16TH EUROPEAN CONFERENCE ON

COMPUTER VISION

WWW.ECCV2020.EU

Associative Alignment for Few-shot Image Classification

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https://lvsn.github.io/associative-alignment/

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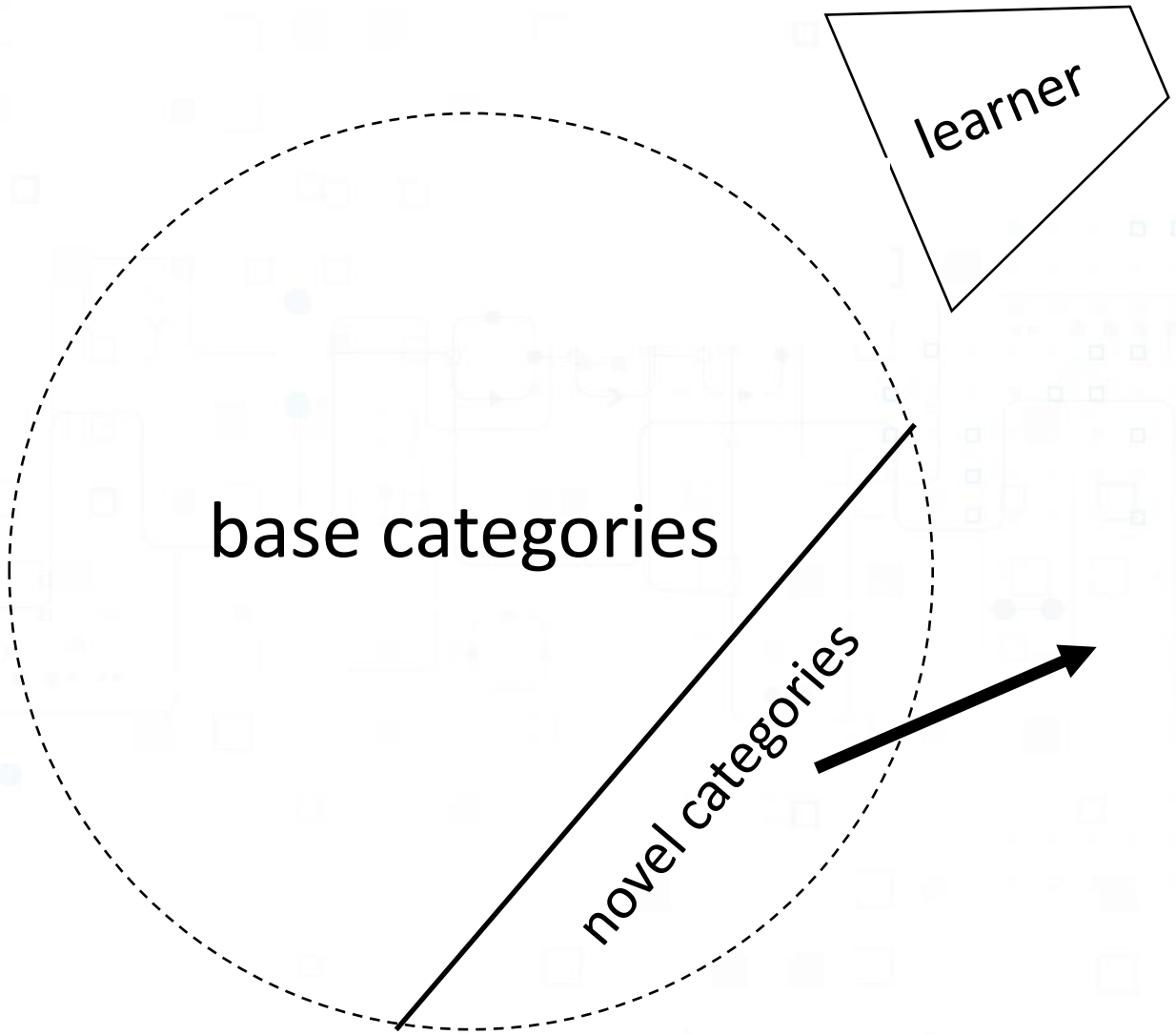
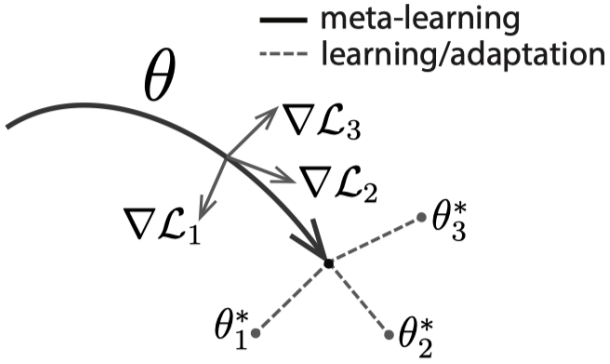
Few-shot learning

