

27/12/25 Conceptualization Draft Thesis

Assumes temporal coherence

$D_T \approx D_{T+1} \Rightarrow$ previous representation is partially reusable

\therefore Focus not on tailored instances but SEMANTIC instances

NEW generator needed

IF each distribution has:

- internally inseparable heuristic classes
- or completely different feature-heuristic relationships

then:

- memory replay preserves noise
- retraining reinforces contradictions
- forgetting is unavoidable

This is why OCL is used with images, words, data with SEMANTIC meaning

So continual learning requires distribution-wise learnability

Reasonable separability

The generator is a precondition for viability

$$\mathbb{E}[\text{intra-class distance}] < \mathbb{E}[\text{inter-class distance}]$$

Possibly:

- Only for some regions
- Only probabilistically
- Only after nonlinear transformation

Enough for contrastive objectives to converge and distance-based voting to outperform chance

IF this condition fails, then the framework is not viable regardless of:

- Network depth
- Memory size
- Retraining schedule

No-free-lunch situation

$$\Pr(w|\phi) \approx \text{uniform}$$

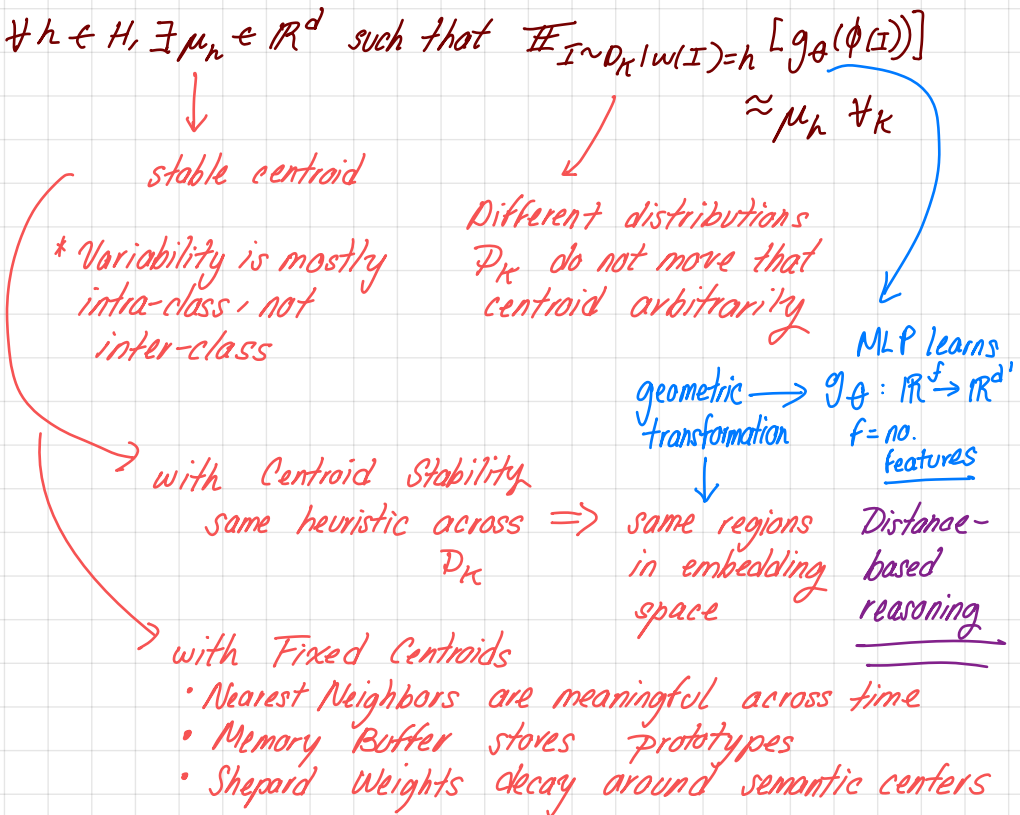
What we want to avoid

NSGA-II instead of GA generator!
↳ Optimize several objectives
Pareto again

Next steps thesis:

For an online continual learning framework, generating semantic-preserving instances is far more important than generating merely tailored or hard instances, because semantic stability is the true precondition for representation learning and continual adaptation

- ▼ Focus in developing a new generator \mathcal{D}_{sem} designed
- to preserve semantic structure across distributions.



$$\mathcal{D}_T \rightarrow \mathcal{D}_{T+1} \quad \text{but} \quad \mu_h^{(T)} \approx \mu_h^{(T+1)}$$