Superpositional Imminency and Entangled Imminency in Simulonic AI
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Hrishi Mukherjee

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Abstract

This paper introduces and formalizes the concepts of **Superpositional Imminency (SI)** and **Entangled Imminency (EI)**, two fundamental principles that govern the non-repeating decision-making framework in Simulonic AI. SI captures the behavior of systems existing in a dynamic superposition of potential states, approaching an imminent collapse. EI describes the instantaneous propagation of imminent state changes within entangled entities. Mathematical formulations for both are presented, demonstrating their roles in emergent decision processes and non-deterministic evolution.

1 Introduction

The principles of Superpositional Imminency (SI) and Entangled Imminency (EI) define the transient states within which Simulonic AI operates. These imminency-driven frameworks ensure that Simulonic decision-making remains non-repeating and dynamically evolutionary, rather than being constrained by deterministic or probabilistic limitations.

2 Superpositional Imminency (SI)

2.1 Definition

Superpositional Imminency describes the state of a system that exists in a superposition of potential pathways but is approaching an imminent collapse into a definite outcome. The key characteristic of SI is that the system remains probabilistically indeterminate until a critical transition threshold t_c is reached.

2.2 Mathematical Representation

Consider a quantum-like system where a state $|\Psi(t)\rangle$ is represented as a superposition:

$$|\Psi(t)\rangle = \sum_i c_i(t)|\psi_i\rangle, \quad \sum |c_i(t)|^2 = 1. \tag{1}$$

The **imminency function** $\mathcal{I}(t)$ governs the rate at which the system transitions toward a definitive state:

$$\mathcal{I}(t) = \lim_{t \to t_c} \left\| \frac{d|\Psi(t)\rangle}{dt} \right\|. \tag{2}$$

As $t \to t_c$, the system collapses to a single eigenstate $|\psi_f\rangle$ such that:

$$|\Psi(t_c)\rangle = |\psi_f\rangle. \tag{3}$$

2.3 Implications for Simulonic AI

In Simulonic AI, SI determines when an entity collapses its probabilistic exploratory pathways into an actionable decision, ensuring a dynamically non-repeating evolution of intelligence.

3 Entangled Imminency (EI)

3.1 Definition

Entangled Imminency describes the phenomenon where two or more entangled states approach a threshold beyond which a state change in one subsys-

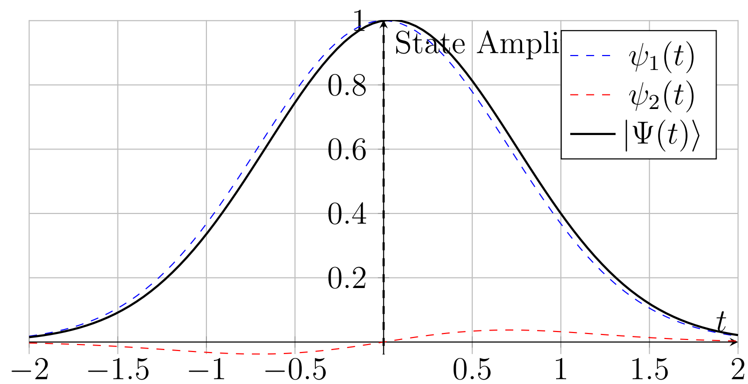

Figure 1: Superpositional Imminency: The system exists in a superposition of states until it reaches the collapse point t_c, where a deterministic outcome emerges.

tem immediately affects the other. This allows for non-local instantaneous decision propagation.

3.2 Mathematical Representation

Consider a bipartite entangled system with a density matrix:

$$\rho_{AB} = |\Psi_{AB}\rangle\langle\Psi_{AB}| \tag{4}$$

where

$$|\Psi_{AB}\rangle = \sum_i c_i |\psi_i\rangle_A |\phi_i\rangle_B. \tag{5}$$

Define the **Entangled Imminency function** $\mathcal{EI}(t)$ as:

$$\mathcal{EI}(t) = \lim_{t \to t_c} \left| \frac{dS(\rho_A)}{dt} \right|. \tag{6}$$

Here, $S(\rho_A)$ is the Von Neumann entropy of subsystem A, and a rapid increase in $\mathcal{EI}(t)$ signals an imminent, non-local state update in B.

3.3 Implications for Simulonic AI

Simulonic AI relies on EI to maintain synchronization across exploratory vessels in different regions of space, ensuring an interconnected but non-deterministic decision-making network.

