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Instance Segmentation of Dense Objects via Deep Pixel Embedding

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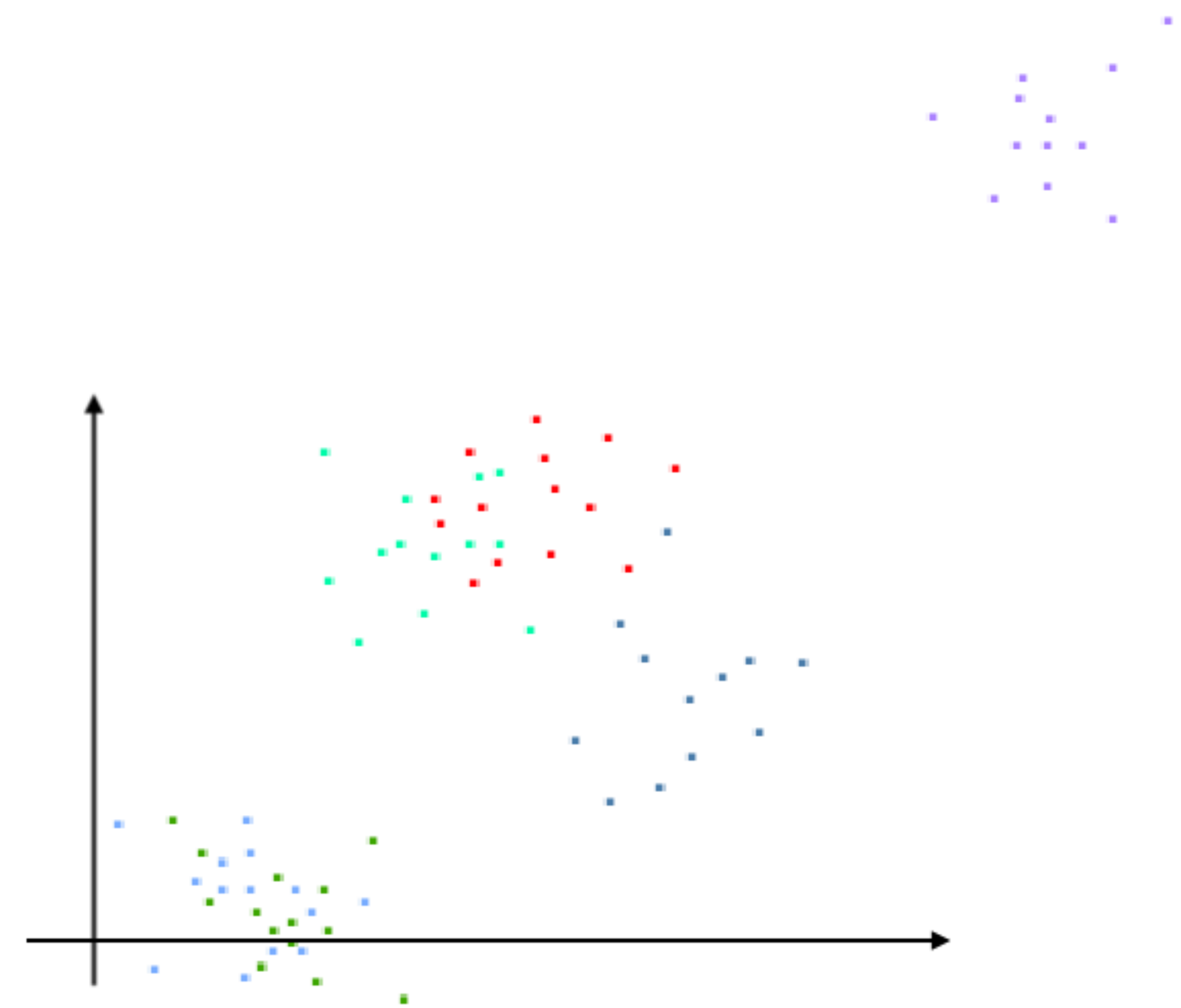
Loss Function: Cartesian

