The Existence of a Constraint-Eliminating Gate

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1/04/26

Defintions

Definition 1 (Configuration).

A configuration x is an element of a configuration space X.

Definition 2 (Constraint).

A constraint C_i is a predicate $C_i : X \to \{0,1\}$,
where
$C_i(x) = 1$ if and only if a configuration x satisfies constraint i.

Definition 3 (Violation).

A configuration x is said to violate a constraint C_i if $C_i(x) = 0$.

Definition 4 (Persistence).

A configuration x is persistent if and only if it satisfies all constraints in a given constraint set $C = \{C_1, \dots, C_n\}$.

Proposition

Proposition 1 (Existence of a Constraint-Eliminating Gate).

There exists a gate G: $X \to X \cup \{\varnothing\}$ such that for any configuration $x \in X$,

$$G(x) = \begin{cases} x, & \text{if } C_i(x) = 1 \text{ for all } C_i \in C, \\ \varnothing, & \text{otherwise.} \end{cases}$$

Construction

Define, for each constraint C_i, an indicator operator

$$1_{(C_i)}(x) = \begin{cases} x, & C_i(x) = 1, \\ \varnothing\hat{H} & C_i(x) = 0. \end{cases}$$

Define the gate G as the intersection over all constraints:

$G(x) := \bigcap (C_i \in C)\ 1_{(C_i)}(x)$.

By construction:

- If any constraint is violated, at least one term in the intersection is ∅, hence $G(x) = \varnothing$.
- If no constraint is violated, all terms equal x, hence $G(x) = x$.

Therefore, G exists and satisfies Proposition 1. □

Corollary

Corollary 1 (Elimination of Non-Persistent Configurations).

Any configuration that violates at least one constraint is eliminated by G and cannot persist.

Equivalently, **only configurations that satisfy all constraints persist.**

Remarks

1. The construction requires no aggregation, weighting, approximation, or probabilistic interpretation.
2. Constraints are not ordered, prioritized, or relaxed.
3. The result is independent of the nature, origin, or discoverability of the constraints.