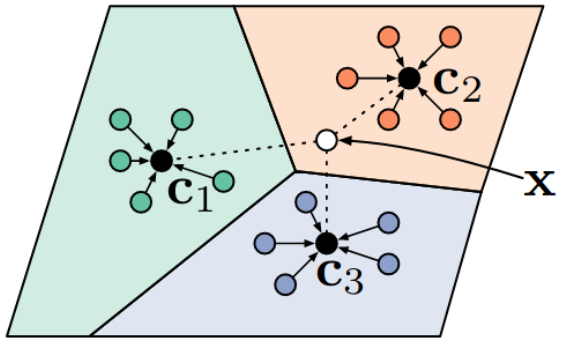


Related works

I) Meta Learning

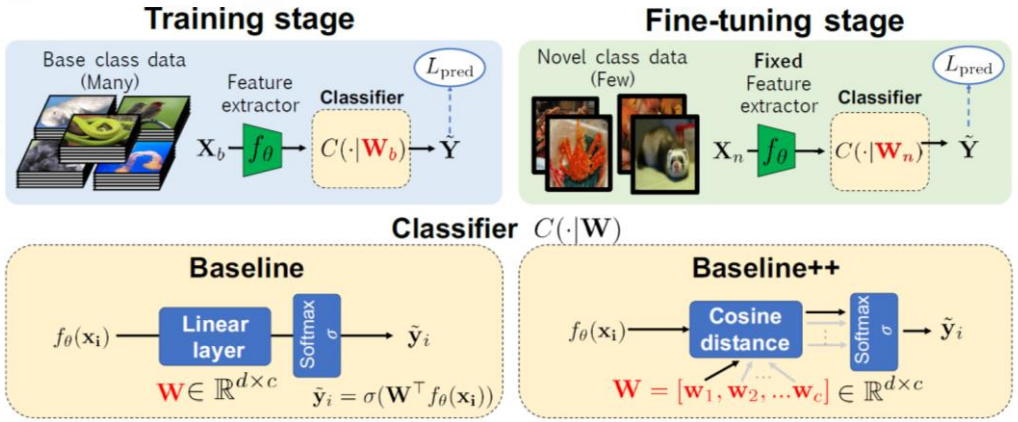


MAML



Proto. Net.

