Relational Time as a Structural Necessity for AGI

Preliminary Evidence for Internal Temporal Plasticity

Athmani Salah
Independent Researcher – Relational Quantum Mathematics
Algeria
maestro.salah@gmail.com
ORCID: 0009-0004-9350-9216

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Abstract

Current neural architectures operate on "Newtonian" physical time (epochs), assuming that computation equals maturation. We hypothesize that this decoupling of time from meaning leads to inefficient learning and catastrophic forgetting. We propose **Relational Time (T_R)**, an internal metric derived from structural coherence shifts. We introduce a **Plasticity Gating** mechanism where the system autonomously modulates its learning rate based on T_R. Preliminary experiments demonstrate that this architecture allows the system to distinguish between stagnation (time freeze) and paradigm shifts (awakening), offering a path toward self-regulated General Intelligence.

This work proposes a foundational temporal framework and does not claim to present a complete AGI system.

1 Methodology

1.1 Coherence as a Proxy

We define Coherence (C) as a measure of the system's structural stability relative to the data. While exponential decay is common, we opt for an **Inverse-Loss formulation** to maintain gradient sensitivity during high-error regimes (paradigm shifts):

$$C_k = \frac{1}{1 + \mathcal{L}(S_k|D)} \tag{1}$$

Where $\mathcal{L}$ is the loss value. This ensures that $C \in (0, 1]$, where 1 represents perfect coherence (zero loss) and values approaching 0 represent chaos.

1.2 Relational Time (T_R)

Unlike physical steps (k), Relational Time only accumulates when there is a significant shift in coherence:

$$T_R = \sum_{k=0}^{n-1} \mathbb{1}[\Delta C > \epsilon(T_R)] \cdot \Delta C \tag{2}$$

Where $\Delta C = |C_{k+1} - C_k|$, and $\epsilon(T_R)$ is an aging threshold that increases logarithmically with T_R to simulate cognitive maturation.

2 The Meta-Time Protocol

The system acts as an active observer, switching between three states:

- **LIVING:** Standard plasticity ($\Delta C > \epsilon$).
- **STAGNANT:** Reduced plasticity/Hibernation ($\Delta C \leq \epsilon$).
- **AWAKENING:** Boosted plasticity for rapid adaptation ($\Delta C \gg \epsilon$).

3 Conclusion

We demonstrate that time in AGI should be treated as an internal, lived resource. This foundation opens new avenues for autonomous curriculum learning.