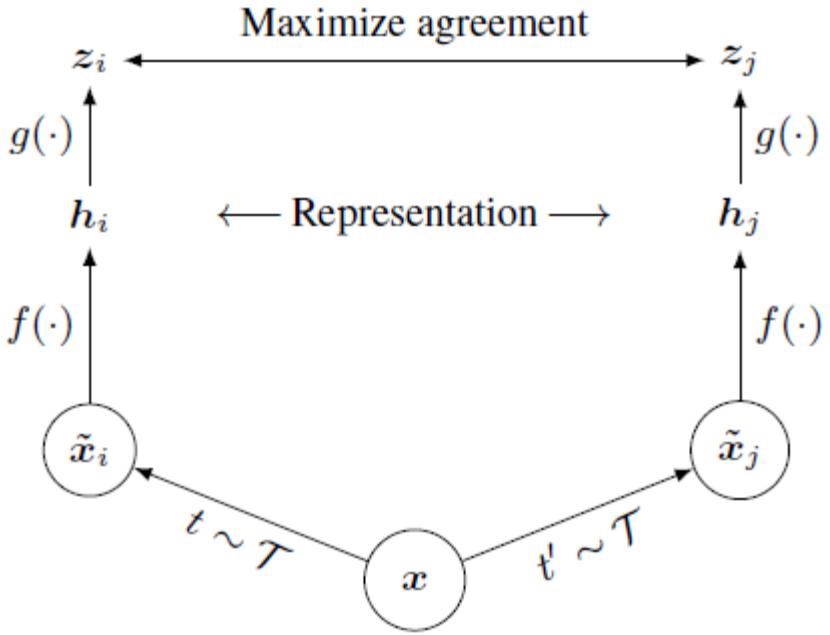
CS5260 Tutorial 4: Contrastive Learning

Xiangyu Peng

Mar 3, 2023

SimCLR

- A simple framework of contrastive learning
- Pull positive samples closer, push negative samples apart



Training

- Generate two different views of the same image as a positive pair
- All other samples are negative samples
- Apply the InfoNCE loss or contrastive loss in the latent space:

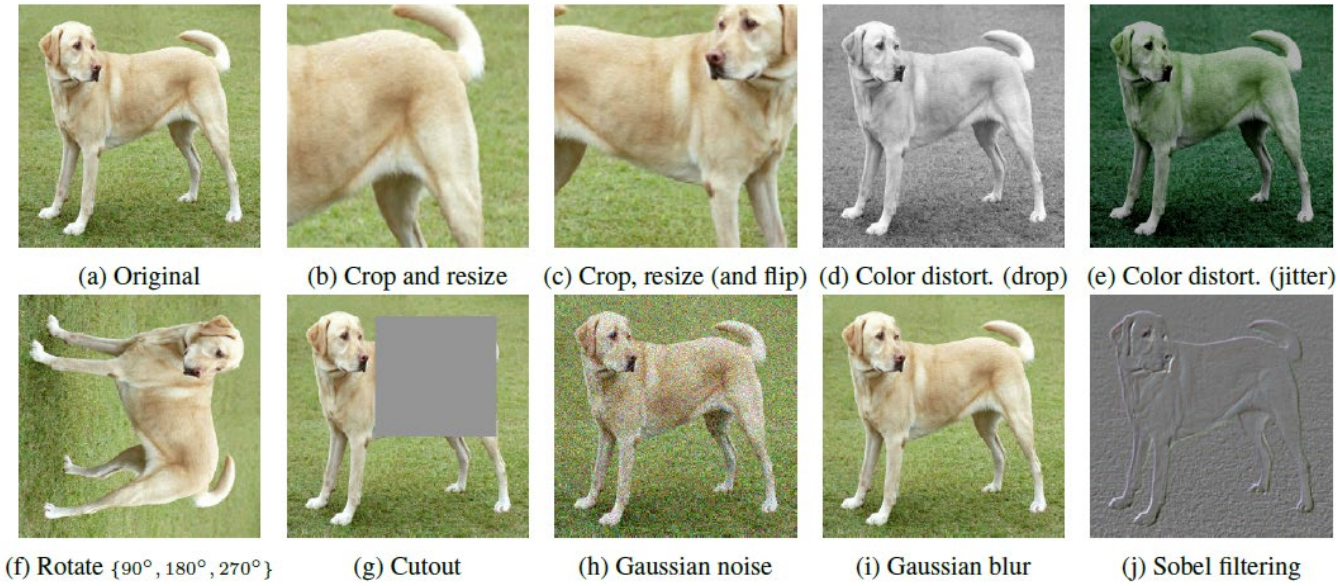
$$\ell_{i,j} = -\log \frac{\exp(\mathrm{sim}(\boldsymbol{z}_i, \boldsymbol{z}_j)/\tau)}{\sum_{k=1}^{2N} \mathbb{1}_{[k \neq i]} \exp(\mathrm{sim}(\boldsymbol{z}_i, \boldsymbol{z}_k)/\tau)}$$