II) Transfer Learning



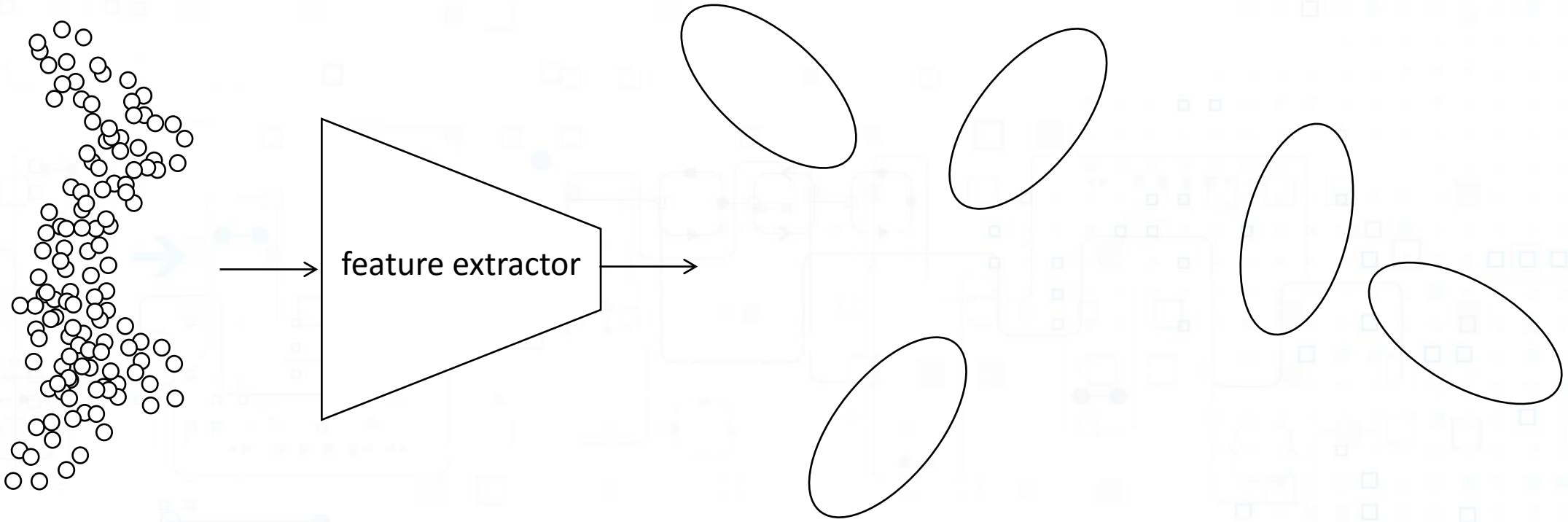
Baseline++

Finn, C., Abbeel, P., Levine, S.: Model-agnostic meta-learning for fast adaptation of deep networks. In: The International Conference on Machine Learning (2017)

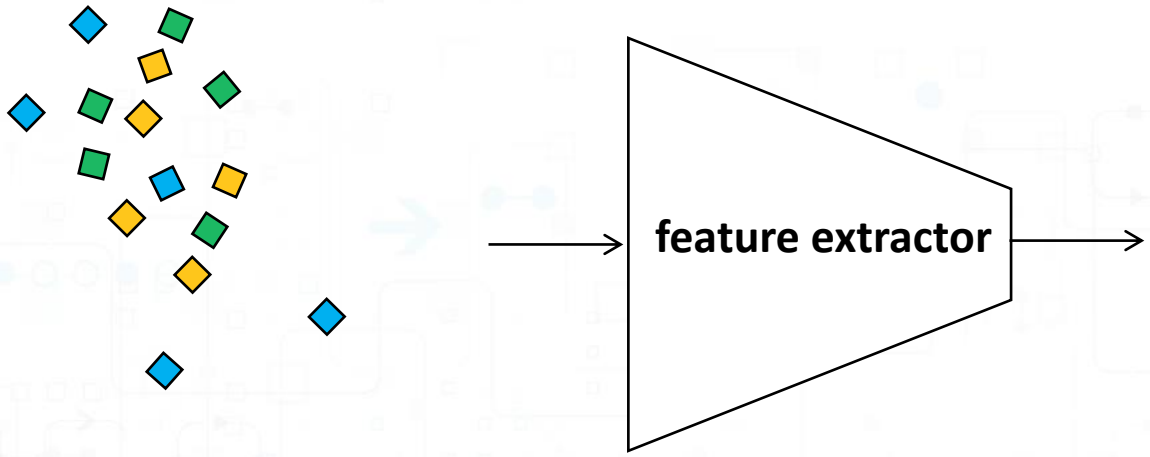
Snell, J., Swersky, K., Zemel, R.: Prototypical networks for few-shot learning. In: Advances in Neural Information Processing Systems(2017)

Chen, W.Y., Liu, Y.C., Kira, Z., Wang, Y.C.F., Huang, J.B.: A closer look at few-shot classification. arXiv preprint arXiv:1904.04232 (2019)

