A hierarchy of partitions is a chain of progressively simplifying partitions.

Classically ground truths are used to evaluate the hierarchy of segmentations.

But conversely could the ground truth be used to modify and improve the hierarchy itself? How to generate a transformed hierarchy based on the proximity to the ground truth?

Classifying hierarchical structures by introducing a distance function $d_{\phi}$ which is minimizes its leave for every saliency function $\phi$.

**REFERENCES**

2. Jordi Pont-Tuset and Ferran Marqués, Supervised Assessment of Segmentation Hierarchies - In ECCV 2012 8-46

**PROPERTIES**

Class opening $\gamma(\phi)$ orders $\phi$ to obtain a saliency, which gives hierarchy $H_\phi$.

Degeneracy: Any strictly increasing mapping of the grey levels $\phi' = \alpha(\phi)$, e.g. square root, log, etc., yields a $\gamma(\phi')$ that generates the same hierarchy $H_{\phi}$ as $\gamma(\phi)$ does.

Operations: If $g_1 \otimes g_2$ denotes an operation from $G \times G \to G$, such as $+, - , \times, \div, \lor, \land$, then $\gamma(g_1 \otimes g_2)$ is the largest saliency under $g_1 \otimes g_2$ and in particular,

**FUTURE DIRECTIONS**

Overview:
1. Generation of family of saliencies using the Class opening $\gamma(s)$ by composition with external function $g$. Results for ground truth distance function.
2. Composition of multiple external functions.
3. Fuse two or more hierarchies (saliencies).

Future directions:
1. Develop the reverse approach where we interchange the roles of saliency and the ground truth.
2. Introduce conditional saliency transform based on attributes like volume, area, dynamic.
3. Use the approach for time varying hierarchies.

**RESULTS**

Unclosed arcs          Closed arcs

Given a finite set of simple arcs $P(E_0)$ in 2D space $E$, we define

$$\gamma : P(E_0) \to P(E_0)$$

$\gamma(X)$ reduces each set of arcs $X \in P(E_0)$ to the closed contours it may produce.

Theorem: the operation $\gamma : P(E_0) \to P(E_0)$ is an opening.

The numerical extension of $\gamma$ the class opening, holds now on a numerical function $\phi$ on the edges of the leaves.

$$X_t(\phi) = \phi \geq t$$

the numerical opening $\gamma(\phi)$ by its level sets

$$X_t[\gamma(\phi)] = \gamma[X_t(\phi)], \quad t > 0$$

When $\phi$ spans the class of all positive functions, then $\gamma(\phi)$ produces all possible saliencies.

**REFERENCES**

2. Jordi Pont-Tuset and Ferran Marqués, Supervised Assessment of Segmentation Hierarchies - In ECCV 2012 8-46