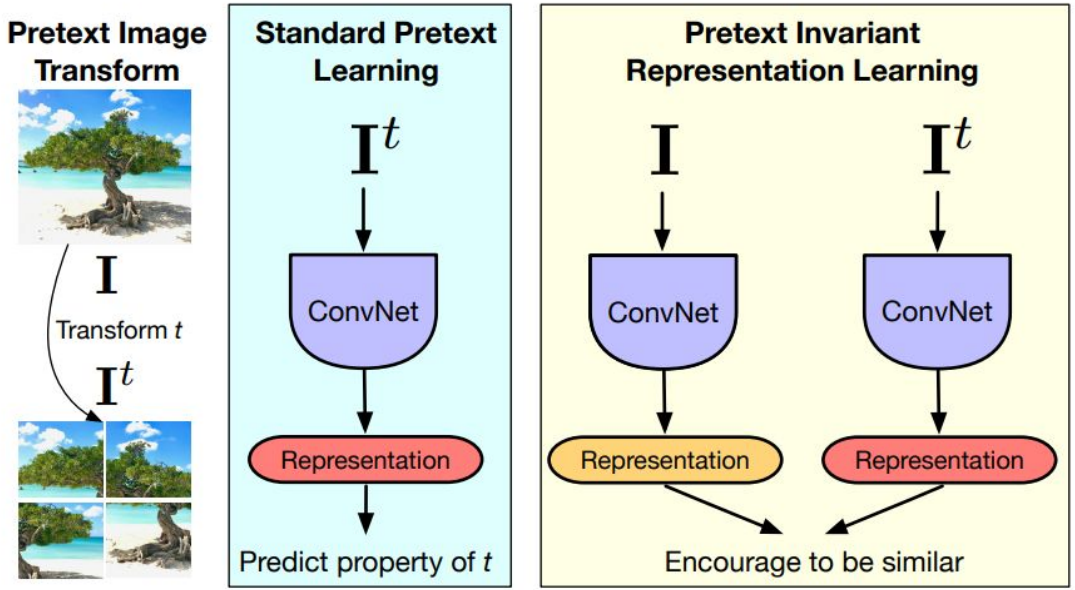
Self-Supervised Learning

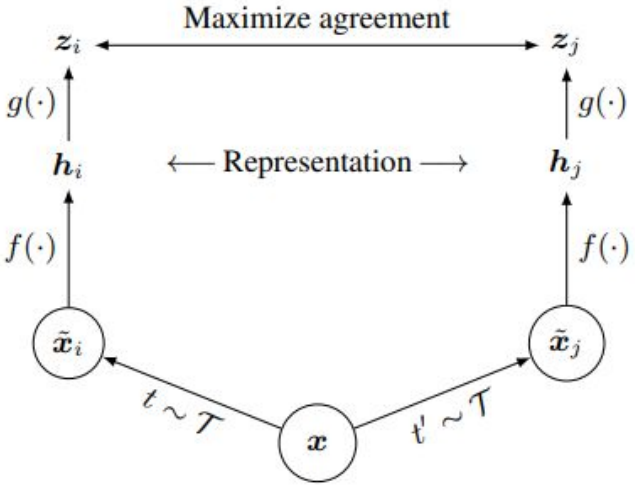
Haoxu Huang

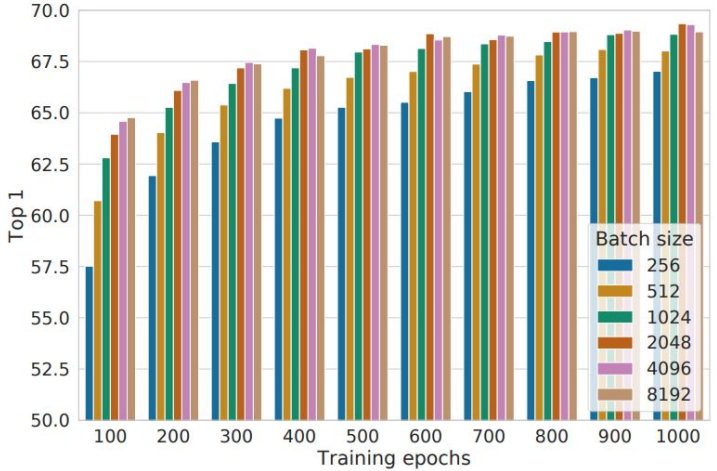
Types of Self-Supervised Learning



I. Misra and L. van der Maaten. Self-supervised learning of pretext-invariantrepresentations.In IEEE/CVF Conference on Computer Vision and Pattern Recognition (CVPR), 2020

