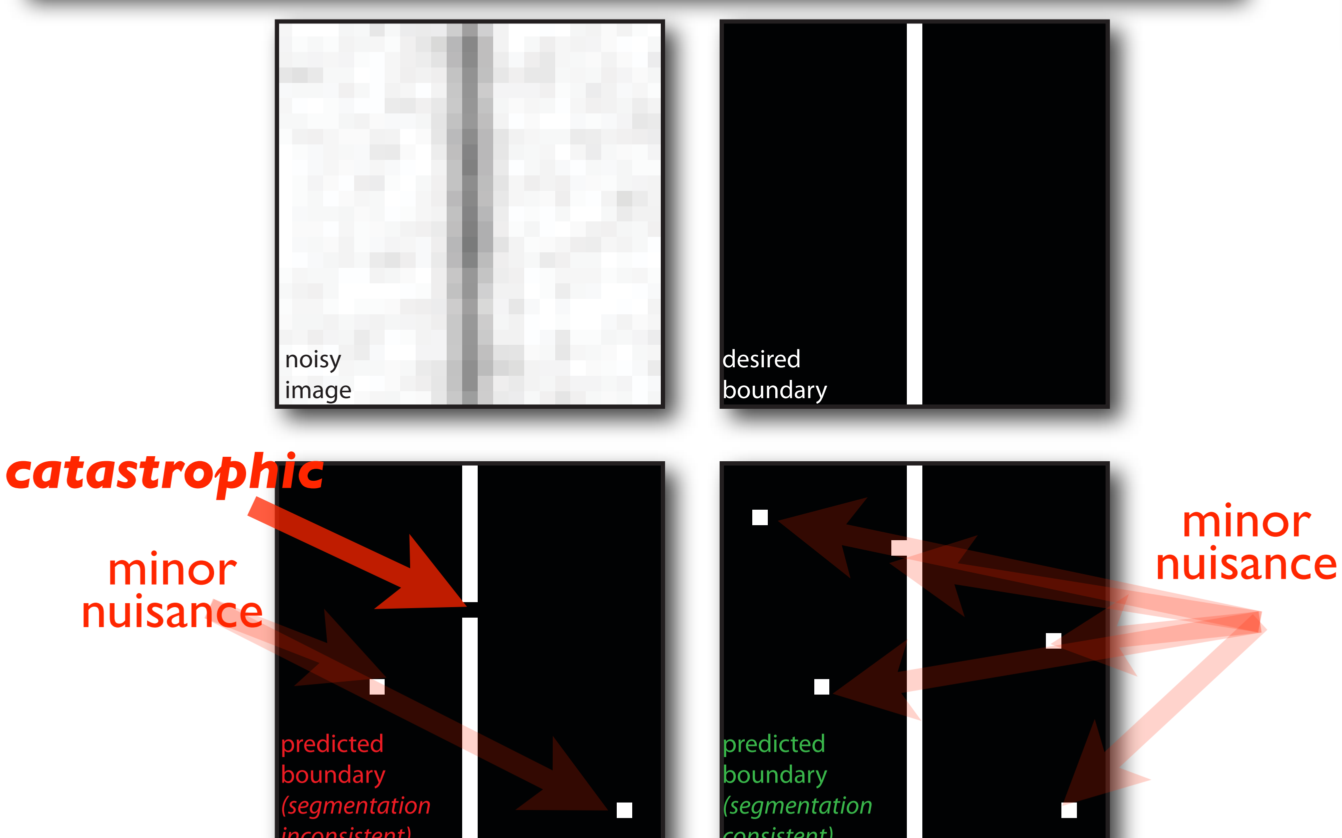
84. Maximin affinity learning of image segmentation

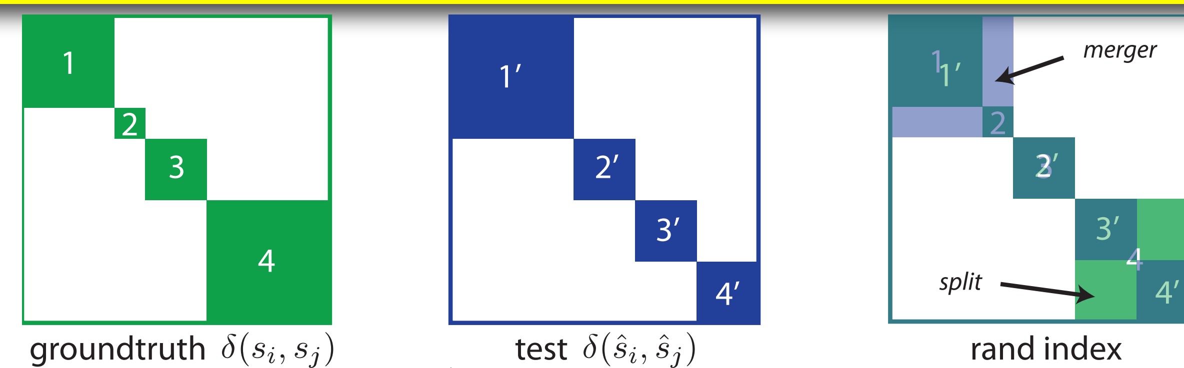
Abstract end-to-end segmentation learning

- Boundary detectors for image segmentation are usually trained to minimize ***local*** boundary classification error.
- But some ***local*** errors in boundary detection can have dramatic ***global*** consequences.
- We show how to train a boundary detector to directly minimize a clustering-based ***global*** segmentation error, resulting in **end-to-end segmentation learning**.

1. Some local errors in boundary detection can have ***dramatic*** global consequences



2. Rand index measures global segmentation error



$$E(S^*, I; W) = \frac{1}{2}\sum_{ab}\left(\delta(s_a^*, s_b^*) - \delta(s_a, s_b)\right)^2$$

all pairs!

$$= \frac{1}{2}\sum_{ab}\left(\delta(s_a^*, s_b^*) - mm_{ab}(I;W)\right)^2$$

$$= \frac{1}{2}\sum_{ab}\left(\delta(s_a^*, s_b^*) - \max_{P_k\in\mathcal{P}^{ab}} \min_{v_a\in P_k} v_a(I;W)\right)^2$$

3. **Maximin** paths are used to directly minimize global segmentation error

minimum pixel along a path

maximum over paths of the minimum pixel

$$\mathrm{mm}_{ab} = \max_{P_k\in\mathcal{P}^{ab}} \min_{v_a\in P_k} v_a(I;W)$$