Unsupervised Deep Learning by Neighbourhood Discovery

ICML-2019

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vision semantics

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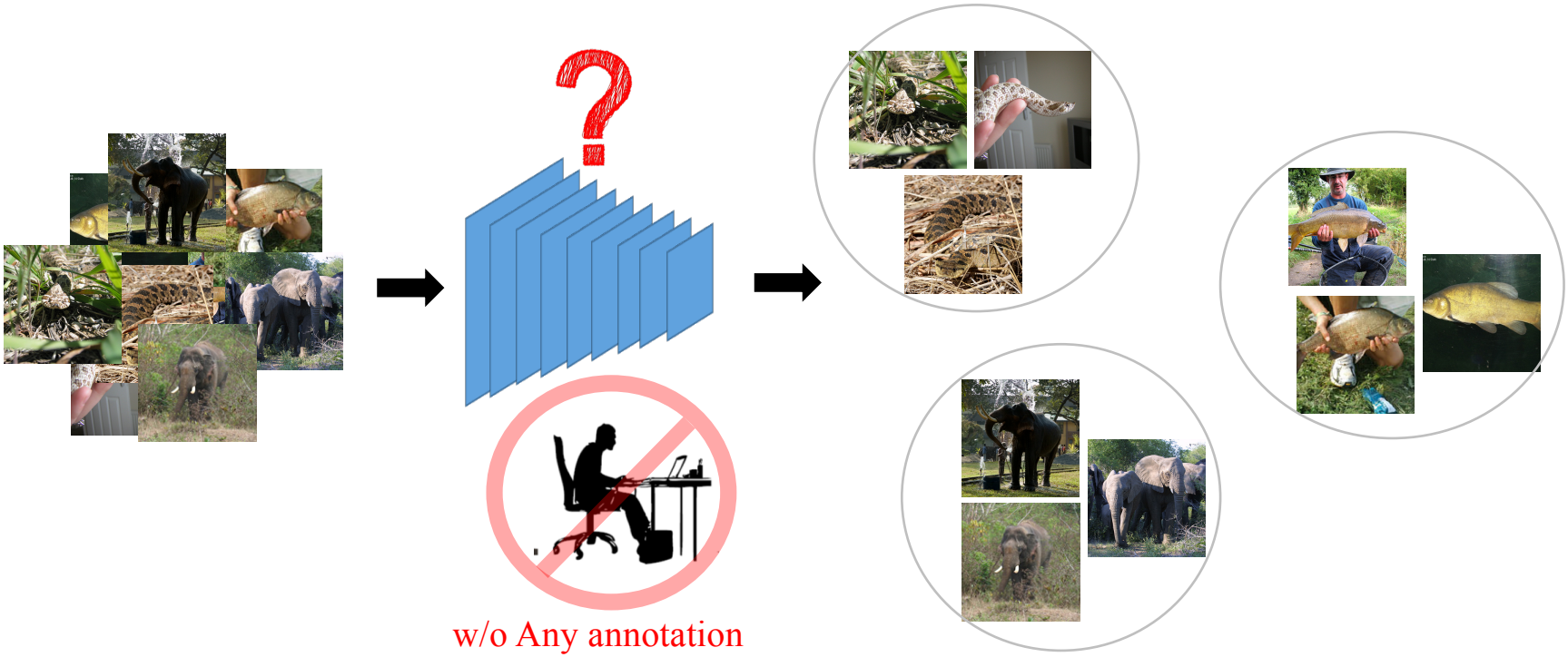
Background

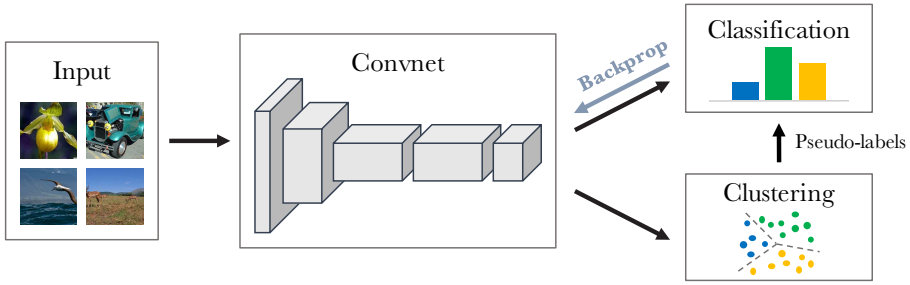
- Unsupervised Deep Learning



Literature Review

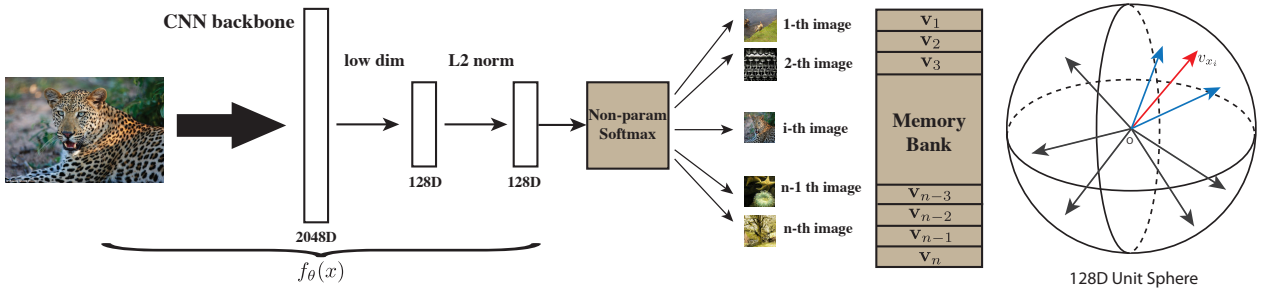
- Clustering Analysis: Caron *et al.*, ECCV, 2018

Jointly optimising clustering analysis and representation learning



- Sample Specificity (Instance) Learning: Wu *et al.*, CVPR, 2018

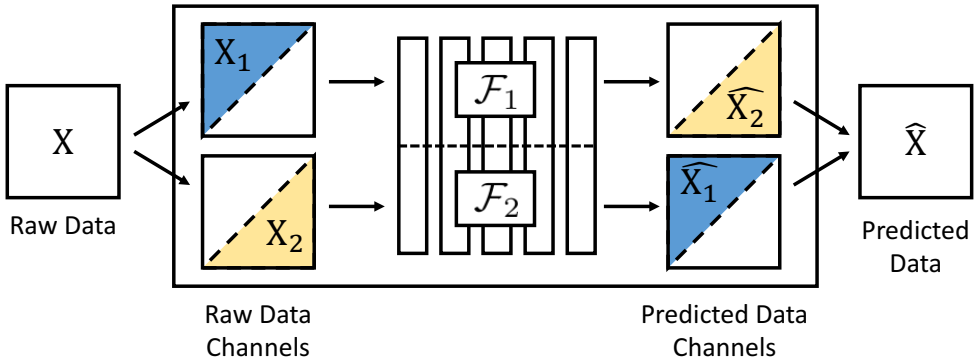
Considering every single sample as an independent class



Literature Review

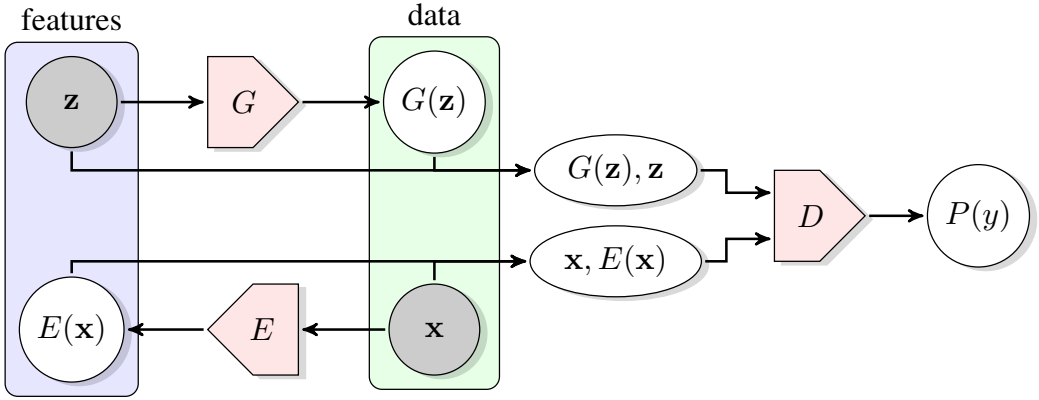
- Self-supervised Learning: Zhang *et al.*, CVPR, 2017

