The UNNS Holographic Principle (UHP): Boundary Recursion as Bulk Geometry

UNNS Research Notes

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Abstract

We propose the *UNNS Holographic Principle* (UHP): all bulk information about recursion-induced geometry is encoded in boundary UNNS sequences. This principle mirrors the AdS/CFT correspondence, but arises intrinsically from recursion-theoretic structures. Boundary coefficients act as "sources," while bulk curvature emerges from their interactions.

Contents

1 Boundary vs Bulk

Definition 1.1 (Boundary Data)**.** *Boundary UNNS data is the collection of recursion coefficients* $\{a_e\}$ *restricted to the outermost layer of a nested mesh.*

Definition 1.2 (Bulk Geometry)**.** *Bulk geometry consists of curvature quantities* $Ric(f)$ *on interior faces* f*, reconstructed from recursion holonomies.*

Remark 1.3. *The boundary acts as a "holographic screen" encoding the bulk recursion universe.*

2 The Holographic Dictionary

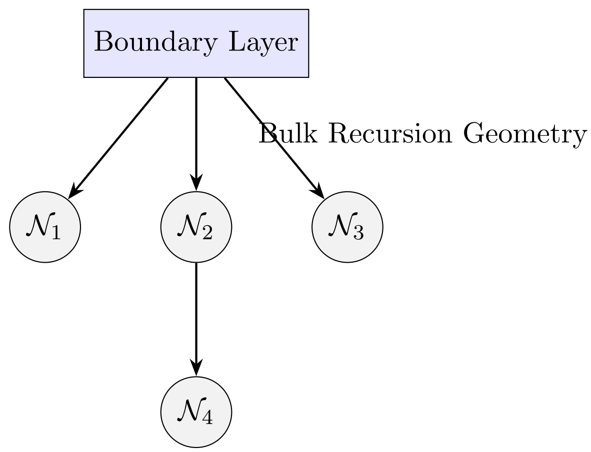
- Boundary coefficients $a_e \longleftrightarrow$ Bulk gauge fields.

- Boundary residues $\rho \longleftrightarrow$ Bulk curvature tensors.
- Boundary entropy $S(\text{boundary}) \longleftrightarrow$ Bulk area law.

Theorem 2.1 (Boundary Determination of Bulk)**.** *Given consistent boundary UNNS data $\{a_e\}_{\partial\mathcal{M}}$, there exists a unique (up to gauge equivalence) bulk recursion geometry realizing these boundary values.*

Sketch of Proof. Bulk holonomies are determined recursively from boundary seeds via UNNS nesting rules. Gauge transformations modify only local vertex factors, leaving global curvature invariants unchanged. Thus boundary data fixes the bulk geometry modulo gauge. □

3 Diagrammatic Overview



4 Entropy and Information

Proposition 4.1 (Entropy Bound)**.** *The information content of a bulk recursion mesh $\mathcal{M}$ is bounded by the entropy of its boundary sequence:*

$$I(\mathcal{M}) \leq S(\partial\mathcal{M}).$$

Remark 4.2. *This is the UNNS analog of the Bekenstein–Hawking bound: bulk information is proportional to boundary complexity.*

5 Applications

5.1 Physics

- Black holes: recursion collapse encoded at the boundary.
- Dark matter: hidden cycles invisible at boundary, detectable via deficit.
- Cosmology: boundary recursion might encode the observable universe.

5.2 Mathematics

- Suggests new dualities between number-theoretic recursions and geometric invariants.
- Provides a recursion-theoretic version of holography.

5.3 Philosophy

- "Reality" emerges from recursion data at the boundary.
- Numbers are not just quantities, but holographic encoders of space.

6 Conclusion

The UNNS Holographic Principle (UHP) states:

$$\text{Bulk Geometry} \equiv \text{Boundary Recursion Data.}$$

This principle reframes recursion as a substrate encoding both numbers and spacetime, offering a recursion-theoretic holography that parallels and generalizes AdS/CFT.