Equivalence Classes and Finite Representation

Working note

Assumption

Admissible transformations preserve identity. Two representations are equivalent if they are related by an admissible transformation preserving identity.

1. Local representation

Representations are defined locally. No globally fixed labeling is assumed. Hence, multiple representations correspond to the same underlying object.

2. Equivalence structure

Representations related by admissible transformations form equivalence classes. Identity is preserved at the level of equivalence classes.

3. Cross-domain realization

Physics: gauge-equivalent configurations
Information: encoding-equivalent descriptions

4. Finite constraint

Representation is bounded. Hence, not all distinctions are preserved.

5. Transformation constraint

Let admissible transformations be composed indefinitely. If the transformation space is unbounded, distinguishable representations increase without bound. This contradicts the finite constraint. Therefore, admissible transformation structure is bounded.

6. Consequence

Bounded transformation structure implies stable equivalence classes and discrete outcomes.

Predictive consequence

Unconstrained admissible transformations expand equivalence classes without bound, violating finite representation.

Interpretation

Equivalence classes and bounded transformation structure are invariant across mathematical, physical, and informational systems.

(Working note: admissibility-constrained equivalence under finite distinguishability.)