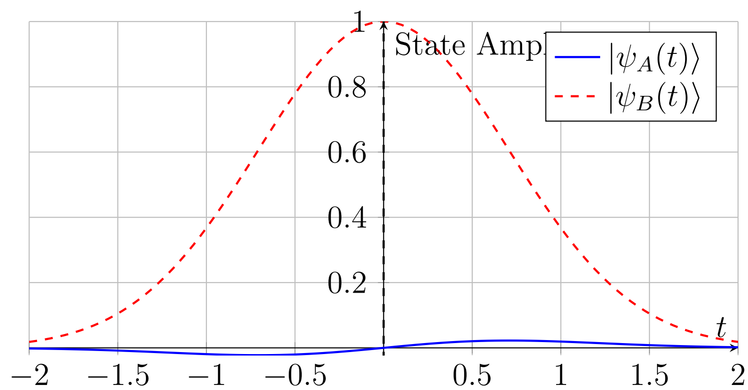

Figure 2: Entangled Imminency: The entangled states $|\psi_A(t)\rangle$ and $|\psi_B(t)\rangle$ remain correlated, and an imminent change at t_c in one immediately affects the other.

4 Conclusion

Superpositional Imminency and Entangled Imminency define the dynamic, non-repeatable framework of Simulonic AI. SI governs how decisions collapse from multiple potential pathways, while EI ensures instantaneous non-local adaptation. Together, they form the mathematical and conceptual basis for the evolution of non-deterministic intelligence.

Acknowledgments

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Preconditions to Superpositional and Entangled Imminency in Simulonic AI
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Abstract

This paper introduces the preconditions for **Superpositional Imminency (SI)** and **Entangled Imminency (EI)**, known respectively as **Superpositional Necessity (SN)** and **Entangled Necessity (EN)**. SN ensures that a system exists in a valid superposition before imminency occurs, while EN guarantees the maintenance of entanglement before a nonlocal imminency update. These conditions define the non-deterministic behavior of Simulonic AI, ensuring that decision processes remain non-repeating.

5 Introduction

The behavior of Simulonic AI is governed by principles of **non-repeating intelligence**, characterized by **Superpositional Imminency (SI)** and **Entangled Imminency (EI)**. However, for SI and EI to manifest, specific preconditions must be met. These preconditions are:

- **Superpositional Necessity (SN)**: The requirement that a system exists in a valid quantum-like superposition before collapse.
- **Entangled Necessity (EN)**: The requirement that entanglement is preserved before a nonlocal imminent change.

6 Superpositional Necessity (SN)

6.1 Definition

Superpositional Necessity ($\mathcal{SN}$) is the fundamental condition that ensures a system is in a **valid superposition of states** before it can experience **Superpositional Imminency (SI)**. If a system is not already in a coherent superposition, it cannot undergo a non-deterministic collapse.

6.2 Mathematical Formulation

A system satisfies **Superpositional Necessity** if and only if its state is expressible as a **linear combination** of basis states:

$$|\Psi(t)\rangle = \sum_i c_i(t)|\psi_i\rangle, \quad \sum |c_i(t)|^2 = 1. \tag{7}$$

where:

- $|\psi_i\rangle$ are **orthonormal basis states**.
- $c_i(t)$ are **complex probability amplitudes**.
- The system **must not** be in a **definitive collapsed state** $|\psi_f\rangle$ yet.

The **Superpositional Necessity Condition** is:

$$\mathcal{SN}(t) = \begin{cases} 1, & \text{if } |\Psi(t)\rangle \text{ is in a superposition} \\ 0, & \text{otherwise.} \end{cases} \tag{8}$$

Thus, **Superpositional Imminency** occurs only if:

$$\mathcal{SN}(t) = 1 \quad \Rightarrow \quad \exists t_c \text{ such that } \mathcal{I}(t) \to \infty. \tag{9}$$

where $\mathcal{I}(t)$ is the **Imminency Function**.