Exploiting information intrinsically available in data



- Data Synthesis: Donahue *et al.*, ICLR, 2016

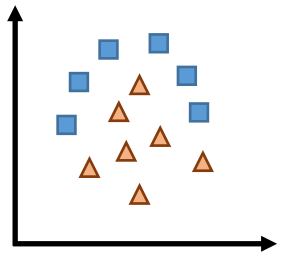
Learning the true data distribution of training set



Motivation

(a) Clustering analysis:

Inconsistent inter-sample relations



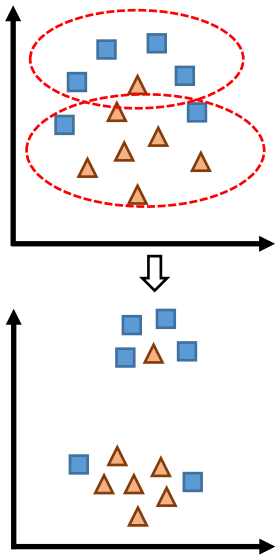
(a)

Motivation

(a) Clustering analysis:

Inconsistent inter-sample relations

error-propagation



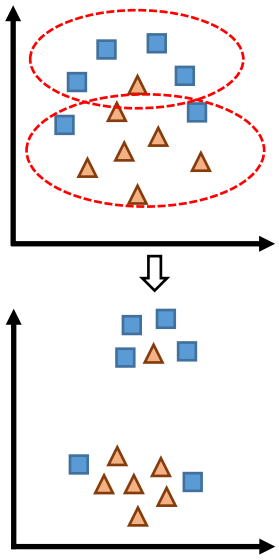
(a)

Motivation

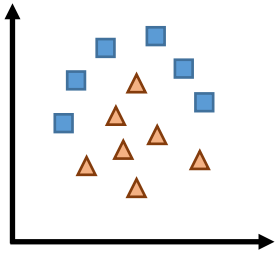
(a) Clustering analysis:
Inconsistent inter-sample relations

error-propagation

(b) Sample specificity learning:
Leaving out the correlation between samples



(a)

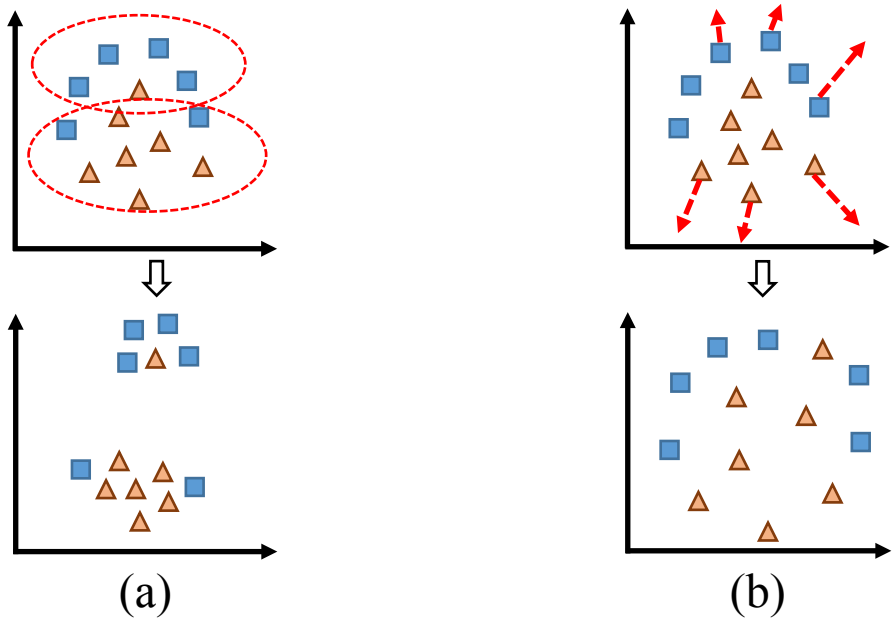


(b)

Motivation

(a) Clustering analysis:
Inconsistent inter-sample relations
↓
error-propagation

(b) Sample specificity learning:
Leaving out the correlation between samples
↓
poor discriminative ability



Motivation

(a) Clustering analysis:
Inconsistent inter-sample relations

↓

error-propagation

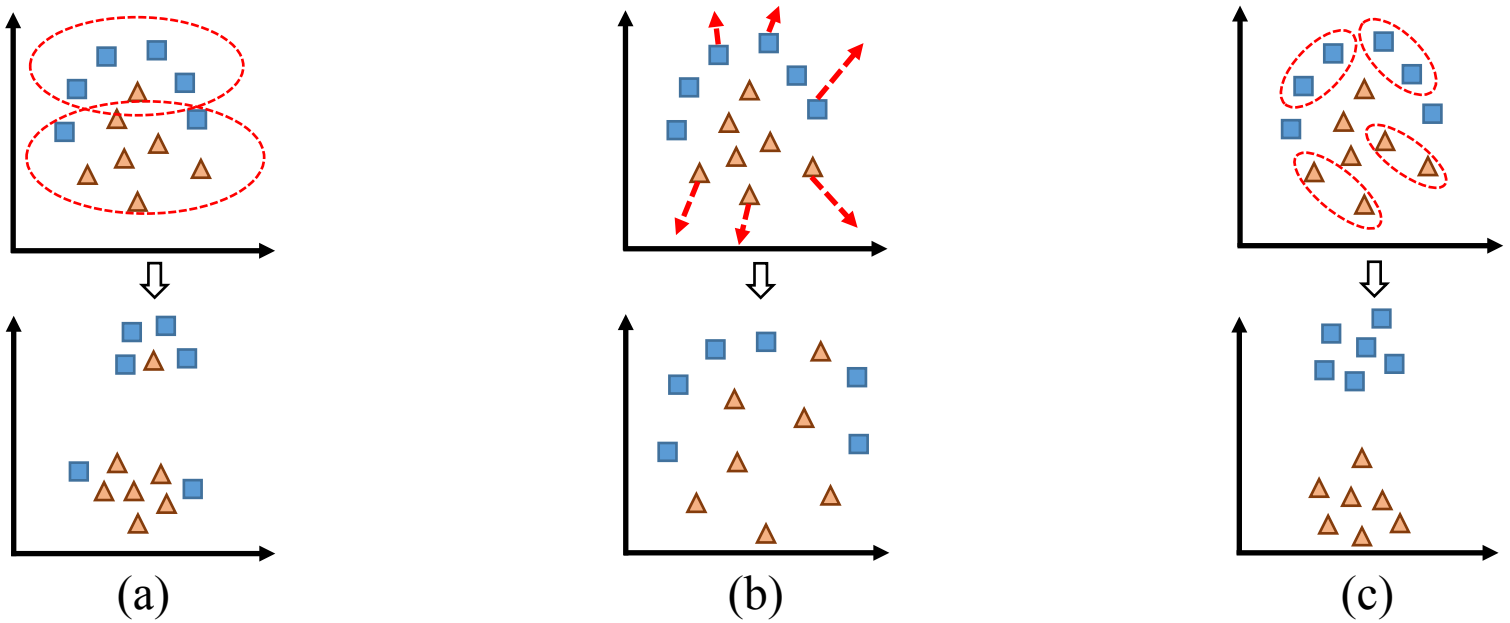
(b) Sample specificity learning:
Leaving out the correlation between samples

↓

poor discriminative ability

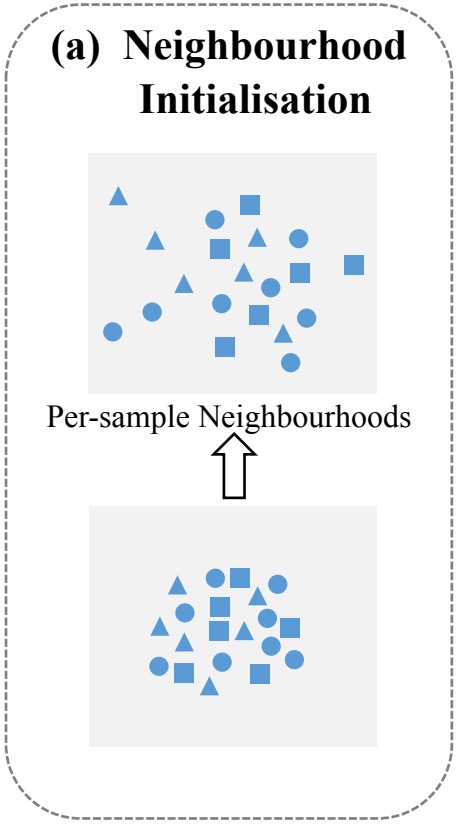
↘ ↙

(c) Measuring the consistency of inter-sample relations and learn from those in high-confidence only



