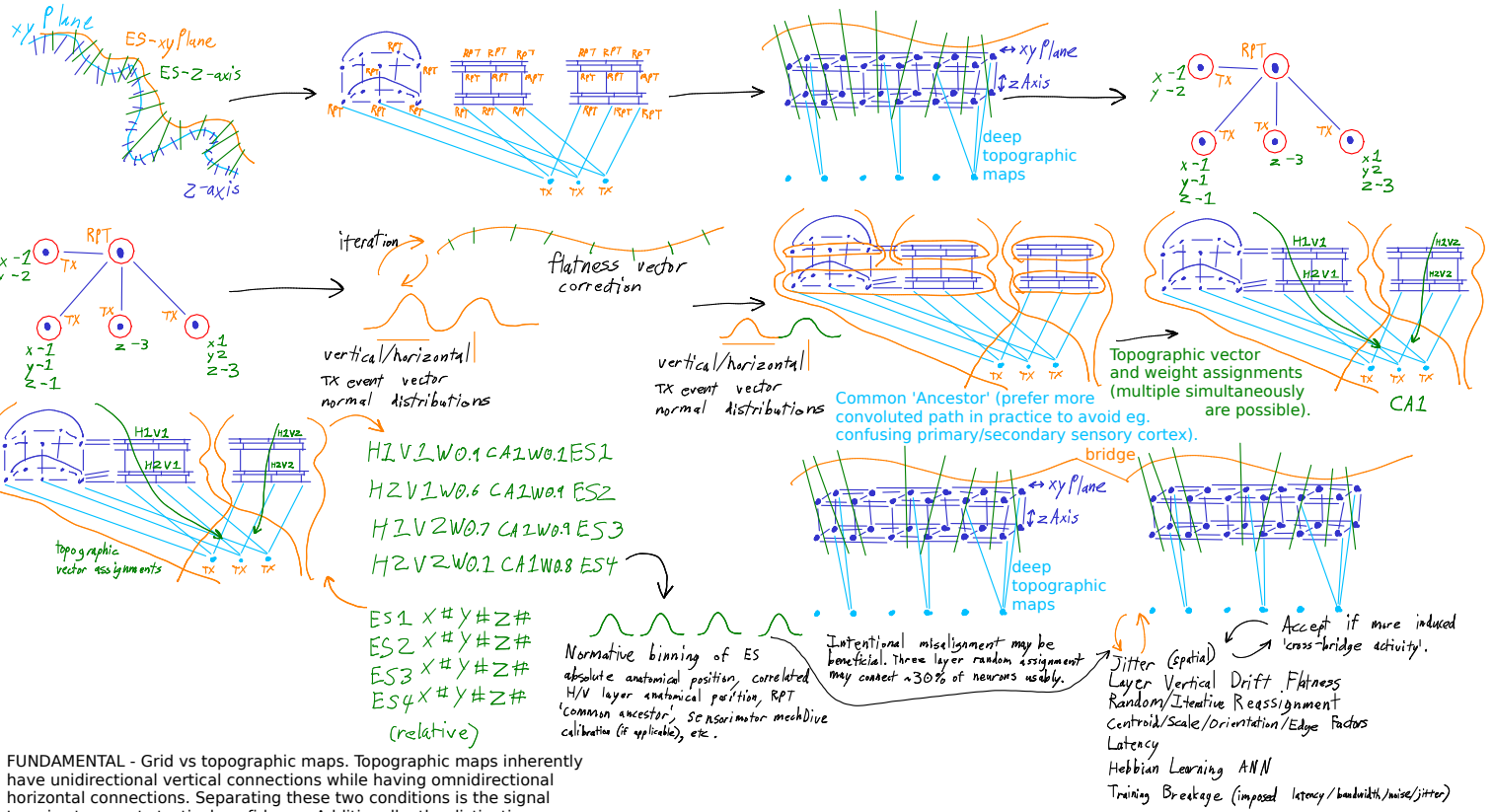


Neurons which RPT from a common vertical TX may be distinguished by their RPT of other neurons in a specific horizontal topographic map.

