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Instance Segmentation of Dense Objects via Deep Pixel Embedding

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Loss Function: Cartesian

Deep Pixel Embedding

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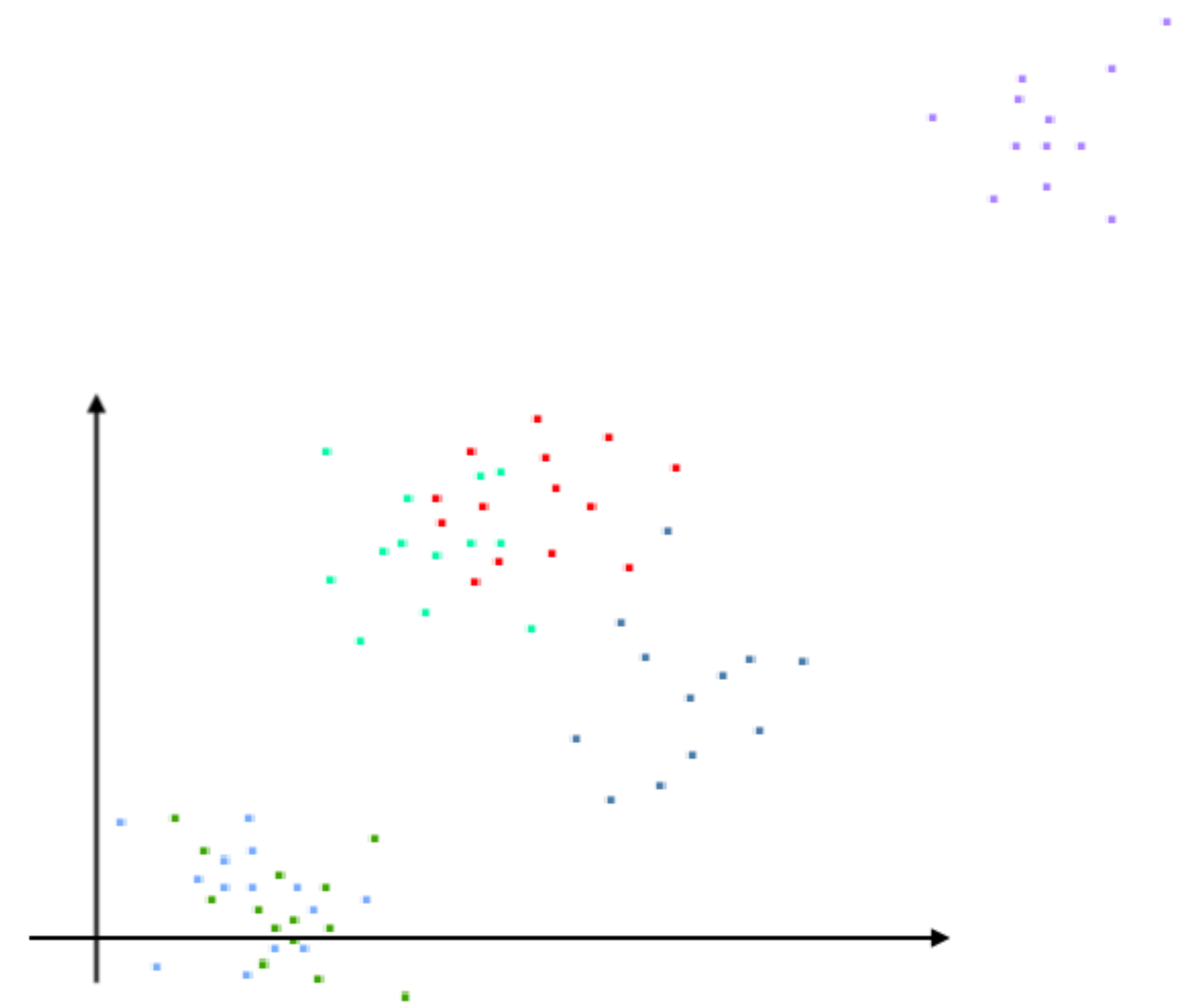
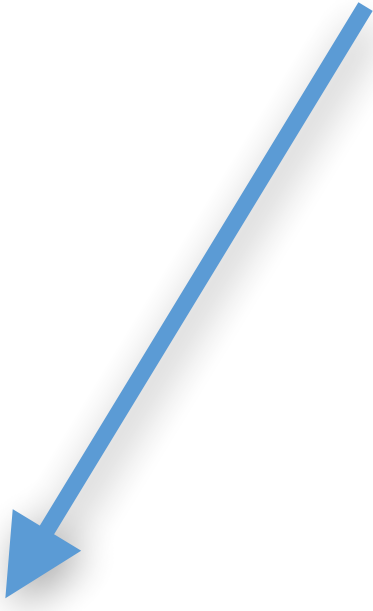
De Brabandere, B., Neven, D., Van Gool, L., & ESAT-PSI, K. U. *Semantic Instance Segmentation with a Discriminative Loss Function.*