Anchor Neighbourhood Discovery

- Overview



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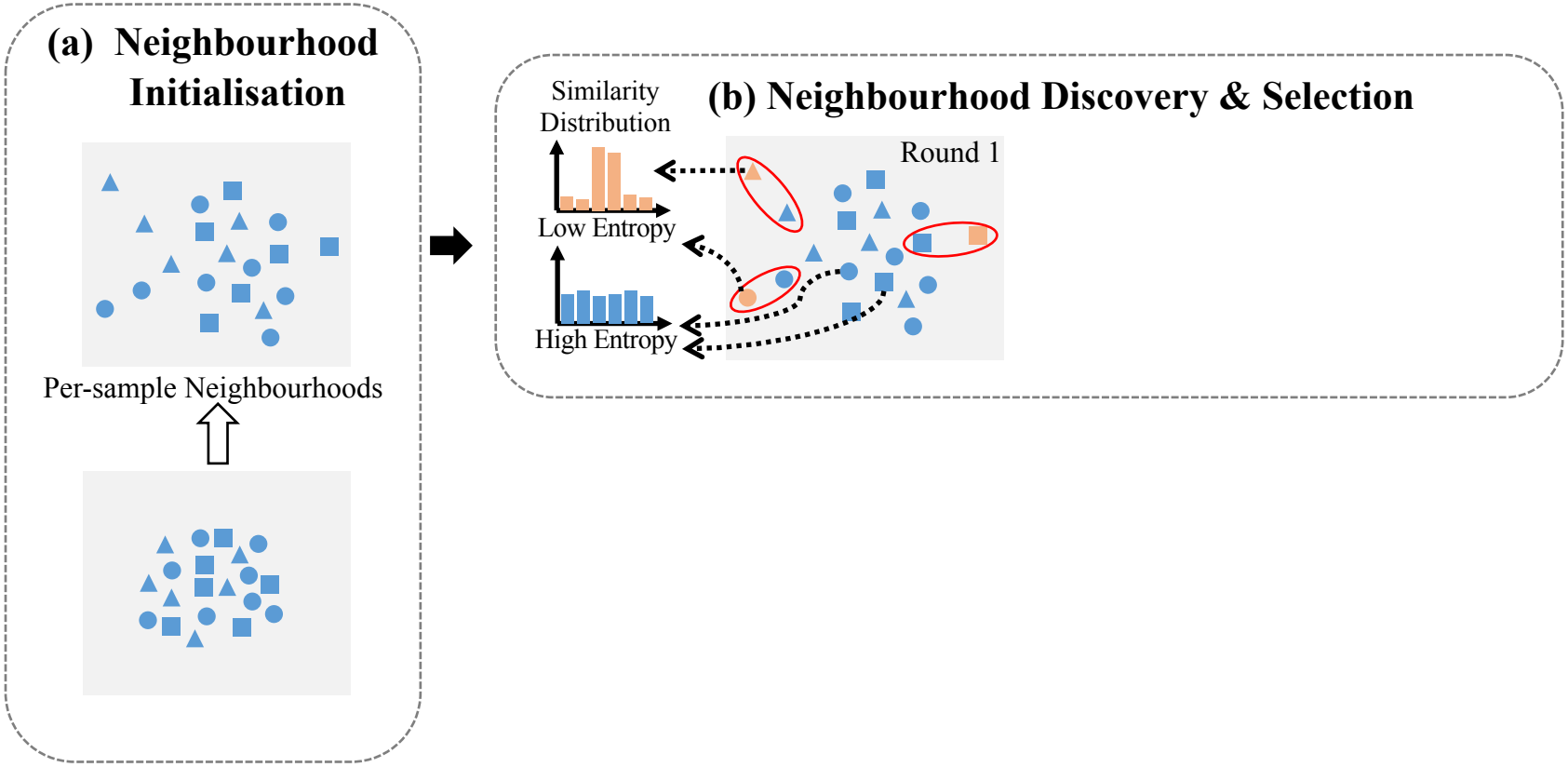

