

## Contrastive Learning

Learning to distinguish positive pairs (different views of the same patient, same diagnosis) and negative pairs to improve medical representation quality

### Positive Pairs

Semantically similar data pairs

- Images of the same patient at different timepoints
- Different modalities of the same disease
- Image-report matching pairs
- Data augmented same samples

### Negative Pairs

Semantically different data pairs

- Images from different patients
- Different disease categories
- Non-matching image-report pairs
- Different samples within batch

### InfoNCE Loss

Core loss function for contrastive learning

- Positive pairs: High similarity (cosine)
- Negative pairs: Low similarity
- Temperature parameter adjustment
- Requires large batch size

### Medical Domain Application

Medical-specialized contrastive learning strategies

- Leveraging anatomical consistency
- Preserving temporal continuity
- Integrating clinical metadata
- Pre-training without labels

Self-supervised

Few-shot

Enhanced

Pre-training	Learning Enabled	Transfer Learning
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