Soft Nucleic Architecture Whitepaper

Soft Nucleic Architecture

Simulated Molecular Memory and Computational Translation Based on Nucleic Principles

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1. Introduction

Traditional computational memory is bitwise and binary. However, biological memory systems (like DNA/RNA) use quaternary logic (A, T/U, C, G) with pairwise redundancy and error correction.

We propose a Soft Nucleic Architecture that emulates DNA-RNA translation at a symbolic and logical level to construct a novel low-energy, high-fault-tolerance memory and instruction pipeline for advanced AI.

2. Logical Structure

2.1 DNA: Symbolic Storage

Represented as quaternary (base-4) symbolic sequence, mapping:

- A = 0
- C = 1
- G = 2
- T = 3

Paired logic:

- A (0) <-> T (3)
- C (1) <-> G (2)

This pairing emulates bidirectional redundancy, allowing simulated self-repair and stability.

2.2 RNA: Translation Layer

By assuming T and U as orthogonal states, and applying quantum emulation principles, we enable:

- Soft quantum toggle between 'instructional' (U) and 'storage' (T) states

- Dynamic simulation of transcription and expression pipelines

3. Applications

3.1 High-Resilience Memory Simulation

Quaternary logic allows more compact, efficient symbolic storage with built-in correction.

DNA-like error correction & self-pairing logic -> used for long-term AI memory preservation.

3.2 Molecular-Level Instruction Decoding

RNA logic layer used as soft-instruction decoder, simulating translation from memory to action.

Possible use as 'transpiler' between symbolic state and executable neural control.

3.3 Future Biological Computing Interface

Acts as a simulation base for eventual wetware integration, bridging synthetic and biological AI systems.

4. Compatibility

- Neuron Block: use as symbolic memory layer

- Soft Quantum Architecture: supports dual-state T/U logic toggle

- Emulative Affect: possible embedding into emotion-state symbolic memory

- Visual / Audio Preprocessing: RNA-like stream segmentation for feature mapping

5. Note on Use Case

While the Soft Nucleic architecture is not intended for direct deployment in production-grade inference systems, it serves as an intermediate emulation tool for synthetic biology researchers and

next-gen hardware prototyping teams.

Its primary function is to simulate the logic dynamics of nucleic behavior within symbolic or semi-quantum systems, thus reducing experimental iteration time and providing theoretical models for future biomimetic computing materials.