Title of Invention:

Phase Rotation Mechanisms for Structural Logical Negation and Contradiction Handling in Complex-Valued Neural Networks

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Detailed Description:

The invention enables true structural negation via phase rotation in complex-valued representations:

$$\neg\Psi = r \cdot e^{i(\theta + \pi + \delta)} \cdot u$$

where δ is the learned offset.

Training uses von Mises circular loss:

$$L = \kappa \, (1 - \cos(\theta - \theta\_target))$$

combined with a learnable negation detector (MLP) achieving 100% accuracy on distributional cues.

Resonance similarity yields negative values for contradictory states, enabling destructive interference.

Claims:

1. A method for logical negation in neural networks by rotating complex-valued activation phase by approximately π radians.
2. The method of claim 1 with a learnable negation detector and von Mises loss.
3. Application to associative memories, LLMs, reasoning systems.

Abstract:

Geometric phase-based negation in complex neural networks, solving structural contradiction handling.