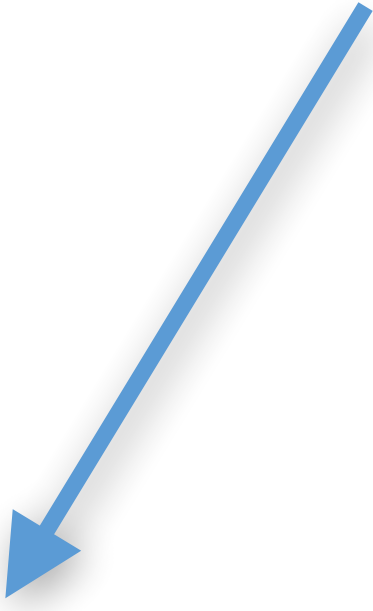
De Brabandere, B., Neven, D., Van Gool, L. *Semantic Instance Segmentation with a Discriminative Loss Function.* CVPR Workshop 2017

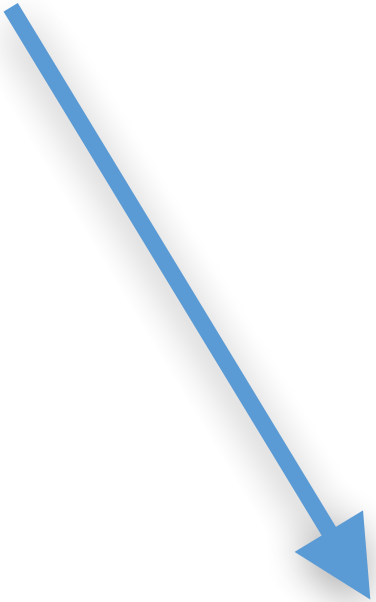
$$\mathscr{L}_{intra} = \frac{1}{C}\sum_{c=1}^{C}\frac{1}{E_c}\sum_{i=1}^{E_c}\left[\,\|e_i - \mu_c\| - \delta_2\,\right]_+^2$$

$$\mathscr{L}_{inter} = \frac{1}{C(C-1)} \sum_{\substack{c_A=1 \\ c_A \neq c_B}}^{C} \sum_{c_B=1}^{C} \left[\|\mu_{c_A} - \mu_{c_B}\| - 2\delta_1 \right]_+^2$$