Anchor Neighbourhood Discovery

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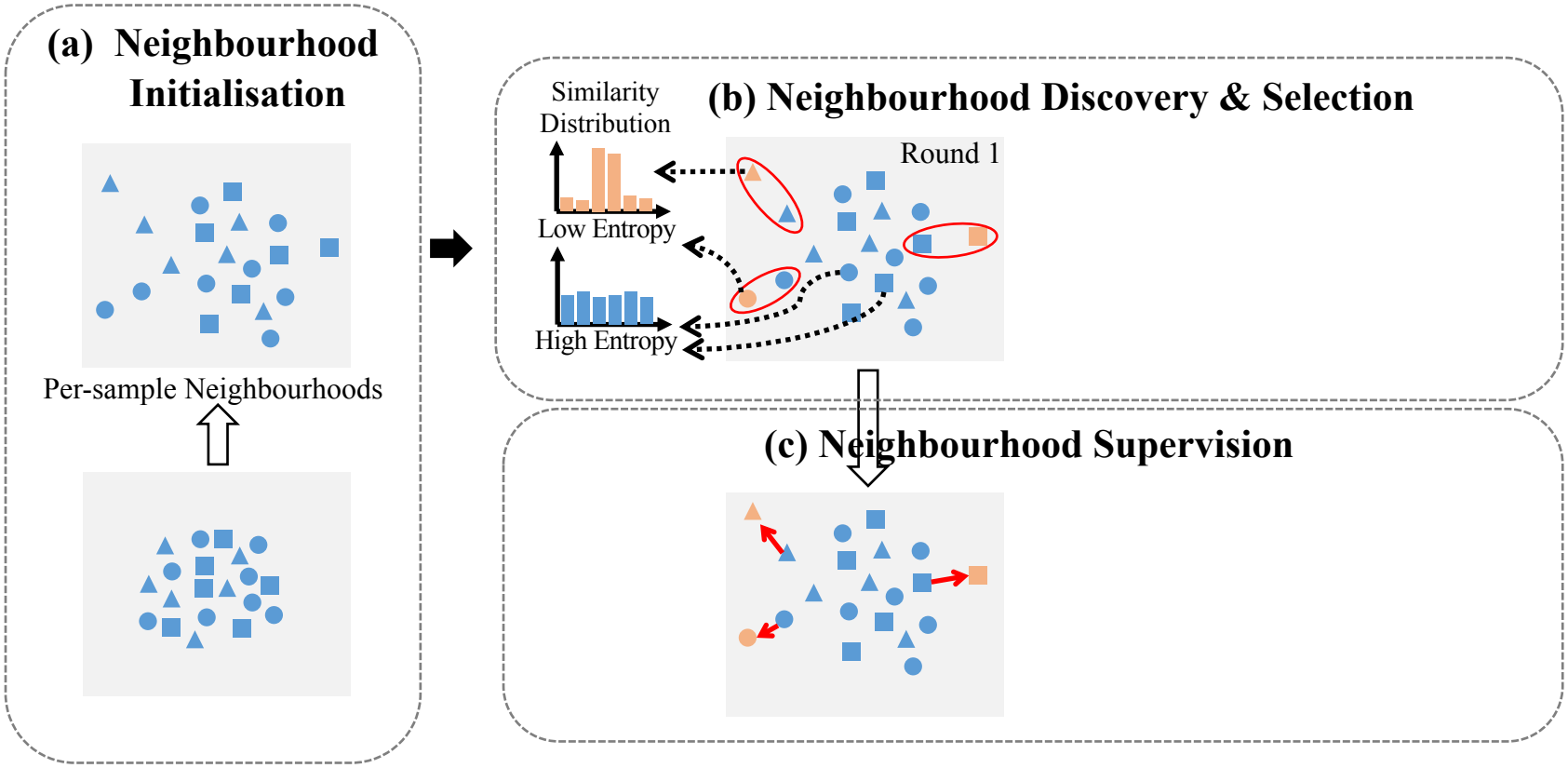
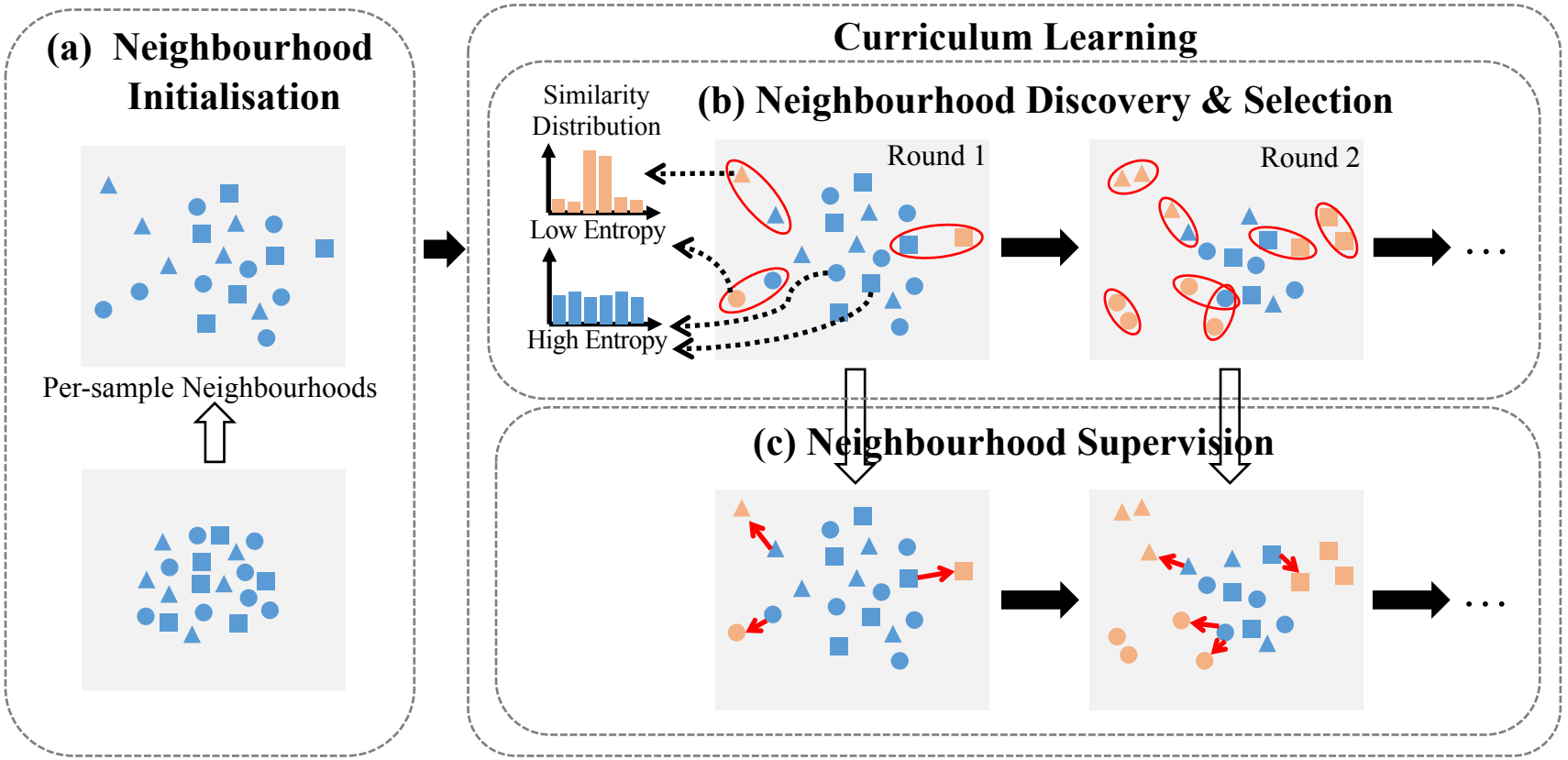
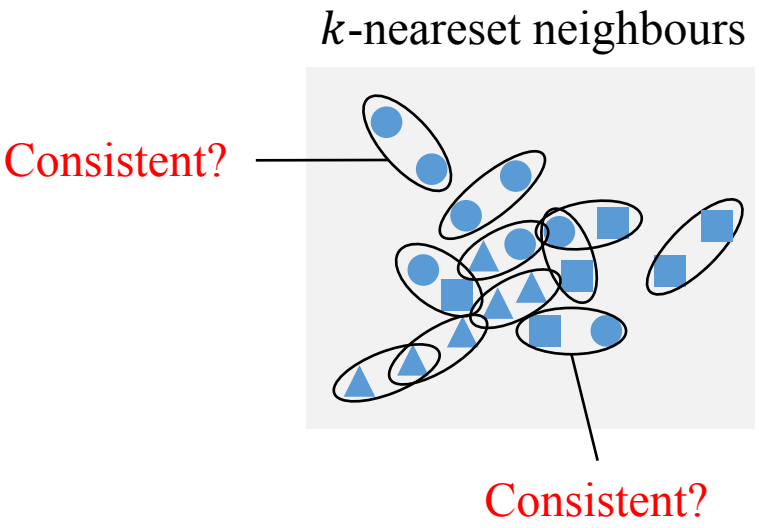