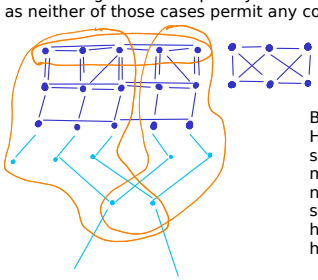
Only the RPT event F-->E, which occurs after D-->F, distinguishes E (of D,E,F horizontal) from B (of A,B,C horizontal).

Center of all topographic maps - E,B,H - will RPT simultaneously from the same vertical TX at Z.

Both B and E will RPT from the same vertical TX event. Only E will RPT of horizontal TX events from processing within that horizontal topographic map.



FUNDAMENTAL - Grid vs topographic maps. Topographic maps inherently have unidirectional vertical connections while having omnidirectional horizontal connections. Separating these two conditions is the signal to noise to assert stastical confidence. Additionally, the distinction between a grid and completely omnidirectional synapses is not relevant as neither of those cases permit any computed overlay (ie. alginment).



FUNDAMENTAL - In practice even substantial misalignment may be tolerable. Minor scaling or layer mismatch, may be adequately accommodated simply by randomizing geometric overlay (ie. alignment) slightly, allowing at least some of the neurons to send precise - if not accurate - data to some of the other neurons. With adequate precision, VR retraining or outright plasticity is expected to be sufficient to adjust sensory perceptions. Moreover, mere VR sensorimotor connection can be achieved by PNS connection which is drastically simpler to align and to supplement by a variety of calibration techniques (aka. 'neural decoder') and mechDive itself.

Biological neural network (ie. 'brain') complexity may be less than tens of thousands of topographic maps. Human Connectome and Human Proteonome projects seem to support such conclusion. Should not be surprising considering the seeming absence of complexity in other tissues derived from similar genetic mechanisms. Much complexity of biological neural networks below horizontal topographic maps (eg. large numbers of distinctly different processing structures, large numbers of distinct neuron morphologies, etc) should not be expected either.
https://www.proteinatlas.org/humanproteonome/brain/human+brain
https://humanconnectomeproject.org

Membrane Phase/Amplitude Variation Visualization

Object memories are expected to at least transfer all of their usable information to and from lower spatial resolution and lower temporal resolution patterns of RPT events from synapses. Whether visualization at better than whole neuron resolution is of practical utility is highly dubious, contemplated mostly as a diagnostic technique.

Globe mapping of phase/amplitude variation across neuron membrane.

Temporal correlation maps rank synapses by most synergistic first, and then from this *1D* plot, fold the most inter-synergistic to be closer on a 2D plot.

Alternatively, the X/Y coordinates of each synapse may be iteratively incremented/decremented with strong dithering (to break any sub-optimum locking of position) towards the lengths beween each synapse being equal to their synergistic effect on synaptic weight.

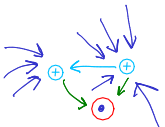
Measurement maps simply read the same neuron from multiple locations at sufficient temporal and spatial resolution to directly observe surface membrane voltage gradients. The exact phase of points along these voltage gradients may be correlated to phase of RPT events at that neuron, at least giving a sense of direction from which the gradients were received, which may be subsequently modeled by simple arithmetic latency, and displayed as a layer in the false-color visualization.

Such an arrangement would allow neuron voltage gradients to be visualized at points across the entire neural network.