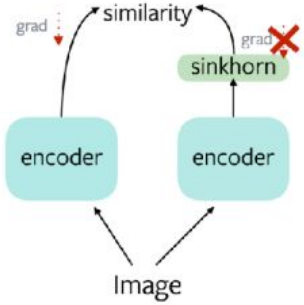
SimCLR Recap



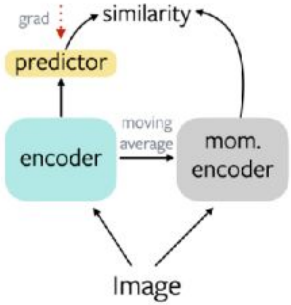


Ting Chen et.al. A simple framework for contrastive learning of visual representations. In International Conference on Machine Learning (ICML), 2020.

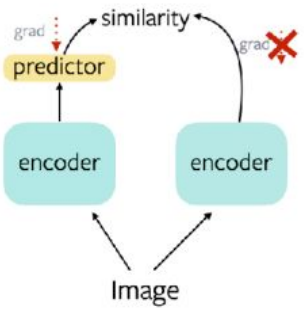
Why there are so many different SSL methods?



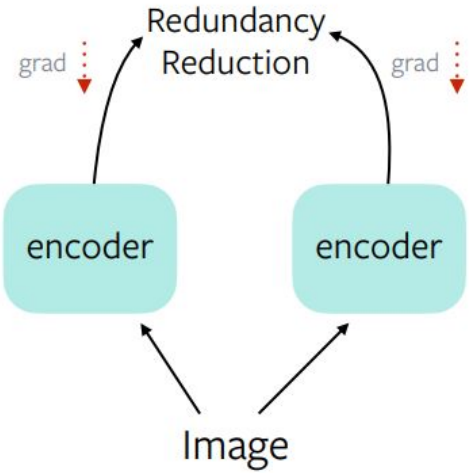
SwAV - Caron et al., 2020



BYOL - Grill et al., 2020



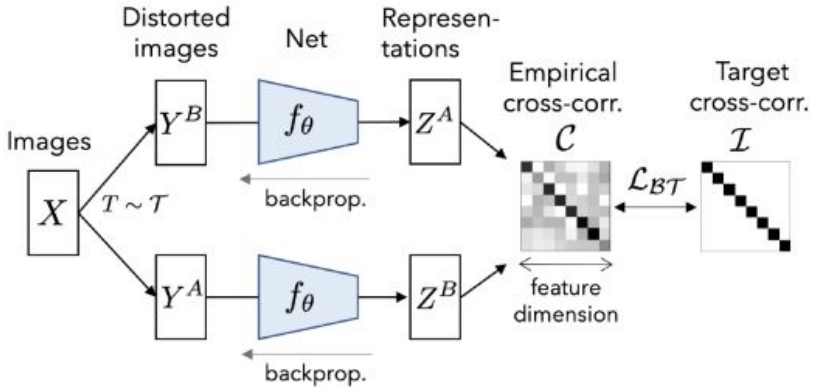
SimSiam - Chen & He, 2020



Barlow Twins

Credits: Ishan Misra

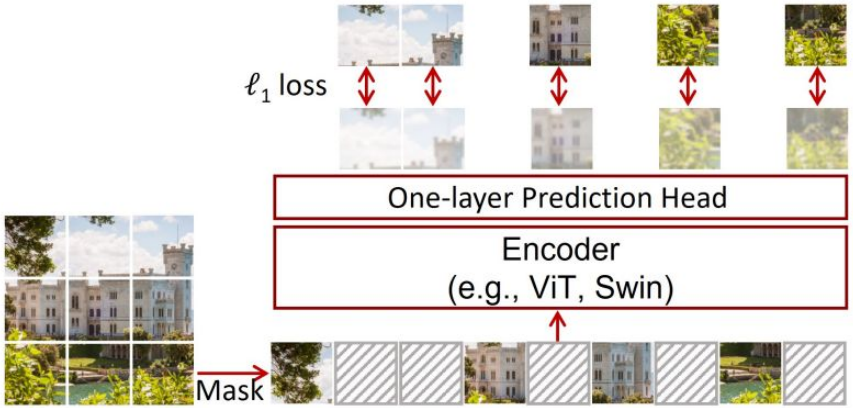
Break Symmetry with Cross-Correlation

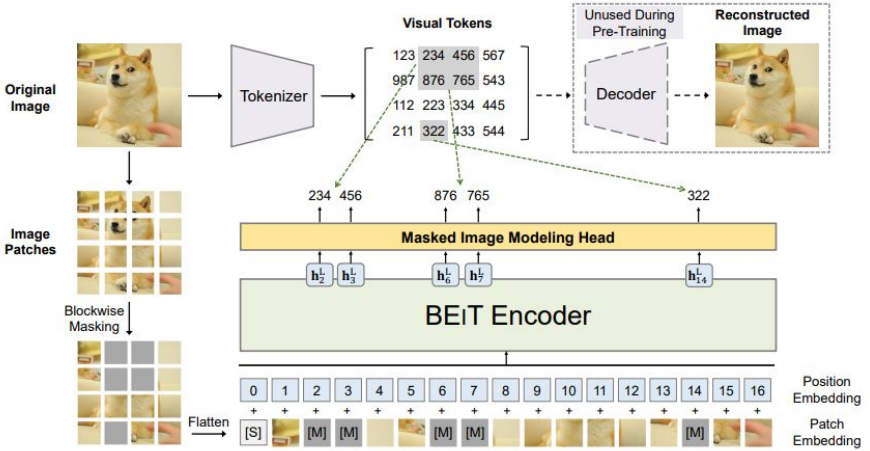