Anchor Neighbourhood Discovery

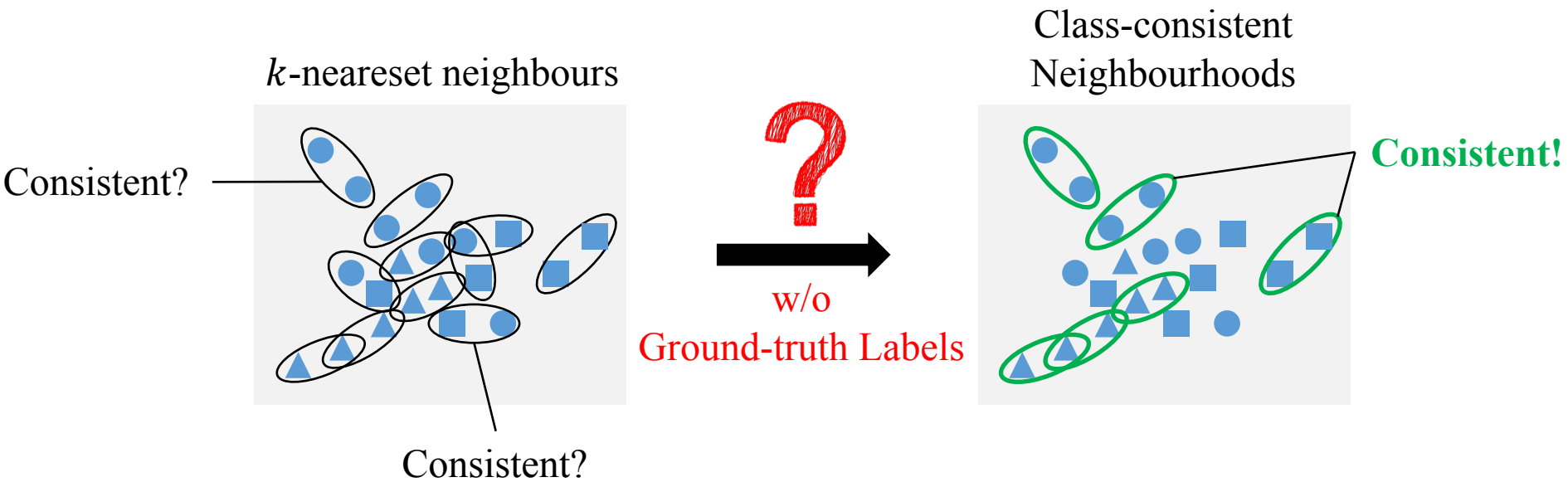
- Overview



Neighbourhood Discovery & Selection

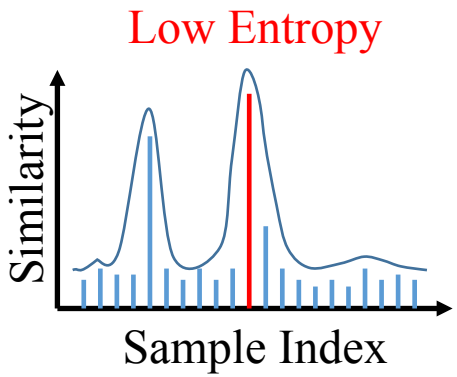


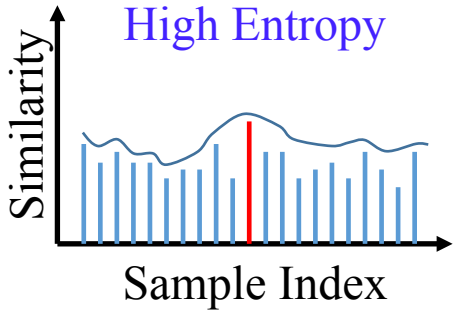
Neighbourhood Discovery & Selection



Neighbourhood Discovery & Selection

- Observation: Consistency *v.s.* Entropy





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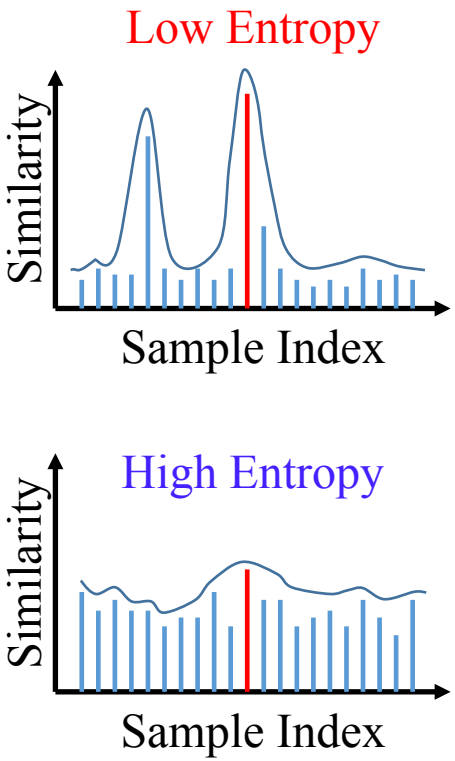

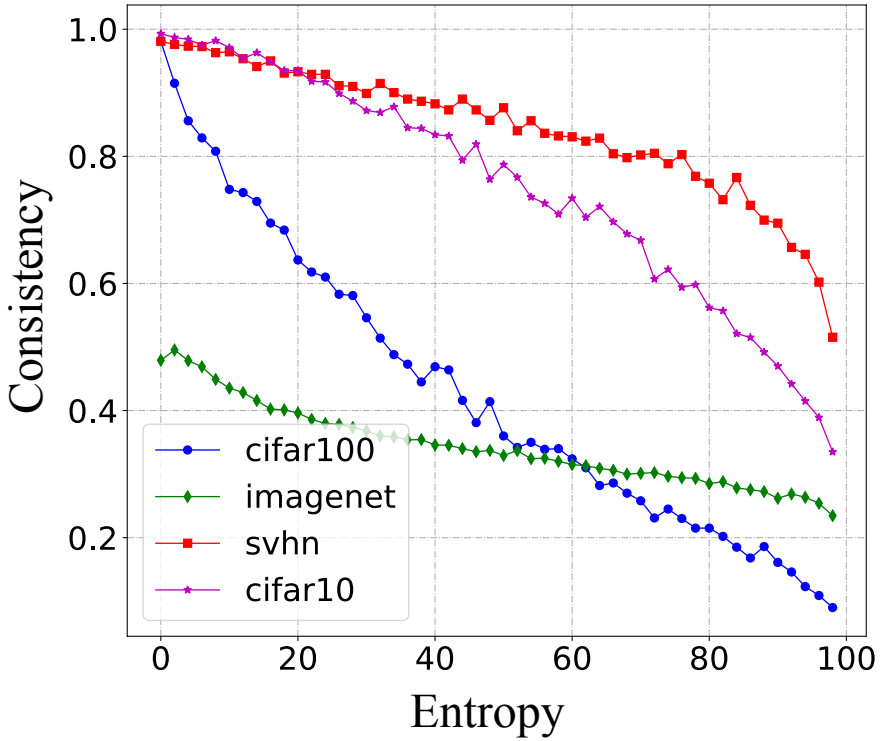

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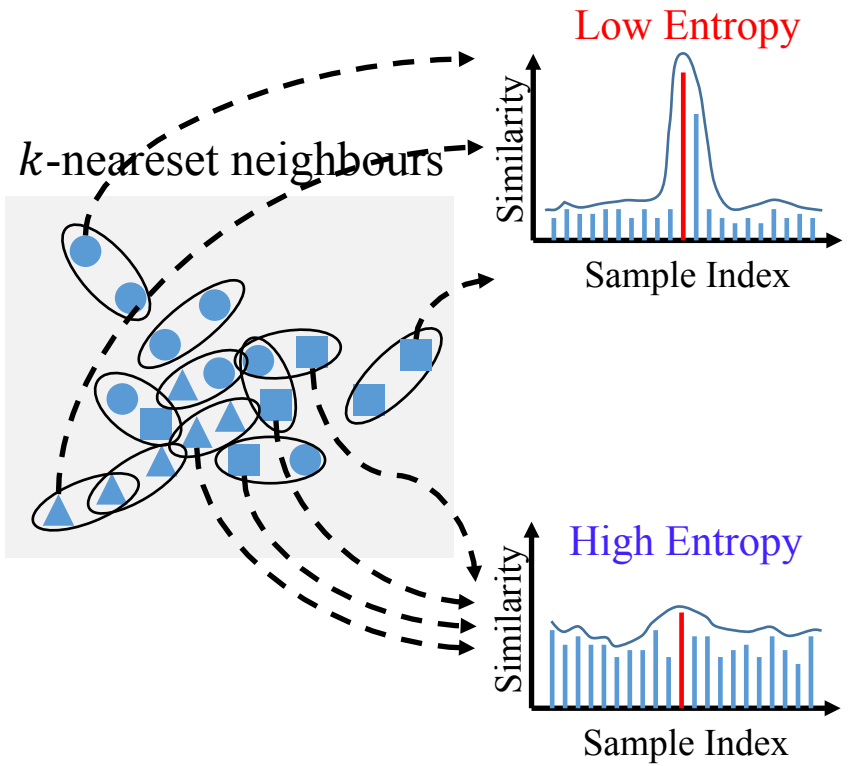

