ICLR

Effective pruning of web-scale datasets based on complexity of concept clusters

Meta AI

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imprs-is

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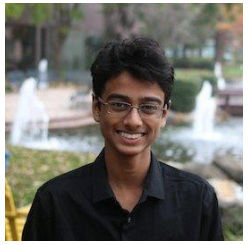

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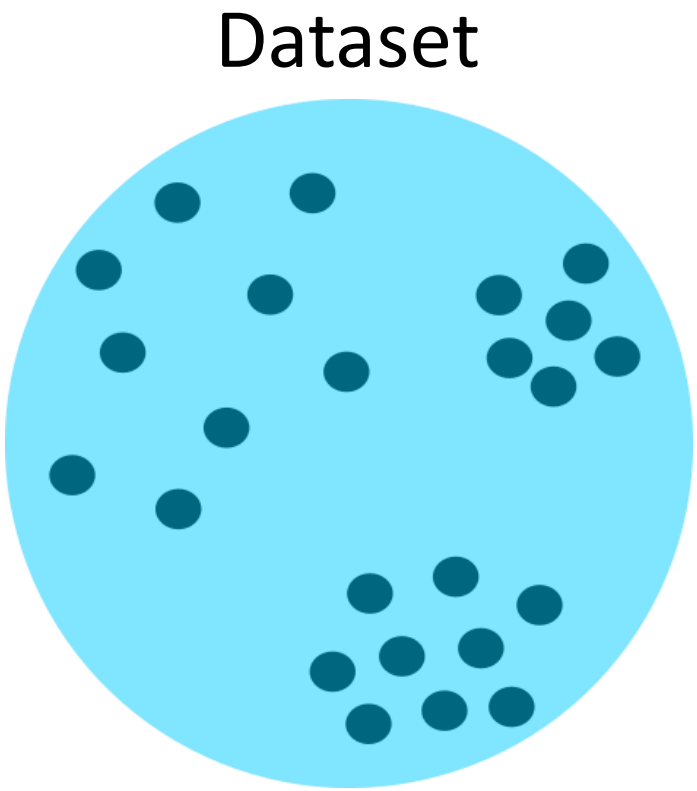
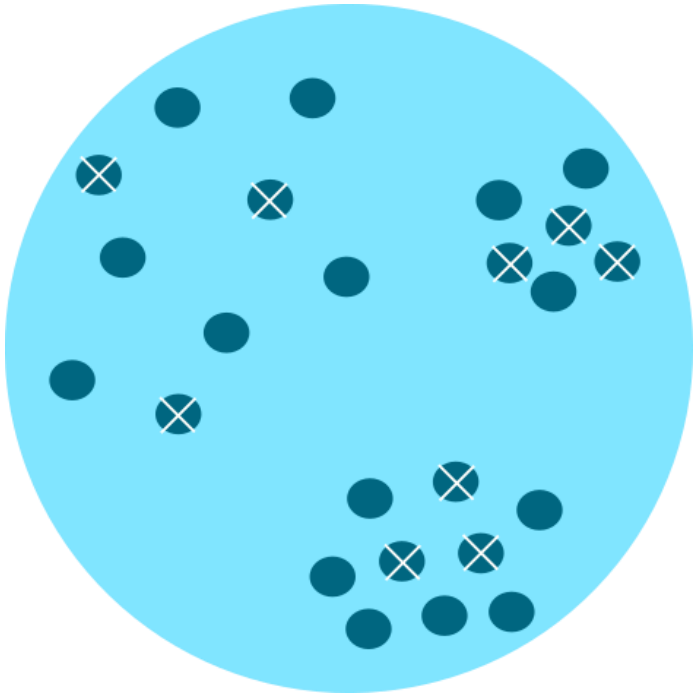
Task: Improve training efficiency

