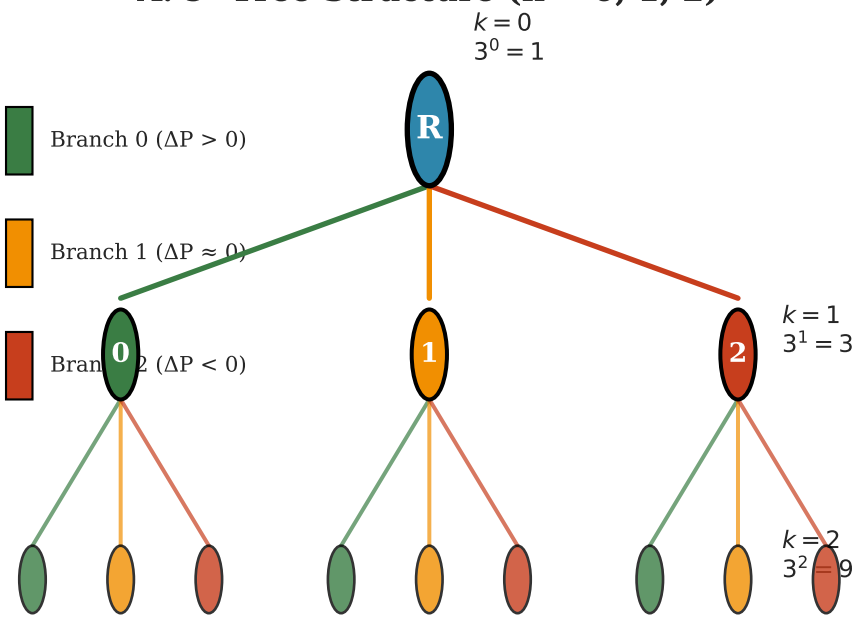
# Categorical Addressing: $3^k$ Hierarchy Structure
# S-Entropy Navigation and Coordinate Decomposition

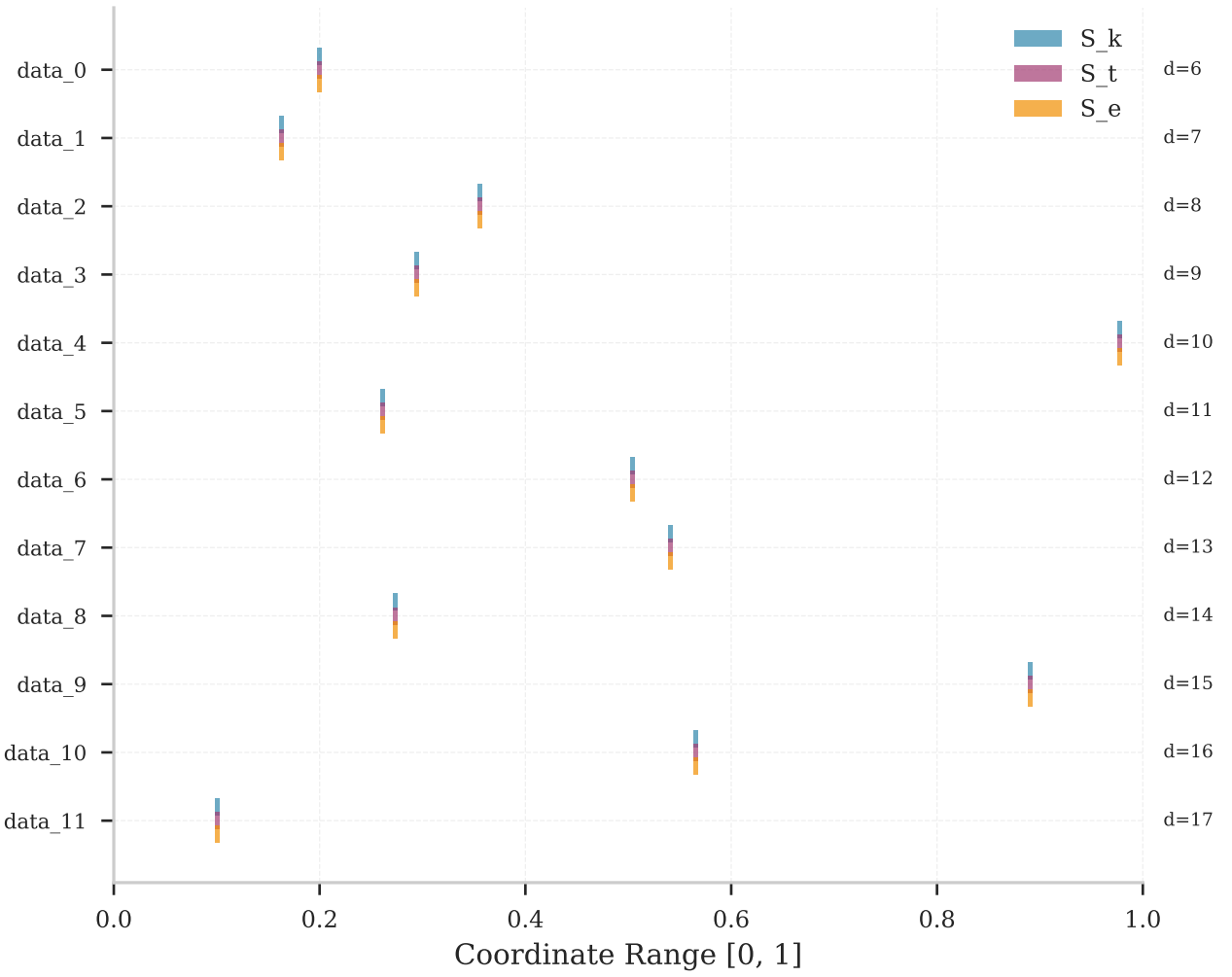
## A. $3^k$ Tree Structure (k = 0, 1, 2)




*Total nodes at depth k:* $N_k = 3^k$

*Total addressable:* $\sum_{i=0}^{k} 3^i = \frac{3^{k+1}-1}{2}$

## B. Node Representation with S-Coordinate Ranges




## C. Path Decomposition (Trajectory → Node Sequence)

### Address: alpha

*Trajectory Hash: 3b224a503f8397ec*

| | | | |
|---|---|---|---|
| Step 0: | Branch 0 | Path: [0] | Region: $3^{-1}$ |
| Step 1: | Branch 2 | Path: [02] | Region: $3^{-2}$ |
| Step 2: | Branch 2 | Path: [022] | Region: $3^{-3}$ |
| Step 3: | Branch 1 | Path: [0221] | Region: $3^{-4}$ |
| Step 4: | Branch 0 | Path: [02210] | Region: $3^{-5}$ |
| Step 5: | Branch 2 | Path: [022102] | Region: $3^{-6}$ |
| Step 6: | Branch 2 | Path: [0221022] | Region: $3^{-7}$ |
| Step 7: | Branch 1 | Path: [02210221] | Region: $3^{-8}$ |

**ΔP → Branch Selection:** 0 (ΔP>0) 1 (ΔP≈0) 2 (ΔP<0)

## D. Coordinate Decomposition (S-Space Partitioning)