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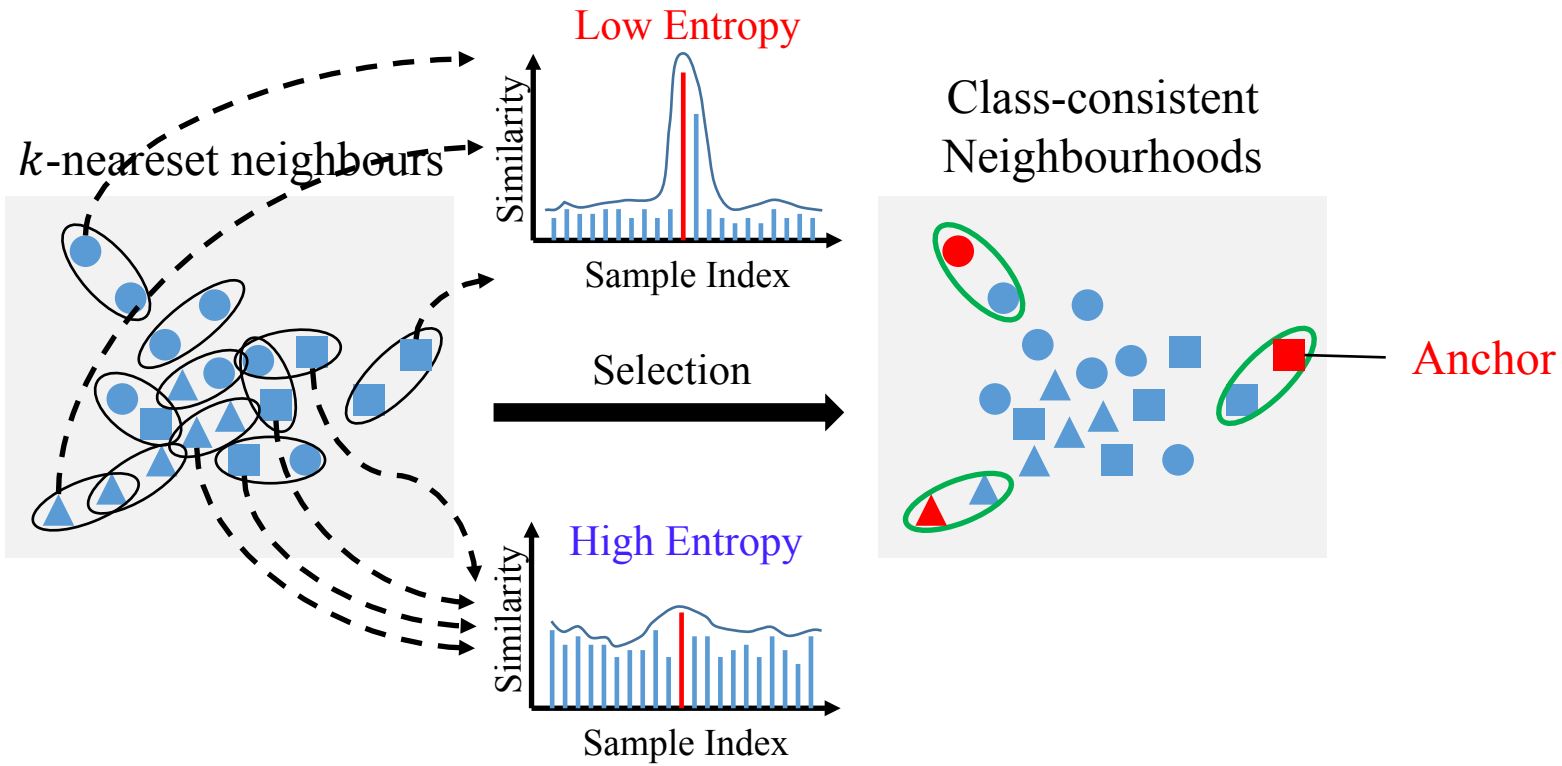
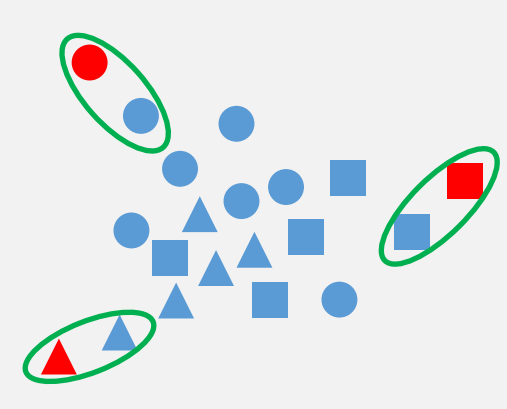


Neighbourhood Supervision

- Neighbourhood Supervision



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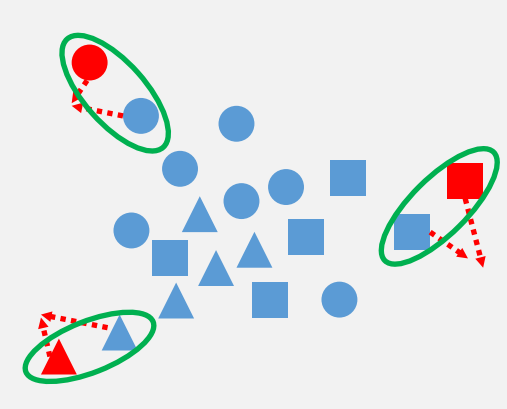

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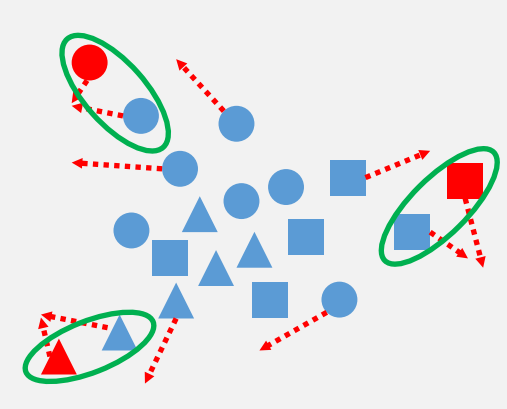

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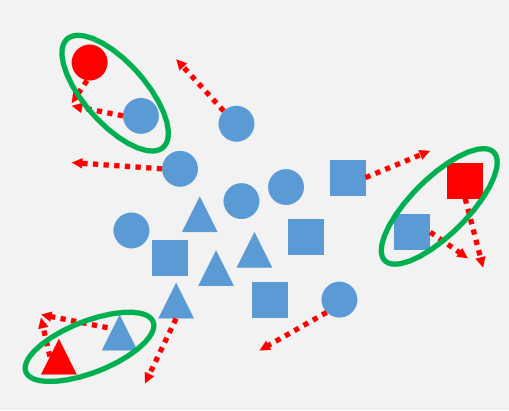
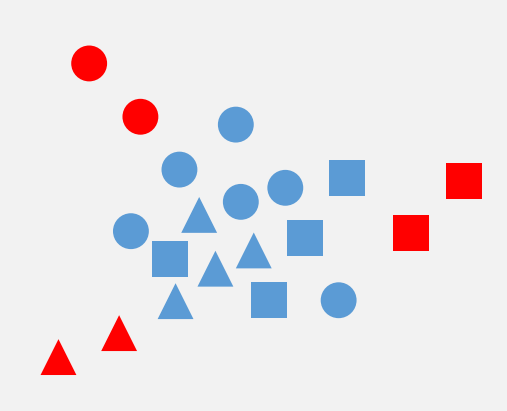


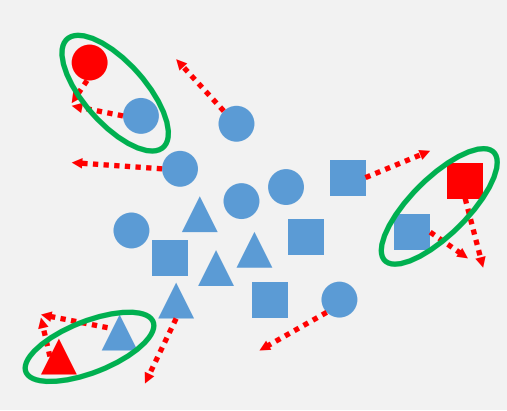
- Curriculum Learning



1st Round

Neighbourhood Supervision

- Neighbourhood Supervision



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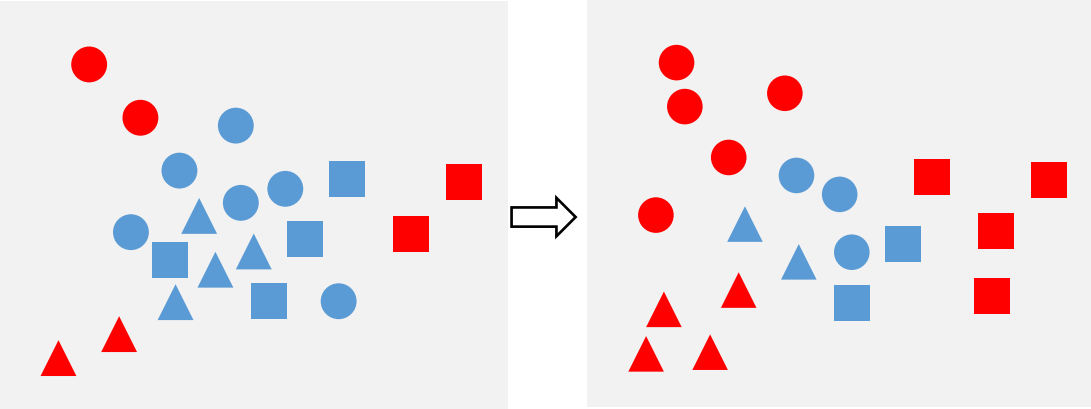
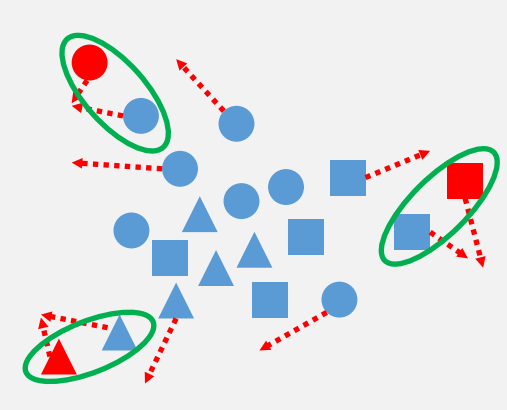