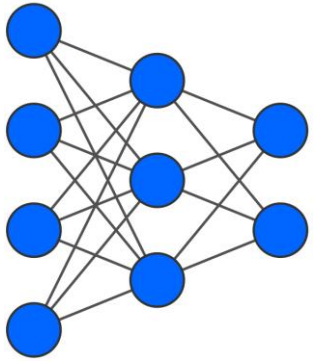


Task: Improve training efficiency

Dataset



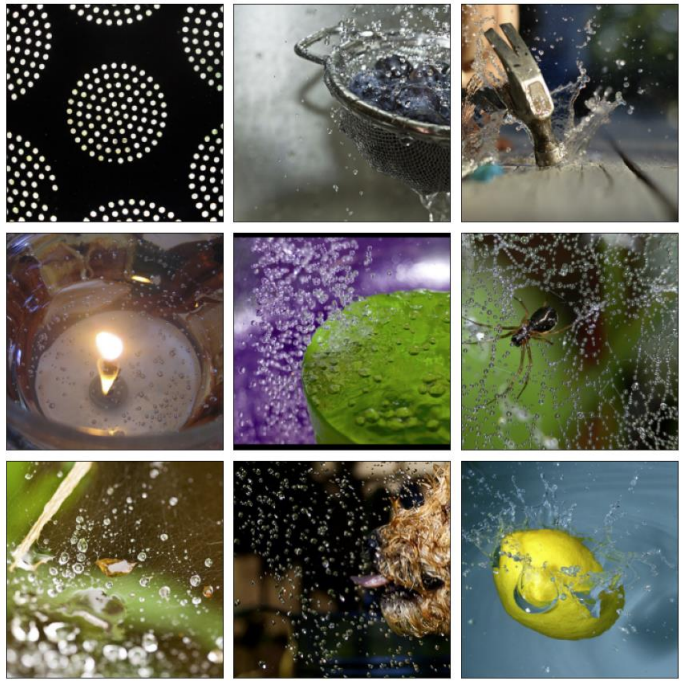
train a model



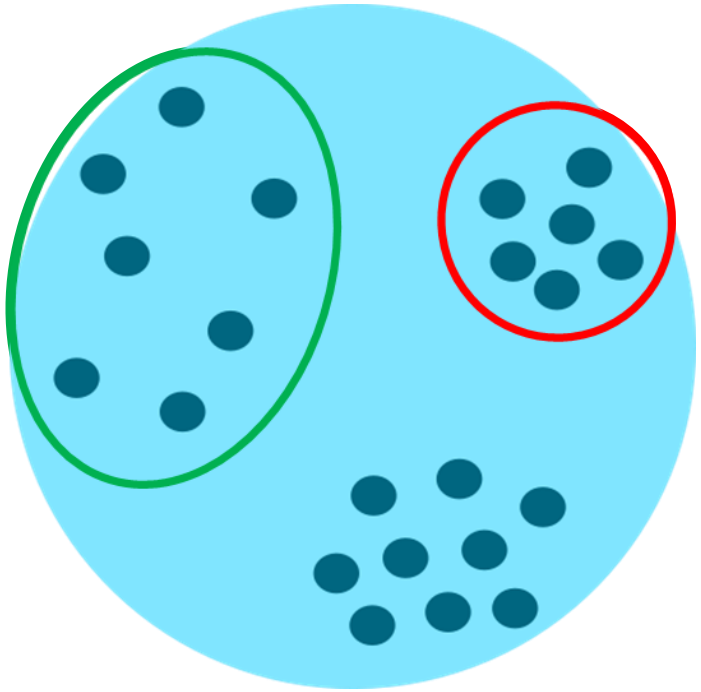
classify

How many examples do we need to learn a concept?

