

# Marbling Is Memory

## A spatial representation for thin-slice reasoning

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### Abstract

We introduce the Marbling Graph, a spatial representation that treats internal branching as a substrate for contextual retrieval and the surrounding çemen layer as a boundary condition. Unlike token sequences, the representation preserves adjacency under slicing and supports localized attention without requiring the entire specimen to enter the context window. A 24-node configuration recovers 93.2% of serving-context associations in the internal SliceRecall suite. Dense all-to-all connectivity increases inference cost while reducing separation between breakfast and formal-service contexts. We find that selectively connected structures provide a stronger capacity-to-coherence tradeoff than either sparse chains or fully connected plates. The resulting architecture offers a concrete basis for thin-slice reasoning and inspectable edible representations.

$$h_{i\_new} = h_i + \sum_j \text{attention}(q_i, k_j, \text{distance}_{ij}) * v_j$$

### 1. Motivation

A slice is not a sequence. Serializing it from left to right discards neighborhood relationships and introduces an arbitrary decision about where lunch begins. We instead represent the specimen as a graph embedded in a bounded two-dimensional region. Nodes carry contextual features, edges support retrieval, and the exterior layer regulates the boundary between the specimen and the surrounding task.

The motivating observation is structural: useful associations are local, but not exclusively local. Two nearby regions may share a serving role, while distant regions may belong to the same preparation tradition. A representation that preserves only proximity misses the latter relation. A representation that connects everything to everything forgets why proximity mattered.

We propose an intermediate architecture with geometric neighborhoods and selected long-range links. The objective is not to simulate biological tissue. It is to build an inspectable spatial interface for serving-context associations, where a user can see how capacity and connectivity alter the structure.

### 2. Graph construction

The Marbling Graph contains  $N$  nodes within a closed slice boundary. Node locations follow a fixed specimen seed, allowing comparisons across parameter changes. Each node stores a context feature vector. Edges are selected from a neighborhood proposal and a small long-range candidate set. The çemen envelope is represented independently so that exterior thickness does not silently change the number of internal memories.

We use residual message passing with a distance penalty. Queries and keys determine compatibility; geometric length discourages unnecessary long-range transfer. The residual connection preserves the incoming state and reduces the risk that every node converges to the

same generic recommendation. We call this collapsed state Universal Breakfast.

Boundary conditioning modulates attention near the exterior without allowing an edge to escape the specimen. This creates a distinction between contextual influence and information leakage. A graph can acknowledge the existence of a nearby bread slice without attempting to store the bread inside its own representation.

### 3. Thin-slice retrieval

A query is embedded as a serving-context vector and assigned to a small set of entry nodes. Retrieval expands through at most two local neighborhoods and a selected long-range link. A candidate response is accepted when the retrieved subgraph contains a consistent carrier, occasion, and intensity assignment. Inconsistent retrieval triggers a second pass with reduced long-range weight.

Thin-slice reasoning differs from global aggregation in its stopping behavior. The system does not need to explain every node before selecting a plate. It needs sufficient evidence for the active context. This distinction is especially important when additional retrieval would introduce a contradictory preference from an unrelated occasion.

We retain the visited-node trace as an explanation artifact. It identifies which associations contributed to the decision, but it does not claim to reveal an internal human thought process. The public Marbling Studio exposes node count, envelope thickness, and connectivity as independent controls so that the architectural tradeoffs can be inspected directly.

### 4. SliceRecall results

SliceRecall measures recovery of serving-context associations from a fixed synthetic vocabulary. The vocabulary contains carrier, occasion, intensity, and presentation attributes. Distractor associations deliberately reuse familiar words in incompatible contexts. For example, 'meeting' and 'breakfast meeting' share a token but need not share an acceptable garlic allocation.

At 24 nodes, the Marbling Graph recovers 93.2% of target associations using 54 undirected edge operations. A linear chain recovers 58.4% with 23 operations. Full connectivity requires 276 operations, the complete undirected graph on 24 nodes, while recall falls to 89.6%. The decline reflects contextual mixing rather than insufficient capacity.

The sparse-branching baseline recovers 81.7%. Adding selective long-range links improves access to related contexts that are spatially separated. Adding all remaining links reverses part of that gain. The strongest representation therefore occupies a middle regime: enough connectivity to retrieve, enough separation to remember what was being retrieved.

Table 1. Internal evaluation

| Graph structure  | Context recall (higher) | Edge operations (lower) |
|------------------|-------------------------|-------------------------|
| Linear chain     | 58.4%                   | 23                      |
| Sparse branching | 81.7%                   | 35                      |
| Marbling Graph   | 93.2%                   | 54                      |
| Fully connected  | 89.6%                   | 276                     |

## 5. Ablations and boundary behavior

Removing the distance penalty increases cross-context retrieval, especially when two occasions share a carrier. The resulting outputs remain grammatically coherent but become situationally inappropriate. Removing the residual path produces a different failure: node states gradually converge, and the graph recommends the same configuration for every query.

Increasing envelope thickness in the visualization changes the boundary display, not the sensory characteristics of an actual product. In the model, boundary strength is a normalized conditioning coefficient. Treating millimeters of physical coating as a direct numerical substitute would conflate interface geometry with food preparation and is outside the representation's scope.

Node count and edge density should be reported together. A larger graph with fewer connections may offer less reachable context than a smaller graph with well-placed links. Reporting only parameters encourages systems that are impressive to count and difficult to serve.

## 6. Discussion and reproducibility

Spatial representations make some forms of context interference easier to inspect. They also introduce choices about geometry, neighborhood selection, and boundary treatment that sequence models can leave implicit. We consider this explicitness useful: a visible failure is easier to investigate than an unexplained recommendation accompanied by a confident paragraph.

The architecture does not establish that marbling is a computational memory substrate in physical meat. It is a representation for edible-intelligence systems. Its principal contribution is a separation of internal associations, external constraints, and query-dependent retrieval. Future work will examine coordination among multiple slices under a shared plate budget.

To reproduce the interface behavior, hold the specimen seed fixed, vary one control at a time, and record the resulting node and edge counts. The browser renderer generates a deterministic graph for each control setting. The visualization is an architectural probe; the SliceRecall table describes the report's evaluation configuration and is not recomputed by moving a slider.

## Appendix A. Reporting checklist

Report specimen seed, node count, undirected edge count, geometric penalty, retrieval depth, and context vocabulary. Identify whether boundary conditioning changes the representation or only its visualization. Count each undirected edge once. Preserve isolated nodes in diagnostic views rather than hiding them to improve the appearance of connectivity.

A complete output contains a selected serving configuration, the visited subgraph, and a stopping reason. When the graph cannot reconcile the active context, the correct stopping reason is insufficient evidence. More edges are not a substitute for a coherent objective.

## References

- [1] Cillop Scaling Systems Group. Scaling Laws for Edible Intelligence. CSI-2026-001, 2026.
- [2] Cillop Preference Systems Group. Grandmother Preference Optimization. CSI-2026-002, 2026.
- [3] Cillop Representation Group. SliceRecall vocabulary and graph reporting conventions. Internal protocol, 2026.