RYAILITI™
Knowledge Engineering
To Navigate Change™

RYAILITI Biomimetic Engine

What is a Biomimetic Engine?

An ecosystem of computing models designed using principles and methods discerned from the human brain. The primary applications of the engine are:

- Practical modeling of highly complex, multi-disciplinary domains to enable holistic discovery and analytics to find realities that are invisible to current ML/NLP, e.g., multi-factor commonality, dark data (Gartner), latent variables
- Chaotic and stochastic simulation that is traceable and repeatable
- Capture elements of human expertise as a computable asset that can be leveraged by standard architectures via an API

Approaches used to build and continually evolve the engine

In the brain, one neuron firing can trigger another neuron firing, which in turn can trigger a third, and so forth, and the message sent is an attenuated stimulation or suppression. The significance of a neuron is all about its connections to other neurons, and the processes are not algorithms but rather dynamic combinatorial interactions. In our software:

- Fundamental components and potential connections are defined in a Meta ontology as structures, systems and known scenarios
- Attributes of the components are defined as categories that are mapped across relational, hierarchical and unstructured data sources
- Behaviors of the components are defined as expressions that include static and/or dynamic variables and operators

The human brain receives enormous amounts of sensory input. Rather than trying to process it all equally, it quickly filters out data likely to be irrelevant, and processes the relevant in great depth.

When humans solve a problem, we rarely invent methods from scratch based solely on our own experience. We usually apply methods learned through education, or copied from others, and often take input from peers and specialists. In our software the model content is integrated and rationalized by a combination of:

- Automated and manual processes
- Standard and proprietary methods
- Subject Matter Experts input

This real-world reasoning approach enables the construction of models that integrate highly diverse elements and information sources to enable exploration and discovery to a scope that traditional information architecture cannot accommodate.

Systems Thinking Approach

The National Academy of Sciences (NAS) recommends addressing complexity using systems thinking. Key observations are:

- Bottom-up, mechanistic, linear approaches to understanding macro-level behavior are limited when considering complex systems
- Bottom-up, reductionist hypotheses and approaches can lead to a proliferation of parameters; this challenge can potentially be addressed by applying top-down, system-level principles
- Systems thinking can be used to predict macroscopic phenomena while bypassing the need to explicitly unmask all the quantitative dynamics operating at the microscopic level

Architecting Stability

"Instability is the Achilles' heel of modern artificial intelligence." (NAS March 16, 2022) This vulnerability grows as neural networks scale. The historical approach has been mathematical, but reality is dynamic and multidimensional, and emulation requires multidisciplinary methods, at the very least including neuroscience, linguistics, biophysics and psychology.

Is brain stability a challenge? Neuroscientist Henry Markram, director of the Blue Brain Project (building a computer simulation of a mouse brain – 2020 interview) describes the mathematical challenge: "The human brain uses over 20,000 genes, more than 100,000 different proteins, more than a trillion molecules in a single cell, nearly 100 billion neurons, up to 1,000 trillion synapses and over 800 different brain regions to achieve its remarkable capabilities. Each of these elements has numerous rules of interaction. Now it would take a very long time to even try to calculate how many combinations there are when one can chose 10,000 possible genes from a set of 20,000, but what is sure is that it is more than the number of sub-atomic particles in this, and probably every other universe we can imagine."

How is stability achieved in the human brain? Markram explains: "Every biological parameter in the brain is constrained by virtually every other parameter in the brain. The parameters can therefore not just assume any value, as every other parameter is holding it in place."

Our methodology includes processes and methods that impose internal constraints on parameter values across the network, but delivers critical benefits in addition to stability. The constraint architecture then becomes a foundation for governing design and audit processes. It also reduces the combinatorial complexity of the network to make bias analysis feasible.

Our approach is a paradigm shift, moving from obscuring reality by narrow technological constraints to discovering reality by applying real-world reasoning to real-world data. But as Einstein said, " You cannot solve problems using the thinking that caused them."