Cluster A



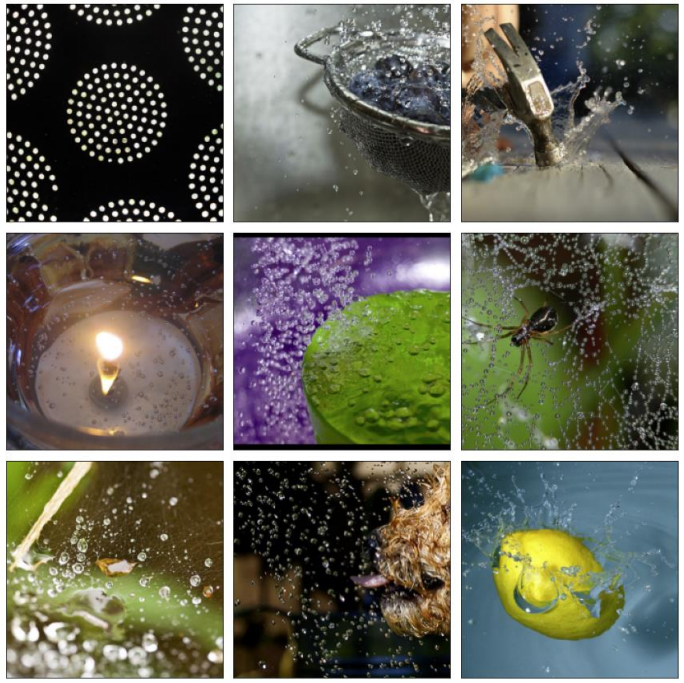
Dataset



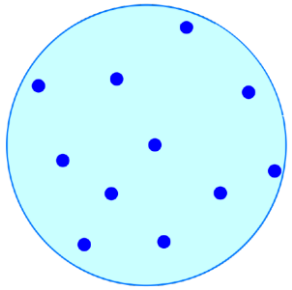
Cluster B

How many examples do we need from each cluster?

