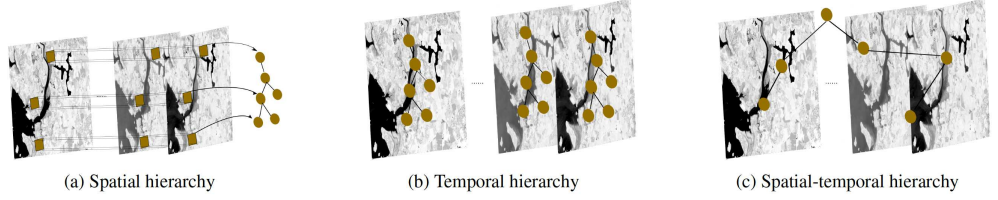


OBJECTIVES

Morphological hierarchies have been recently extended to cope with image sequences, and different strategies have been proposed to allow their construction from spatio-temporal data. In this paper, we compare these hierarchical representation strategies for image sequences according to their structural properties. We introduce a projection method to make these representations comparable. Furthermore, we extend one of these recent strategies in order to obtain more efficient hierarchical representations for image sequences.

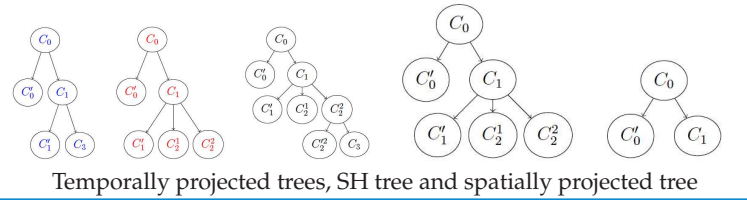
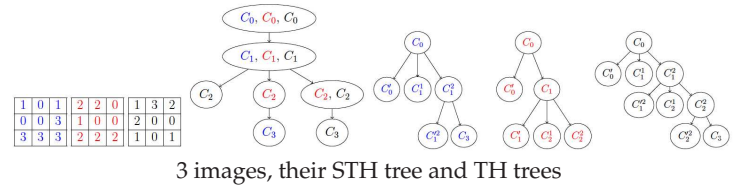
TREE BUILDING STRATEGIES FOR IMAGE SEQUENCES



- SH: The series of image frames first mapped into a single, representative image
- TH: Tree building for each frame separately
- STH: Space-time tree building for each set

PROJECTION

- Three strategies
 1. Spatial h. \rightarrow Spatial domain T_x
 2. Temporal h. \rightarrow Spatial domain T_1, T_2, \dots, T_n
 3. Spatio-temporal h. \rightarrow Spatio-temporal T
- Tree projection from space-time tree T to make them comparable
 - Spatial projection: $T \rightarrow T^x$
 - Temporal projection: $T \rightarrow T^1, T^2, \dots, T^n$
- Comparison is made between T_x, T^x and between T_t, T^t



COMPARISON STRATEGIES

Number of Nodes

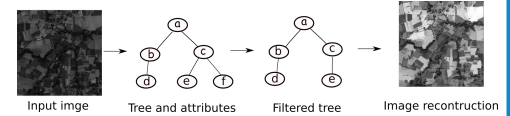
- Measuring the number of nodes or connected components contained in a tree provides a simple way to assess its structure
- Complexity analysis
- Less nodes mean more compact tree

Dasgupta's Cost

- Adapted to morphological hierarchies
- If similar objects meet at the top of tree, it should be penalized
- $Cost(\mathcal{T}) = \sum_{a,b \in \mathcal{T}} w_{a,b} \cdot |leaves(\mathcal{T}[a \vee b])|$

Filtering

- Filtering consists in pruning the tree according to some node attributes and selected criteria. A filtered image is reconstructed after pruning process.



EXPERIMENTS

Dataset

- 6 Sentinel-2 images
- 6 Pleiades images

Node Analysis

	\mathcal{T}_t		\mathcal{T}^t		\mathcal{T}^n	
	Max	Min	Max	Min	Max	Min
$t = 1$	13640	14274	6377	5874	4917	3481
$t = 2$	13577	14231	4471	4523	3688	4007
$t = 3$	14268	14002	2418	5726	2099	2924
$t = 4$	13883	14178	5111	3067	3469	2626
$t = 5$	12495	11592	6726	2966	6178	2862
$t = 6$	15176	13943	4106	6789	1614	5838
avg.	13839	13703	4818	4824	3631	3623
std.	804	951	1445	1438	1558	1090
total	83039	82220	28909	28945	21789	21738

Cost Analysis

	\mathcal{T}_t		\mathcal{T}^t		\mathcal{T}^n	
	Max	Min	Max	Min	Max	Min
$t = 1$	57.2	93.5	23.8	10.4	6.4	5.8
$t = 2$	41.7	82.2	4.4	12.8	3.2	9.9
$t = 3$	54.7	86.5	2.1	10.9	1.00	4.4
$t = 4$	58.6	86.0	12.8	4.5	5.2	2.42
$t = 5$	66.9	70.2	25.6	1.2	23.1	1.00
$t = 6$	70.6	98.4	7.2	20.6	1.3	14.1

	Max	Min
\mathcal{T}_t	500.00	1000.00
\mathcal{T}^t	15.00	3.00
\mathcal{T}^n	1.00	1.00

Filtering results