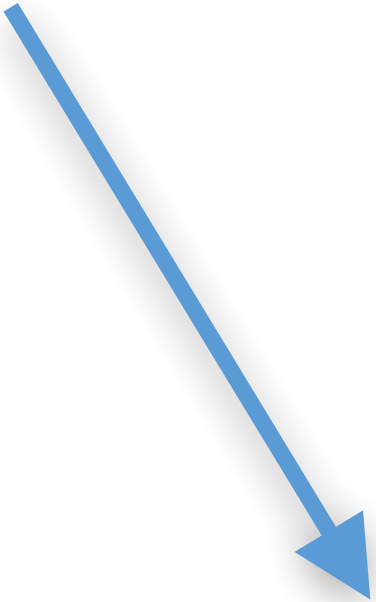
$$L_{intra} = \frac{1}{C} \sum_{c=1}^{C} \frac{1}{E_c} \sum_{i=1}^{E_c} \left[\| \mu_c - e_i \| - \delta_2 \right]_+^2$$

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

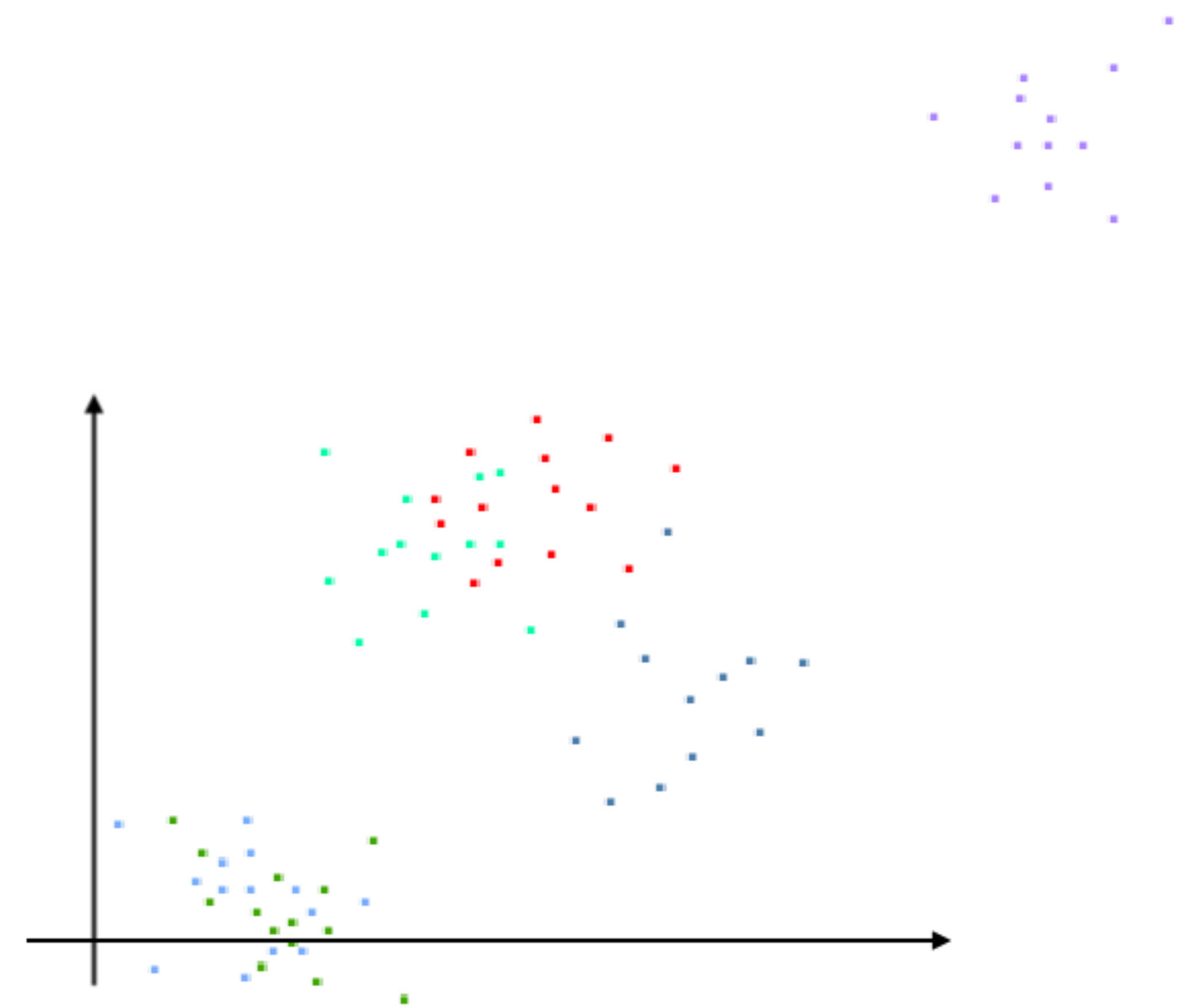


Centres





Embedding



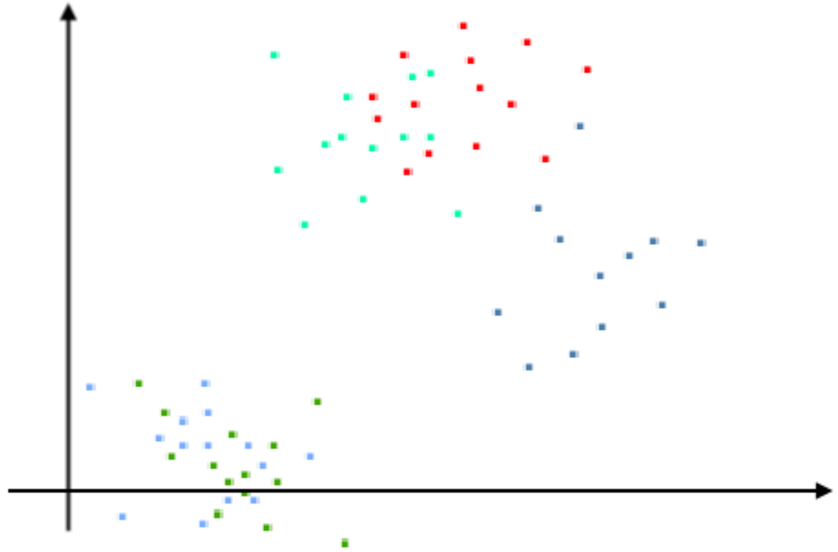
Loss Function: Cartesian

Centres

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

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

Embedding



De Brabandere, B., Neven, D., Van Gool, L., & ESAT-PSI, K. U. *Semantic Instance Segmentation with a Discriminative Loss Function.*

Loss Function: Polar

Neighbours

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

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

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

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