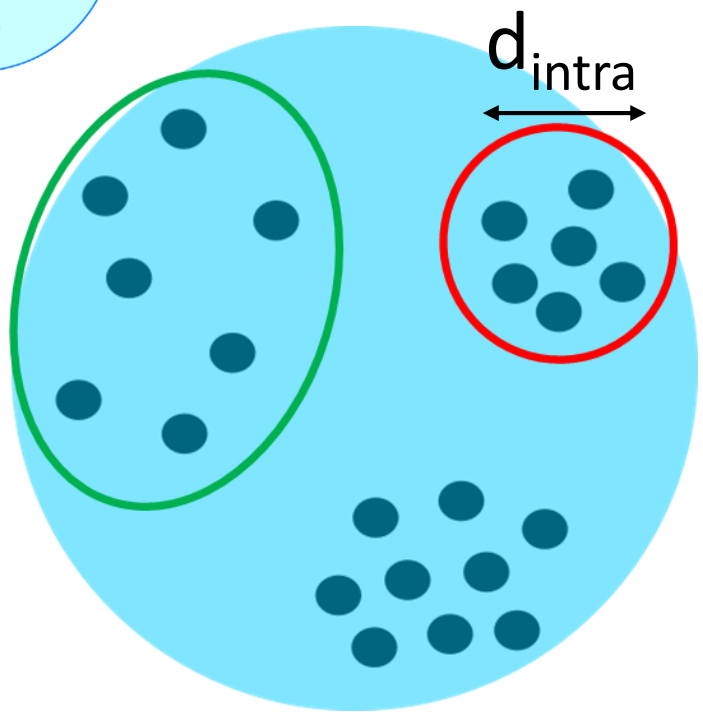
Cluster A



high d_{intra}



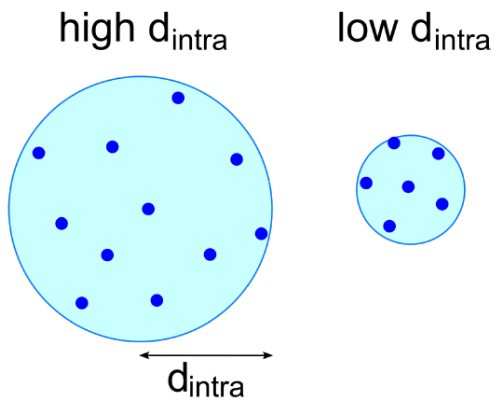
Dataset



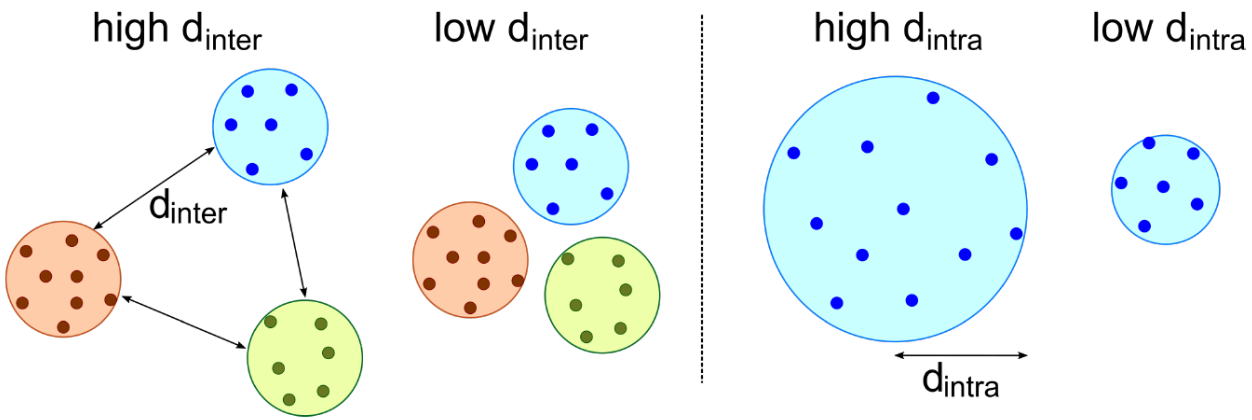
low d_{intra}

Cluster B

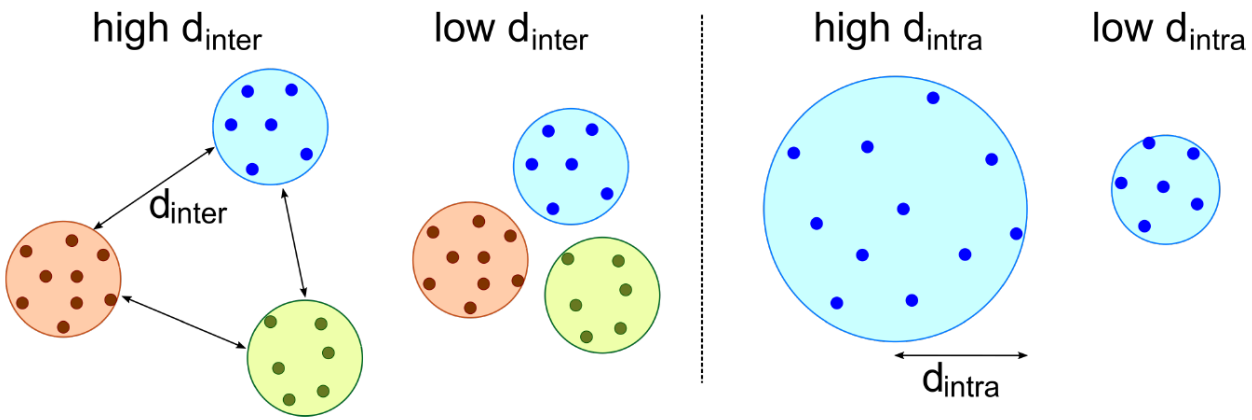
Density-based pruning



Density-based pruning



Density-based pruning



$$C_j = d_{inter,j} \cdot d_{intra,j}$$

$$P_j = \frac{\exp(C_j/\tau)}{\sum_i^n \exp(C_i/\tau)}$$

Density-based pruning: Method summary

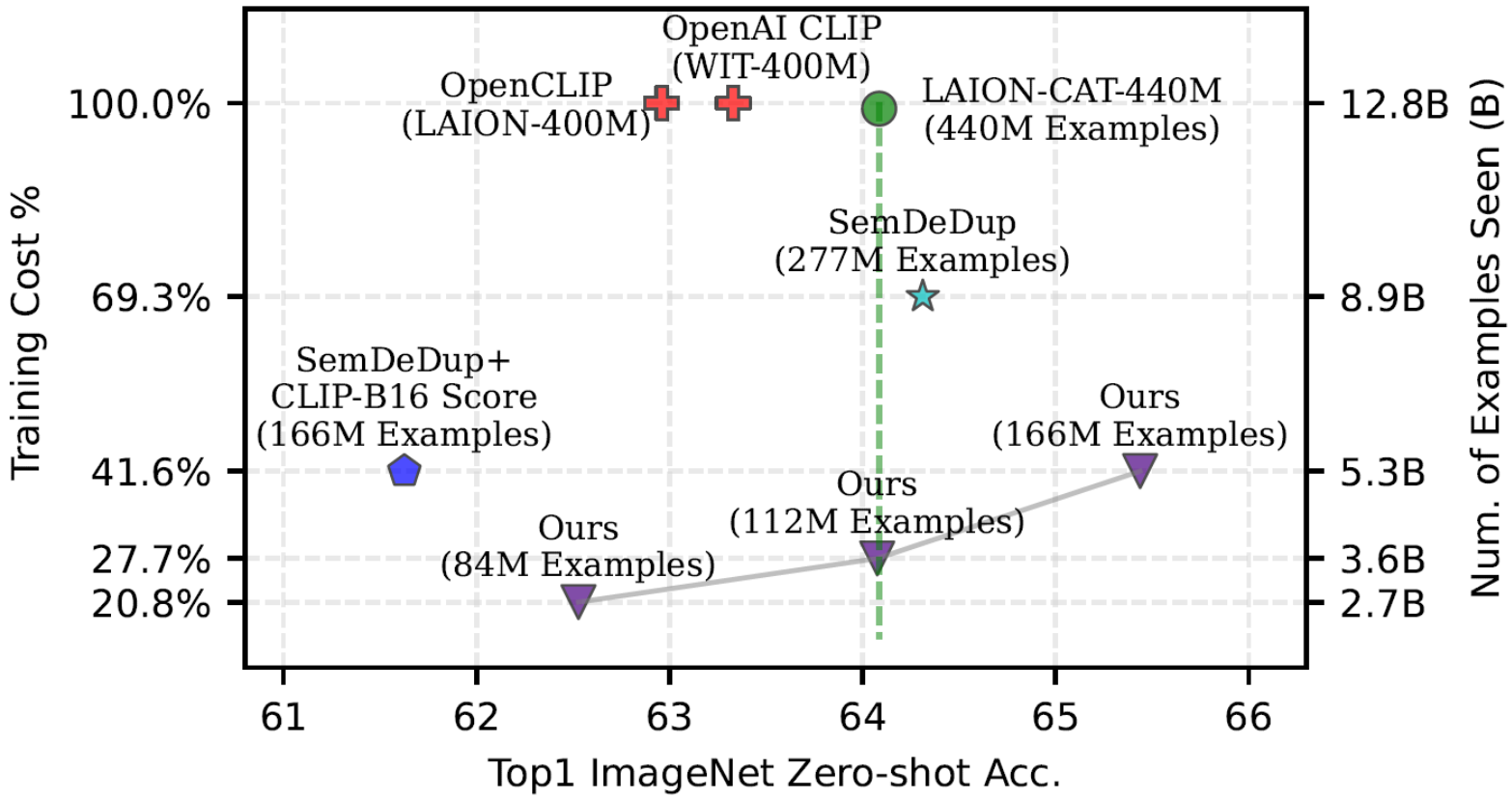
1. Deduplicate LAION / DataComp.
2. Calculate image embeddings with a pretrainer encoder.
3. Cluster the embeddings with kmeans.
4. Calculate d_{intra} and d_{inter} for each cluster.
5. Calculate the number of examples per cluster N_j.
6. Keep the furthest N_j samples from each cluster centroid.

Results on DataComp Medium

Task: Train a CLIP model on 128M examples seen.

Method	Size	ImageNet	ImageNet dist. shifts	VTAB	Retrieval	Average
TMARS	25M	33.00	27.00	36.30	22.50	36.10
Image-based ∩ CLIP Score (L/14 top 30%)	14M	29.70	23.90	34.60	23.10	32.80
CLIP Score (L/14 top 30%)	38M	27.30	23.00	33.80	25.10	32.80
Ours (DeDup, 80% + CLIP-L/14 Score, 50% + DBP)	19.2M	33.35	24.73	37.26	26.82	34.52
Ours (DeDup, 80% + CLIP-L/14 Score, 40% + DBP)	19M	32.02	25.74	37.26	26.80	35.35

Results on LAION-400M



Key message: Taking the complexity of different concepts into account when designing pruning methods can reduce redundancy and improve training efficiency.

Path forward: Combine different pruning techniques.

Thank you for your attention ☺.

Meet me at my poster!