Title of Invention:

Complex-Valued Persistence-Weighted Associative Memory Networks with Fractal Resonance Units and Hurst-Derived Ontological Mass

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Cross-Reference to Related Applications:

This application claims priority to U.S. Provisional Application filed December 2025 titled "Method for Anisotropic Information Routing in Neural Networks Using Persistence-Weighted Conductance".

Background:

Current neural networks suffer from quadratic scaling and ontological flatness. Modern Hopfield networks achieve exponential capacity but fail to distinguish persistent laws from transient noise.

Detailed Description:

The invention comprises a neural network layer using **Fractal Resonance Units (FRUs)** defined as complex-valued states:

$\Psi_i = p_i \cdot r_i \cdot e^{i \theta_i} \cdot u_i$

where:

- $p_i = \sigma(k (H_i - 0.5))$, $k \geq 2$, H_i = Hurst exponent estimated from activation trajectory autocorrelation decay $C(\tau) \sim \tau^{2H-2}$
- r_i = salience/magnitude
- θ_i = phase encoding logical valence (negation $\approx \pi$)
- u_i = unit vector in $\mathbb{C}^d$

Retrieval uses continuous-time modern Hopfield dynamics with persistence-boosted resonance:

$d\xi/dt = -\xi + \Sigma R(\Psi_j, \xi) \Psi_j$

$R(\Psi_j, \Psi_k) = \mathrm{Re}(\Psi_j^H \Psi_k) \cdot (p_j p_k \text{ boost})$

Persistence H_i may be derived from internal trajectories, coin-age accumulation, or any scalar field encoding structural importance.

Claims (provisional – largi):

1. A neural network comprising complex-valued memory units with persistence weights derived from Hurst exponents of activation trajectories.
2. The network of claim 1 using continuous Hopfield updates with persistence-boosted resonance similarity.
3. The network of claim 1 wherein persistence is computed via autocorrelation decay estimation in O(T) time. 4–25: variants including training objectives, neuromorphic implementation, integration with reaction-diffusion routing.

Abstract:

A bio-fractal neural architecture replacing transformers with persistence-weighted complex Hopfield networks achieving exponential capacity, ontological law/noise separation, and sub-quadratic routing.