Testing

- Linear probing:
  - train a linear classifier on top of frozen weights

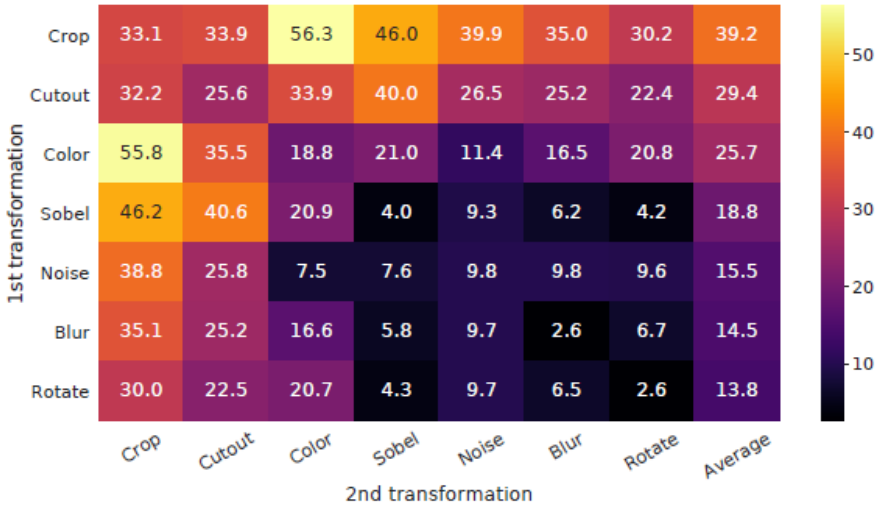
- K-Nearest Neighbour:
  - building a feature bank of training samples and look up topk similar samples in the bank

Augmentation: a key component



(a) Original (b) Crop and resize (c) Crop, resize (and flip) (d) Color distort. (drop) (e) Color distort. (jitter)

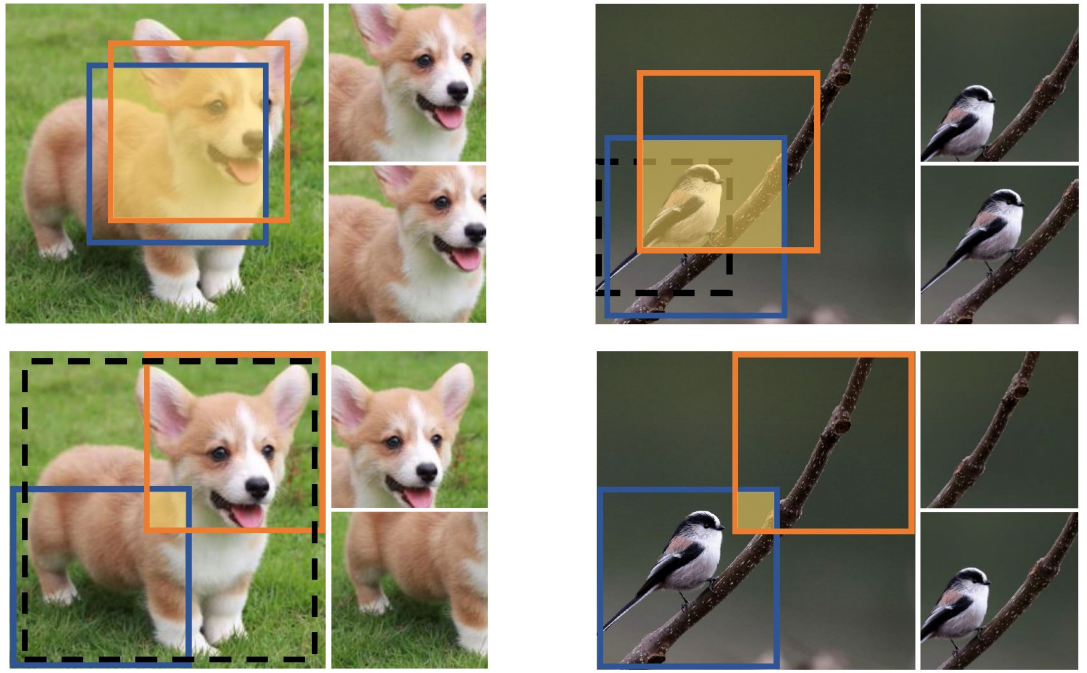
(f) Rotate $\{90°, 180°, 270°\}$ (g) Cutout (h) Gaussian noise (i) Gaussian blur (j) Sobel filtering



Our work

ContrastiveCrop:

- crafting better contrastive views
- larger variance among positive samples
- consistent semantic information between positive pairs



Paper: Crafting Better Contrastive Views for Siamese Representation Learning. CVPR 2022 Oral.
Github: https://github.com/xyupeng/ContrastiveCrop

Q & A