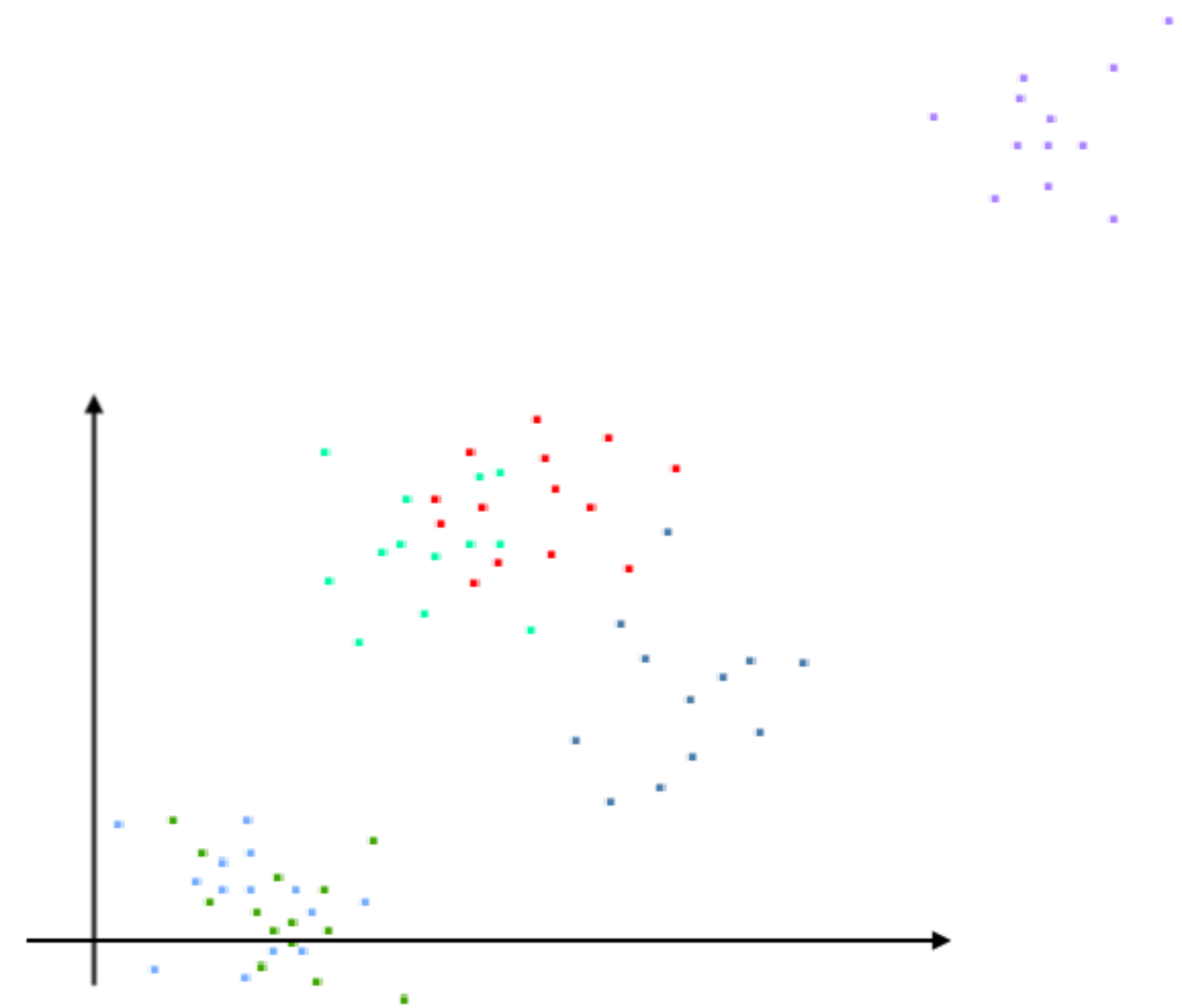
Centers





Embedding

Embedding Module



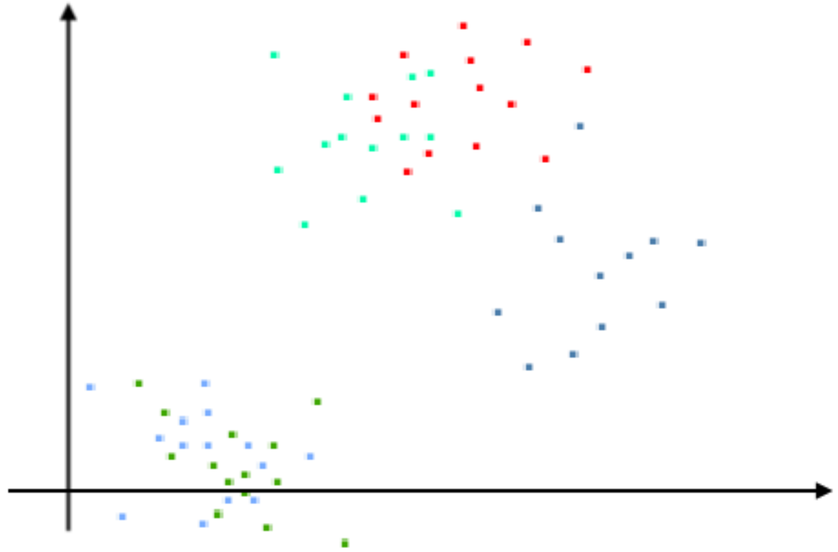
Loss Function: Cartesian

Centers

$$\mathcal{L}_{inter} = \frac{1}{C(C-1)} \sum_{\substack{c_A=1 \\ c_A \neq c_B}}^{C} \sum_{c_B=1}^{C} \left[\|\mu_{c_A} - \mu_{c_B}\| - 2\delta_1 \right]_+^2$$

$$\mathcal{L}_{intra} = \frac{1}{C} \sum_{c=1}^{C} \frac{1}{E_c} \sum_{i=1}^{E_c} \left[\|e_i - \mu_c\| - \delta_2 \right]_+^2$$

Embedding



De Brabandere, B., Neven, D., Van Gool, L. *Semantic Instance Segmentation with a Discriminative Loss Function.* CVPR Workshop 2017

Loss Function: Polar

Neighbors

$$\mathscr{L}_{inter} = \frac{1}{C}\sum_{c_A=1}^{C}\frac{1}{|\mathbf{N}_{c_A}|}\sum_{c_B\in\mathbf{N}_{c_A}}\left[\mathrm{CosS}(\mu_{c_A},\mu_{c_B})\right]$$

$$\mathscr{L}_{intra} = \frac{1}{C}\sum_{c=1}^{C}\frac{1}{E_c}\sum_{i=1}^{E_c}\left[1-\mathrm{CosS}(e_i,\mu_c)\right]$$

$$\mathrm{CosS}(a,b) = \frac{a\cdot b}{\|a\|_2\,\|b\|_2}$$

Chen, L., Strauch, M., & Merhof, D. *Instance Segmentation of Biomedical Images with an Object-Aware Embedding Learned with Local Constraints.* MICCAI 2019