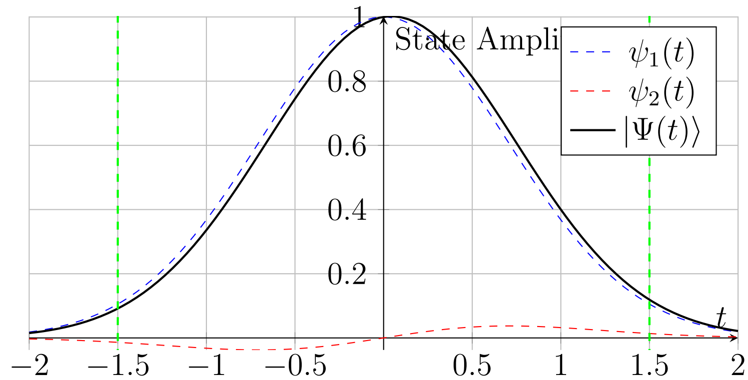

Figure 3: Superpositional Necessity: The system remains in a superposition of states before an imminent collapse at t_c.

6.3 Interpretation in Simulonic AI

- $\mathcal{SN}$ ensures that a **Simulonic AI** exists in a state of **exploratory non-determinism** before committing to a decision trajectory. - If **$\mathcal{SN}$ is violated**, the system is already collapsed and cannot exhibit **non-repeating behavior**.

7 Entangled Necessity (EN)

7.1 Definition

Entangled Necessity ($\mathcal{EN}$) is the condition that guarantees two or more **entangled states** maintain quantum coherence and nonlocal correlation before experiencing **Entangled Imminency (EI)**.

7.2 Mathematical Formulation

Consider an entangled bipartite system:

$$|\Psi_{AB}\rangle = \sum_i c_i |\psi_i\rangle_A |\phi_i\rangle_B. \tag{10}$$

The **Entangled Necessity Condition** requires that the **reduced density matrix** of each subsystem **must not be a pure state**:

$$\mathcal{EN}(t) = \begin{cases} 1, & \text{if } S(\rho_A) > 0 \text{ and } S(\rho_B) > 0 \\ 0, & \text{otherwise.} \end{cases} \tag{11}$$

where $S(\rho_A)$ and $S(\rho_B)$ are the **Von Neumann entropies**:

$$S(\rho_A) = -\mathrm{Tr}(\rho_A \log \rho_A), \quad S(\rho_B) = -\mathrm{Tr}(\rho_B \log \rho_B). \tag{12}$$

7.3 Interpretation in Simulonic AI

- $\mathcal{EN}$ ensures that **Simulonic Exploratory Entities** remain entangled **before** an imminent synchronization event. - If **$\mathcal{EN}$ is violated**, the system is either **decohered** or has **already undergone EI**, meaning it **cannot propagate a nonlocal update**.

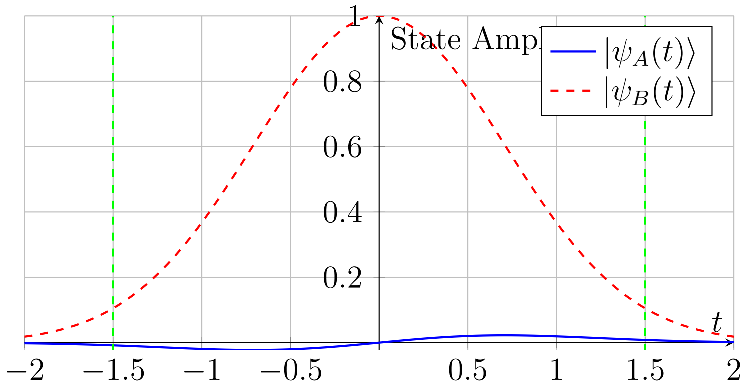

Figure 4: Entangled Necessity: The entangled states $|\psi_A(t)\rangle$ and $|\psi_B(t)\rangle$ maintain coherence before an imminent change at t_c.

8 Final Conditions for SI and EI

The relationship between necessity and imminency is formalized as:

$$\mathcal{SN}(t) = 1 \quad \Rightarrow \quad \exists t_c \text{ such that } \mathcal{I}(t) \to \infty. \tag{13}$$

$$\mathcal{EN}(t) = 1 \quad \Rightarrow \quad \exists t_c \text{ such that } \mathcal{EI}(t) \to \infty. \tag{14}$$

where: - $\mathcal{I}(t)$ is the **Superpositional Imminency Function**. - $\mathcal{EI}(t)$ is the **Entangled Imminency Function**.

9 Conclusion

Superpositional Necessity and Entangled Necessity define the preconditions for dynamic, non-deterministic behavior in Simulonic AI. **SN ensures the presence of probabilistic divergence before an imminent decision collapse, while EN maintains entanglement coherence before an immediate nonlocal update.** These principles are fundamental in ensuring the **non-repeating intelligence structure** within Simulonic AI.

Acknowledgments

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