



# Contrastive learning(대조 학습)

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# Contrastive learning

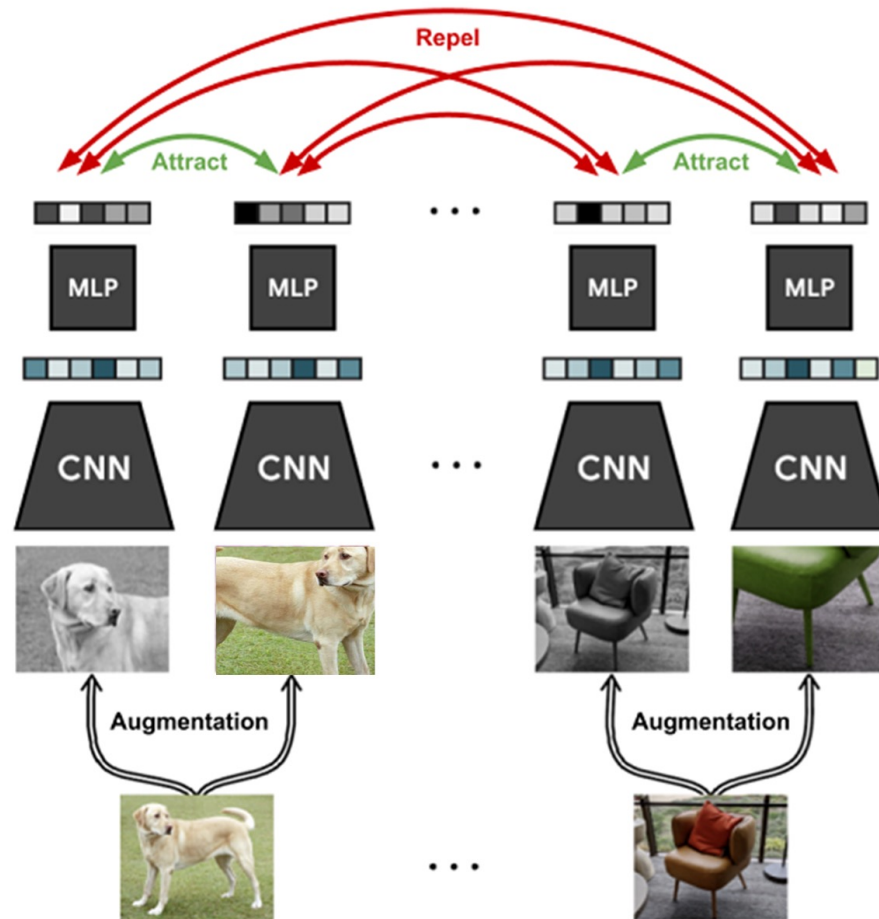
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- 주요 특징
  - Self-supervised representation learning
  - Contrastive learning is an approach to learning that focuses on extracting meaningful representations by contrasting positive and negative pairs of instances.
- 주요 알고리즘
  - SimCLR
    - Chen, T., Kornblith, S., Norouzi, M., & Hinton, G. (2020, November). A simple framework for contrastive learning of visual representations. In International conference on machine learning (pp. 1597-1607). PMLR.
  - SimCSE
    - Gao, T., Yao, X., & Chen, D. (2021). Simcse: Simple contrastive learning of sentence embeddings. arXiv preprint arXiv:2104.08821.

# SimCLR

## ■ 구조

Downstream tasks



# SimCLR



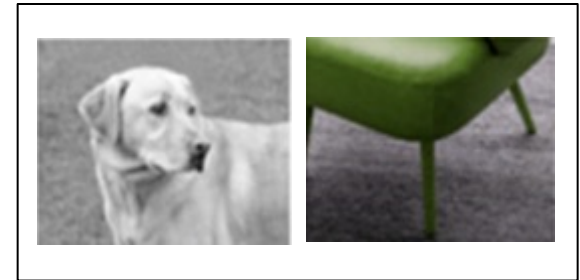
Anchor image



Positive pair



Negative pair



# SimCLR

## ■ Loss



Noise Contrastive Estimation Loss

$$l(i, j) = -\log \frac{\exp(s_{i,j})}{\sum_{k=1}^{2N} l_{[k \neq i]} \exp(s_{i,k})}$$

$$e^{\text{sim}}( \text{ , \text{} )$$

$$= -\log( \frac{e^{\text{sim}}( \text{ , \text{} ) + e^{\text{sim}}( \text{ , \text{} ) + e^{\text{sim}}( \text{ , \text{} )}{e^{\text{sim}}( \text{ , \text{} ) + e^{\text{sim}}( \text{ , \text{} ) + e^{\text{sim}}( \text{ , \text{} )} )$$

# SimCLR

## ■ Total loss

$$\text{Loss}(\text{img}_1, \text{img}_2) + \text{Loss}(\text{img}_2, \text{img}_1) + \text{Loss}(\text{img}_3, \text{img}_4) + \text{Loss}(\text{img}_4, \text{img}_3)$$

The equation illustrates the total loss for a 2x2 grid of images. The first two terms represent the loss for a pair of images (two dogs), and the next two terms represent the loss for another pair of images (two chairs). The images are shown in a 2x2 grid, with the first two images being dogs and the next two being chairs.

2x2



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# Q & A