1st Round

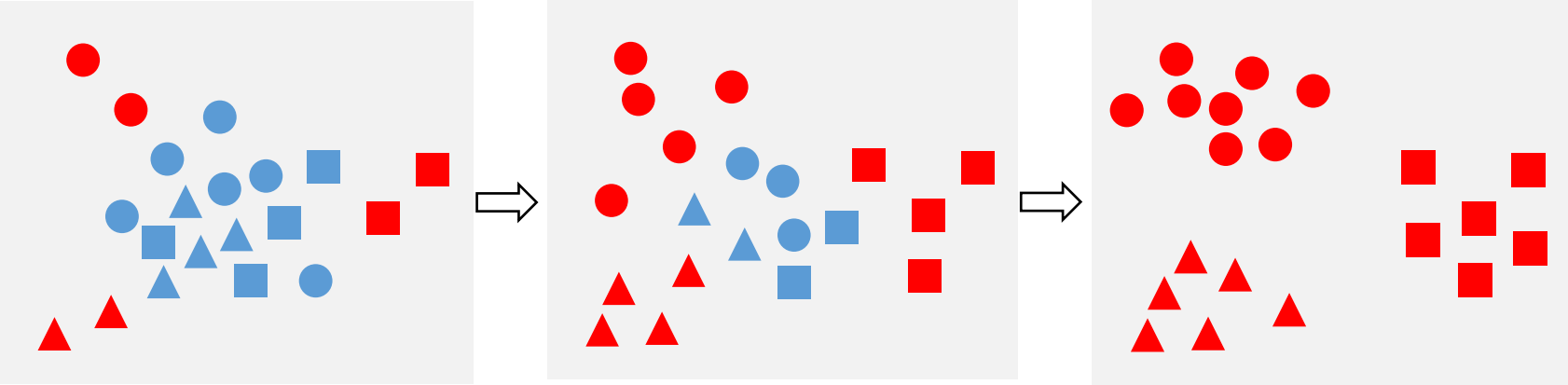
2nd Round

Neighbourhood Supervision

- Neighbourhood Supervision



- Curriculum Learning



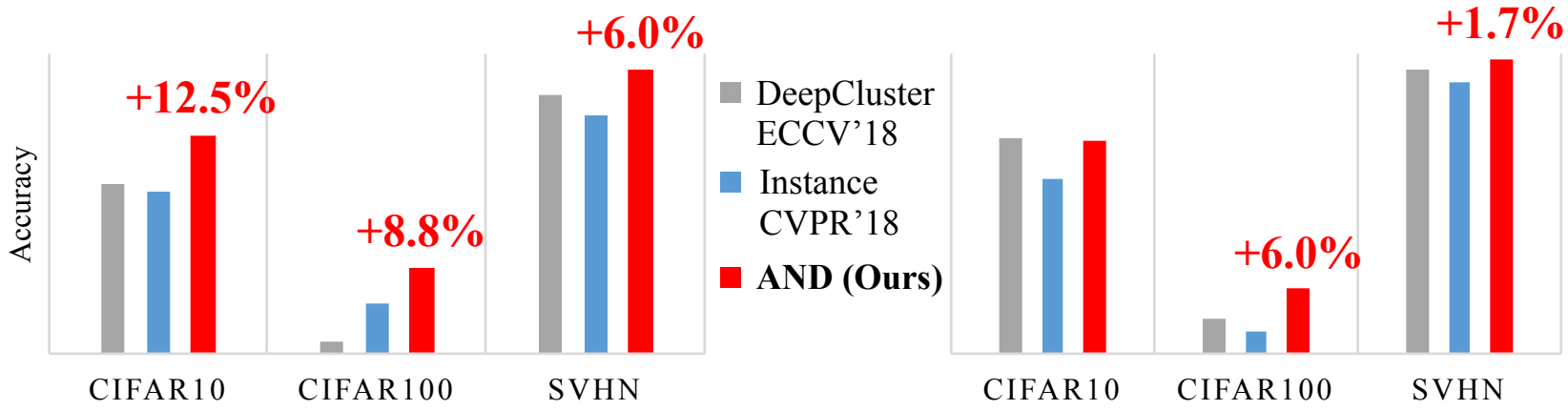
1st Round

2nd Round

Last Round

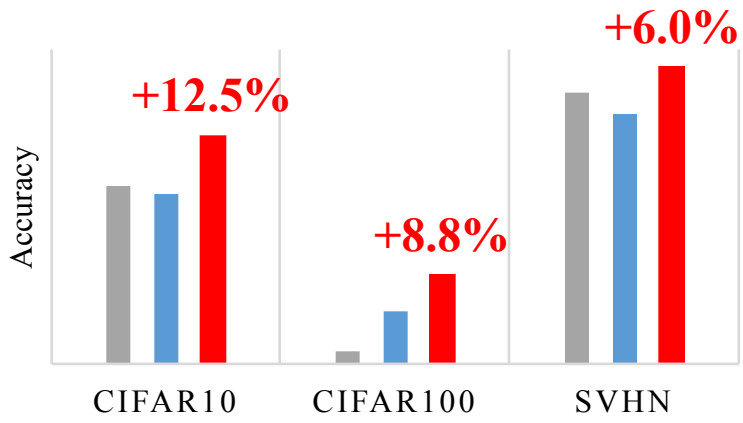
Experiments

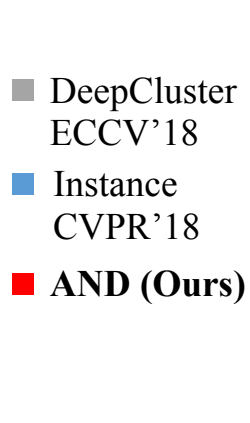
- Small scale Image Classification (kNN)
- Small scale Image Classification (LC)



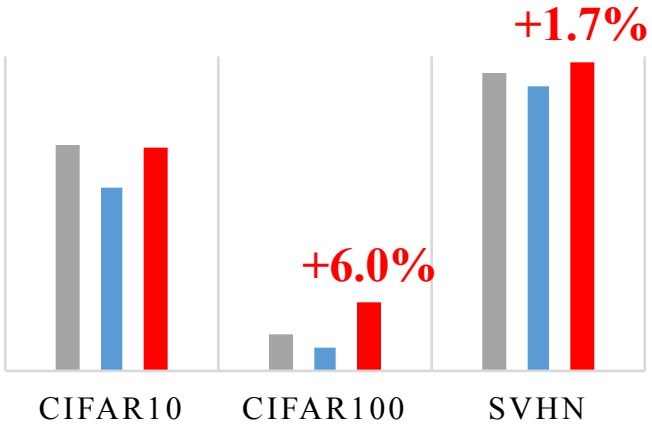
Experiments

- Small scale Image Classification (kNN)

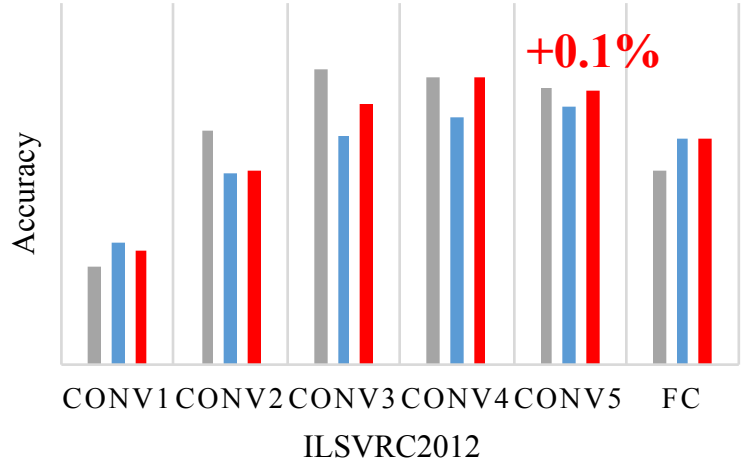




- Small scale Image Classification (LC)