$$\mathcal{C}_{ij} \triangleq \frac{\sum_b z^A_{b,i} z^B_{b,j}}{\sqrt{\sum_b \left(z^A_{b,i}\right)^2} \sqrt{\sum_b \left(z^B_{b,j}\right)^2}}$$

$$\mathcal{L}_{\mathcal{BT}} \triangleq \underbrace{\sum_i (1 - \mathcal{C}_{ii})^2}_{\text{invariance term}} + \lambda \underbrace{\sum_i \sum_{j \neq i} \mathcal{C}_{ij}{}^2}_{\text{redundancy reduction term}}$$

Masked Image Modeling

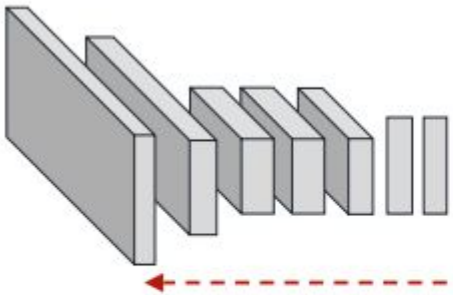




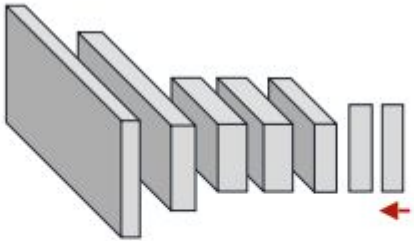
Zhenda Xie, et al. Simmim: A simple framework for masked image modeling. In International Conference on Computer Vision and Pattern Recognition (CVPR) , 2022.

Hangbo Bao, et. al. BEit: BERT pretraining of image transformers.In International Conference on Learning Representations, 2022.

