

Gestalt-Based Object Group Selection

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Introduction

Object grouping in graphical systems is supported by Lasso or Rectangle techniques which could require extra steps. This work presents a new approach to group objects by Gestalt principles of proximity, curve-linearity, similarity and common region. We demonstrate the results with several examples.

Our Model

● **Proximal Groups:** proximity coefficient of two objects is a function of their distances (a modified version of [1]):

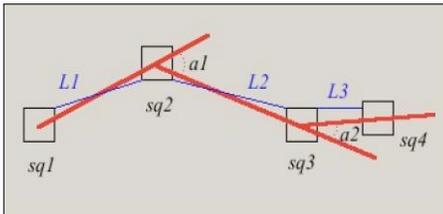
$$PC = e^{-\alpha \times dist}$$

Neighboring objects with PC higher than a threshold form proximity groups. Groups with common objects are merged.

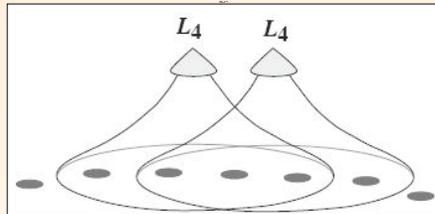
● **Regular Groups:** regularity coefficient of four neighboring objects is:

$$R4 = f1(a1, a2) \times f2(L1, L2, L3)$$

$L1, L2,$ and $L3$: successive distances;
 $a1$ and $a2$: curvatures;
 $f1$: a Gaussian distribution function [2];
 $f2$: an exponential function



Groups with $R4$ higher than a threshold form primary groups. They are then merged hierarchically by a Bayesian-based model[3]:

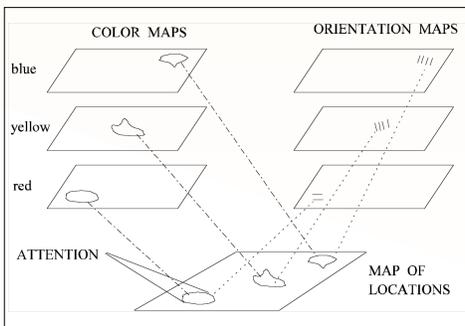


$$RC = \prod_i R_4(a_i, a_{i+1})$$

● **Similarity Groups:** Objects are grouped based on color, shape and size.

● **Common-Region Groups:** Objects inside a closed structure are grouped and considered as part of it.

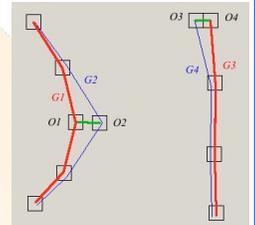
● **Sim. and Prox. Groups Interactions:** based on the Treisman's feature map model, primitive properties are stored in a number of stacks called feature maps. At the attention level, different features at a particular location are selected and integrated.



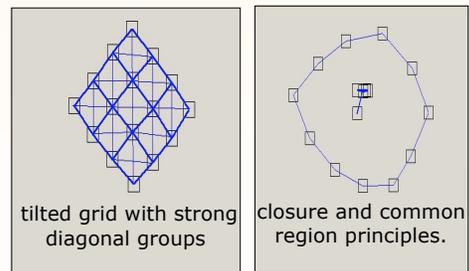
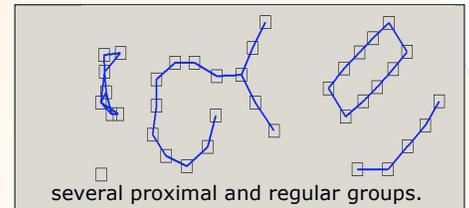
Prox. and Reg. Groups Interactions:

➤ Regularity coefficient of each group is multiplied by average proximity of its successive objects.

➤ If regular groups $R1$ and $R2$ share proximal objects $P1$ and $P2$ such that $R1-R2 = \{p1\}$, and $R2-R1 = \{p2\}$, the weaker group is removed.



Examples of Detected Groups



References

- [1] M. Kubovy and A. Holcomb, *On the lawfulness of grouping by proximity*, 1998.
- [2] J. Feldman, *Curvilinearity, covariance, and regularity in perceptual groups*, 1997.
- [3] J. Feldman, *Bayesian contour integration*, 2001.