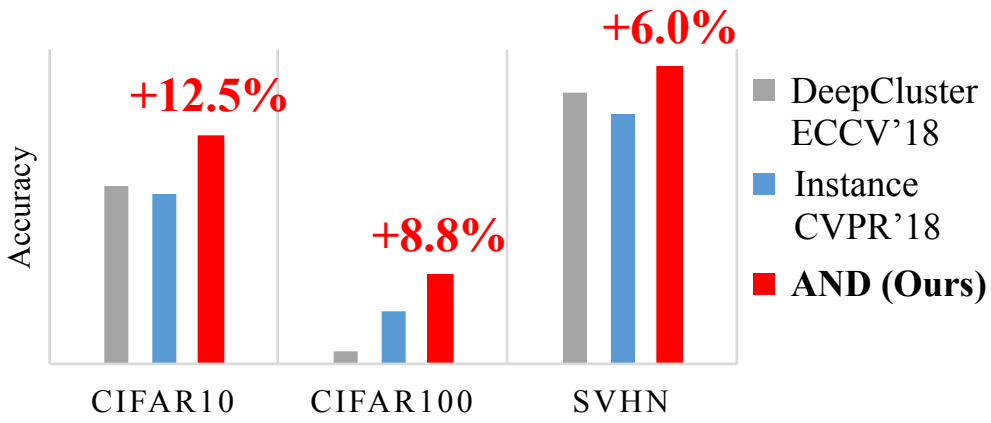


- Large scale Image Classification

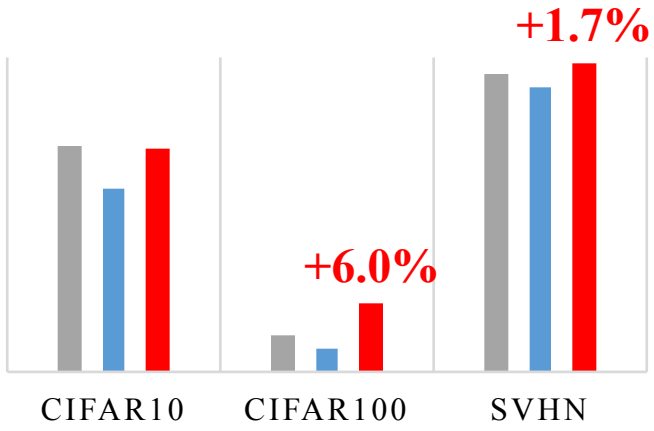


Experiments

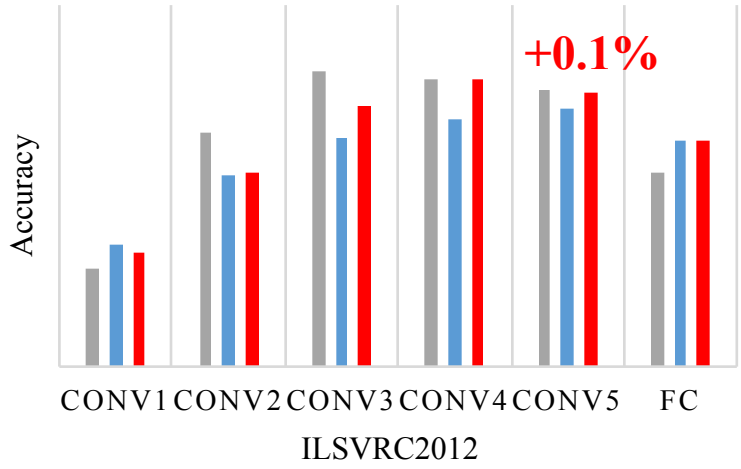
- Small scale Image Classification (*k*NN)



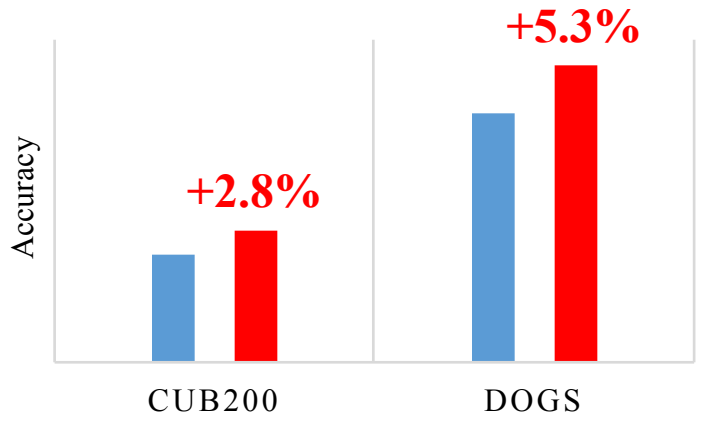
- Small scale Image Classification (LC)



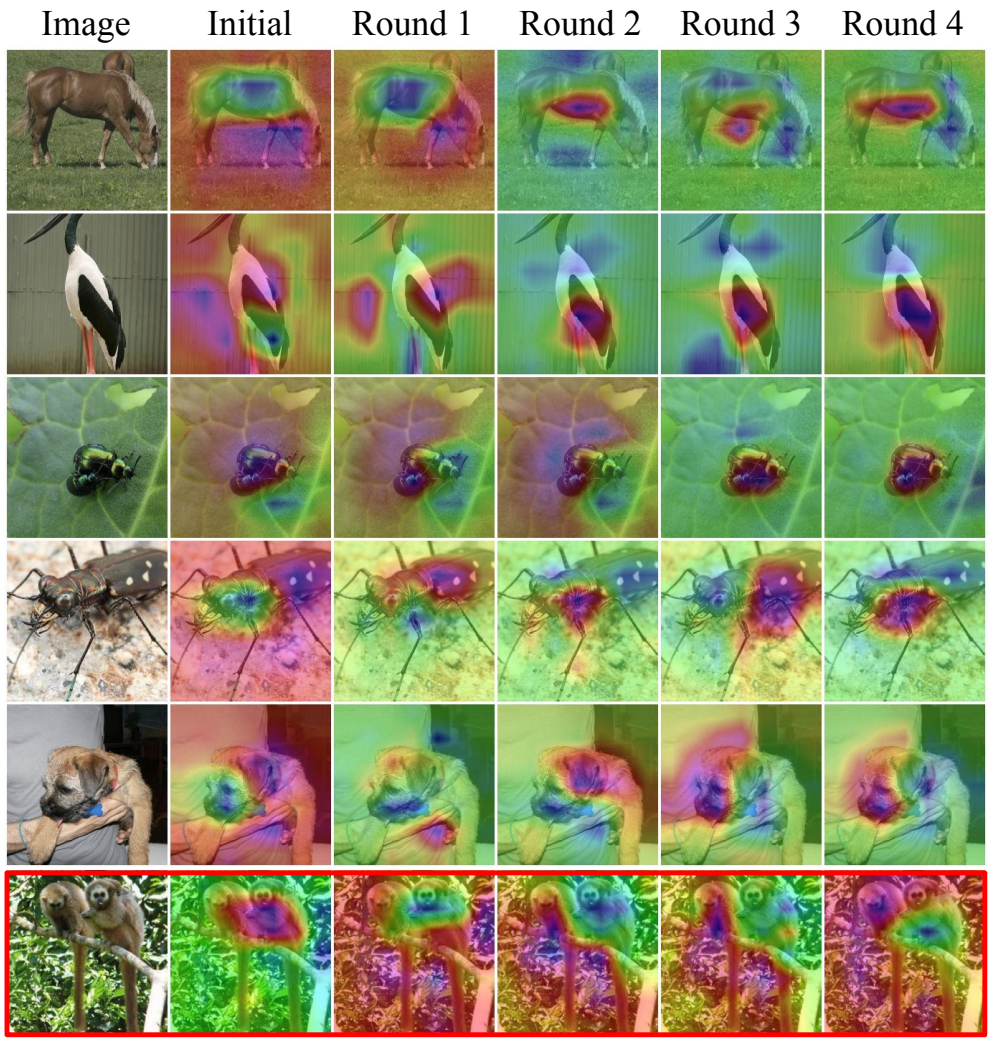
- Large scale Image Classification



- Fine-grained Image Classification (*k*NN)



Evolving attention



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Thank You!

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