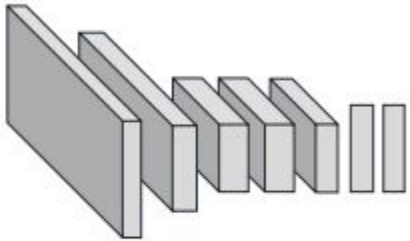
Evaluating Self-Supervised Learning



Fine-tune all layers

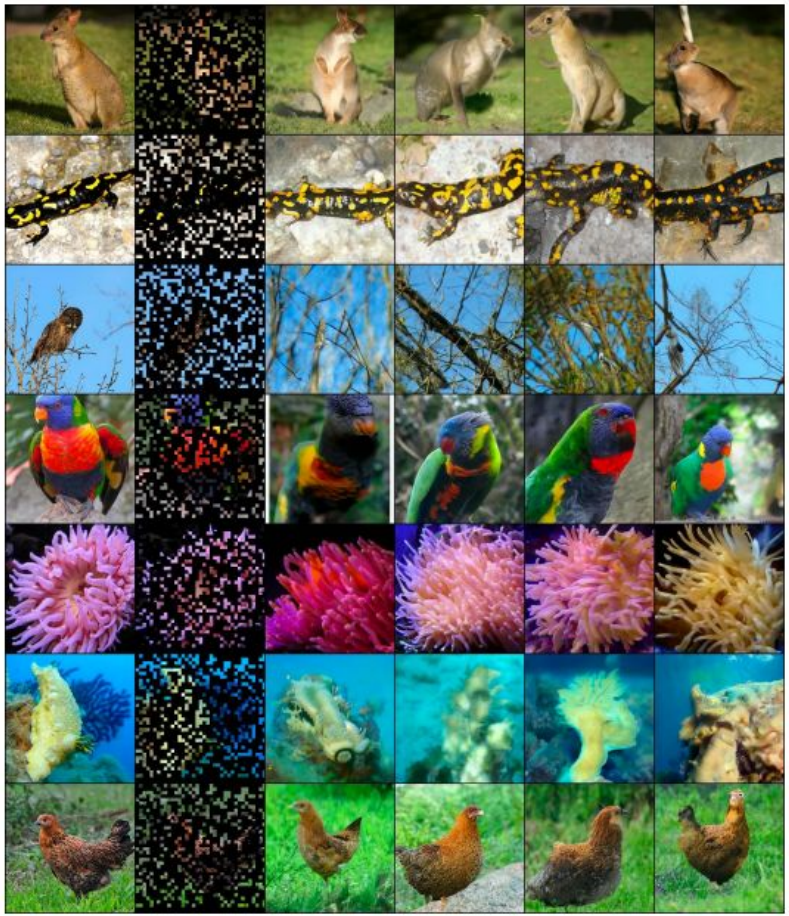


Linear classifier



kNN

Visualizing the Representation in Self-Supervised Learning

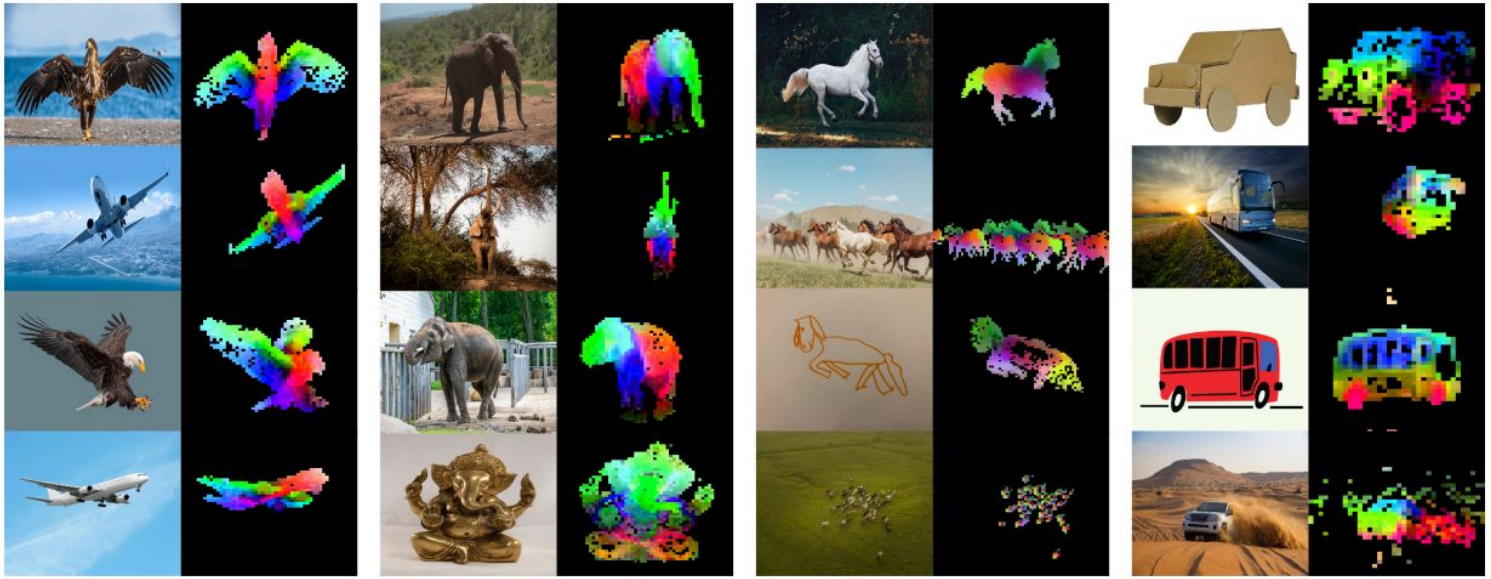


Mahmoud Assran, el al. Masked siamese networks for label-efficient learning. ECCV 2022

Self-Supervised Learning can show Segmentation with ViT

Visualize the “CLS” token attention. Note that the CLS token or the network are not supervised

Large Scale Self-Supervised Learning (DINOv2)



https://ai.facebook.com/blog/dino-v2-computer-vision-self-supervised-learning/