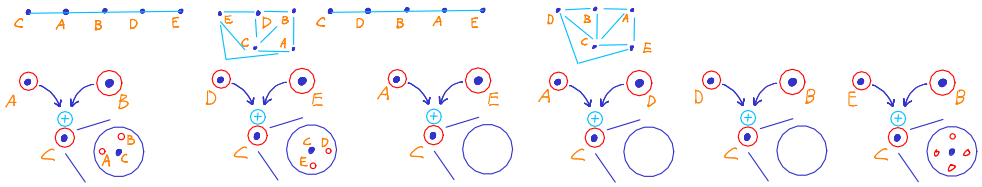
Sparse pattern mapping ranks synapses by synergy, binning synapses into separate groups that are most synergistic to each other and less so with other synapses. Visualization of this data is of the X/Y/Z coordinates of the ES (Electrode Sites) from which the relevant TX events originate.

In this way, the separate patterns recognized by neurons might be observed.

Diagonal synapses are not expected. Most synapses to a neuron are expected to be almost exclusively vertical or horizontal. Most groups are also expected mostly vertical (eg. perhaps apical synapses) or almost entirely horizontal synapses.



Small synergy between synaptic clusters may require additional analysis.

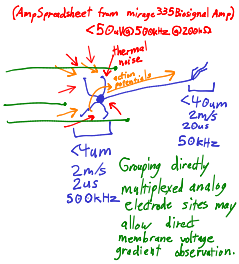


Axon (at center) may not be plotted without sufficiently high temporal and/or spatial resolution to directly observe membrane gradients.

Both phase and amplitude changes across gradients are interesting, to a very high degree of sensitivity. False color images must represent both.

As little as a 1us change in relative phase between synapses may reflect an alternate path taken to reach that synapse, carrying substantial information about the pattern of precepts processed by the receiving neuron (ie. revealing a pair of images in which certain precepts were replaced outright by other precepts).

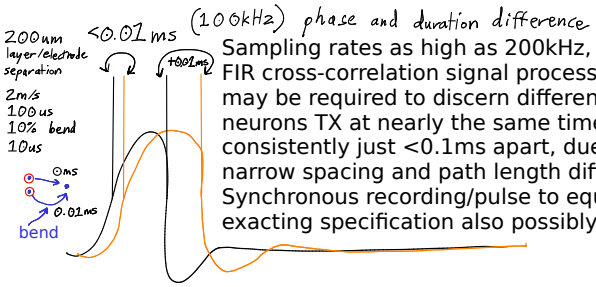
Sampling Rates



Sampling rates as high as 10MHz may be required to fully resolve smallest neural voltage gradient features, across the telodendria and dendrites. Spike sorting (single neuron recording) if not by amplitude then by temporal correlation to identified synapse, may also be required. Such precise studies may benefit greatly from Active Matrix multiplexed direct analog connection to external ADC.

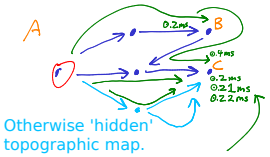
Membrane potential phase differences as high as 500kHz clearly exceed local thermal noise floor. Microelectrode signal to noise ratios are drastically worse than for membrane potential, and still remains at <50uV, below the ~100uV reported by Neuralink for relatively high amplitude spikes.

Further, this conclusion implies usability of membrane integrated biological nanowire semiconductor devices as action potential duration limiters (a possible technological addition to improve biological neuron performance without discarding possible wetware neural correlates of consciousness entirely in favor of semiconductor hardware).



Sampling rates as high as 200kHz, and FIR cross-correlation signal processing may be required to discern different neurons TX at nearly the same time, but consistently just <0.1ms apart, due to narrow spacing and path length differences. Synchronous recording/pulse to equally exacting specification also possibly required.

Very strong correlations may exist for very small timing differences, due to occasional inputs from nearly same-length paths, particularly between just two topographic layers.



Otherwise 'hidden' topographic map.

Possible phase/amplitude variation across neuron membrane?

A-->B
0.1ms, 1%weight, 99%confidence
0.2ms, 90%weight, 99%confidence
0.3ms, 1%weight, 51%confidence (spurious noise)

A-->C
0.2ms, 99%weight, 99%confidence
0.21ms, 1%weight, 99%confidence
0.22ms, 1%weight, 99%confidence