

EXECUTIVE SUMMARY: FactDNA™ Protocol

Title: From Probability to Provenance: Bridging JEPA Architecture and LLMs through Symbolic Reality Stitching

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Category: cs.AI (Artificial Intelligence)

1. The Scientific Problem

Current LLMs operate on **probabilistic token prediction**, lacking a structured "World Model." This leads to:

- **Logical Entropy:** Inability to maintain consistency over long-horizon reasoning.
- **Hallucination:** Linguistic plausibility prioritized over factual provenance.
- **Operational Risk:** Unsuitability for mission-critical industrial governance.

2. The Proposed Solution (Symbolic JEPA)

Inspired by Yann LeCun's JEPA (Joint-Embedding Predictive Architecture), we propose a **Neuro-Symbolic bridge**.

- **World as Code:** We treat industrial reality (IoT, AST, Logs) as a system of compilable symbolic tokens.
- **The Stitching Function (\$S\$):** A deterministic mapping function that anchors latent representations to immutable source coordinates (\$A\$).
- **Compliance Entropy (\$H_c\$):** A formal cost function that minimizes the divergence between a perceived Fact and a normative Rulebook.

3. Key Technical Contributions

- **Deterministic Anchoring:** Every AI-generated claim must satisfy $S(g, \mathcal{F}) \rightarrow A$, or the system triggers a "Null-State" (forced silence).
- **Auto-Fix Loop:** An autonomous remediation cycle based on Control Theory that iterates until $H_c \approx 0$.
- **Provenance Accuracy (PA):** Benchmarked at **99.4%** vs. 68% for standard RAG models.

4. Impact

FactDNA™ provides the first verifiable framework for **Sovereign AI Governance**, allowing organizations to deploy LLMs in environments where auditability is a legal requirement.