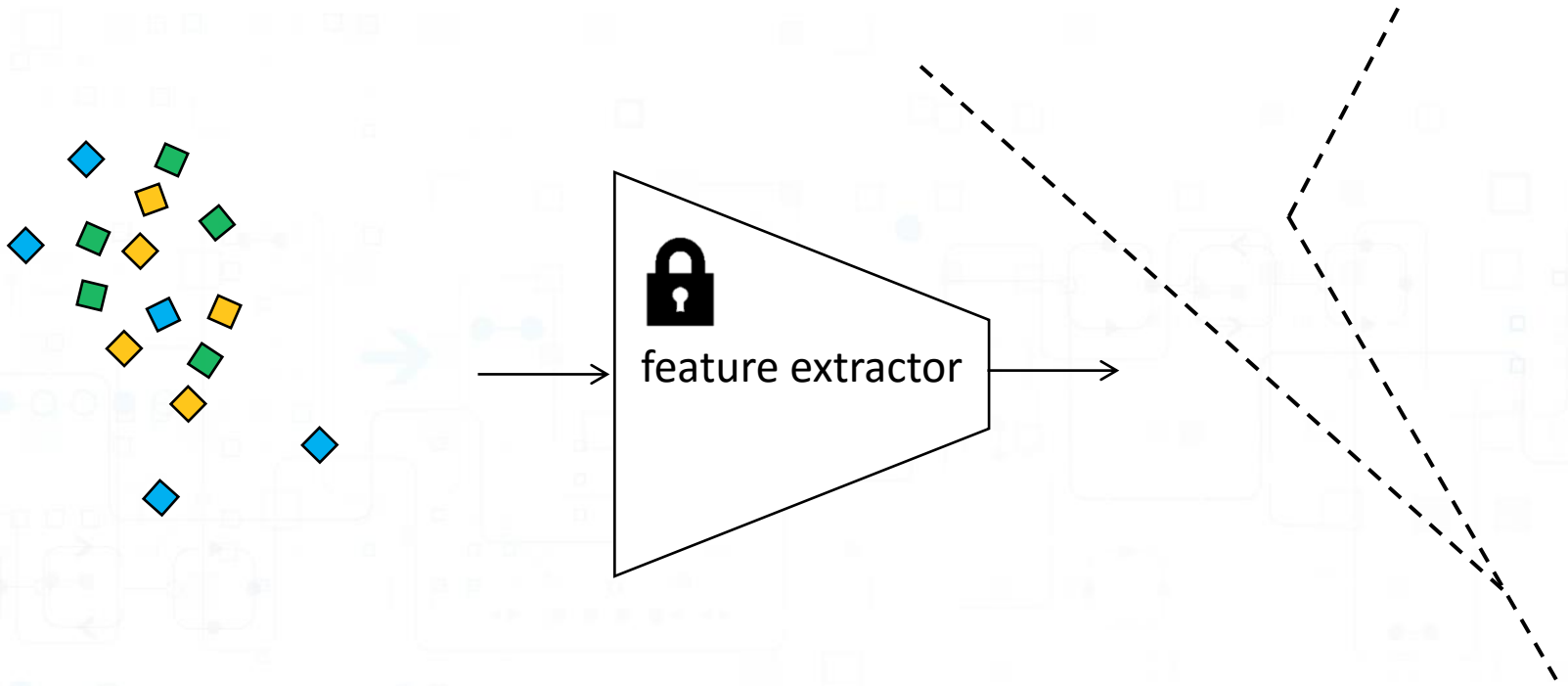
Stage 1: pretraining



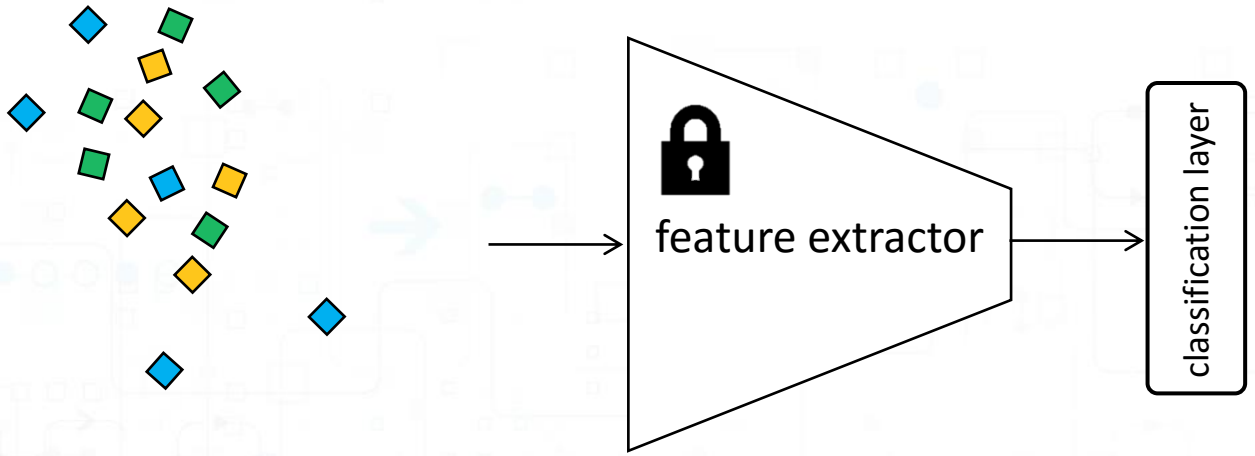
Stage 2: fine-tuning



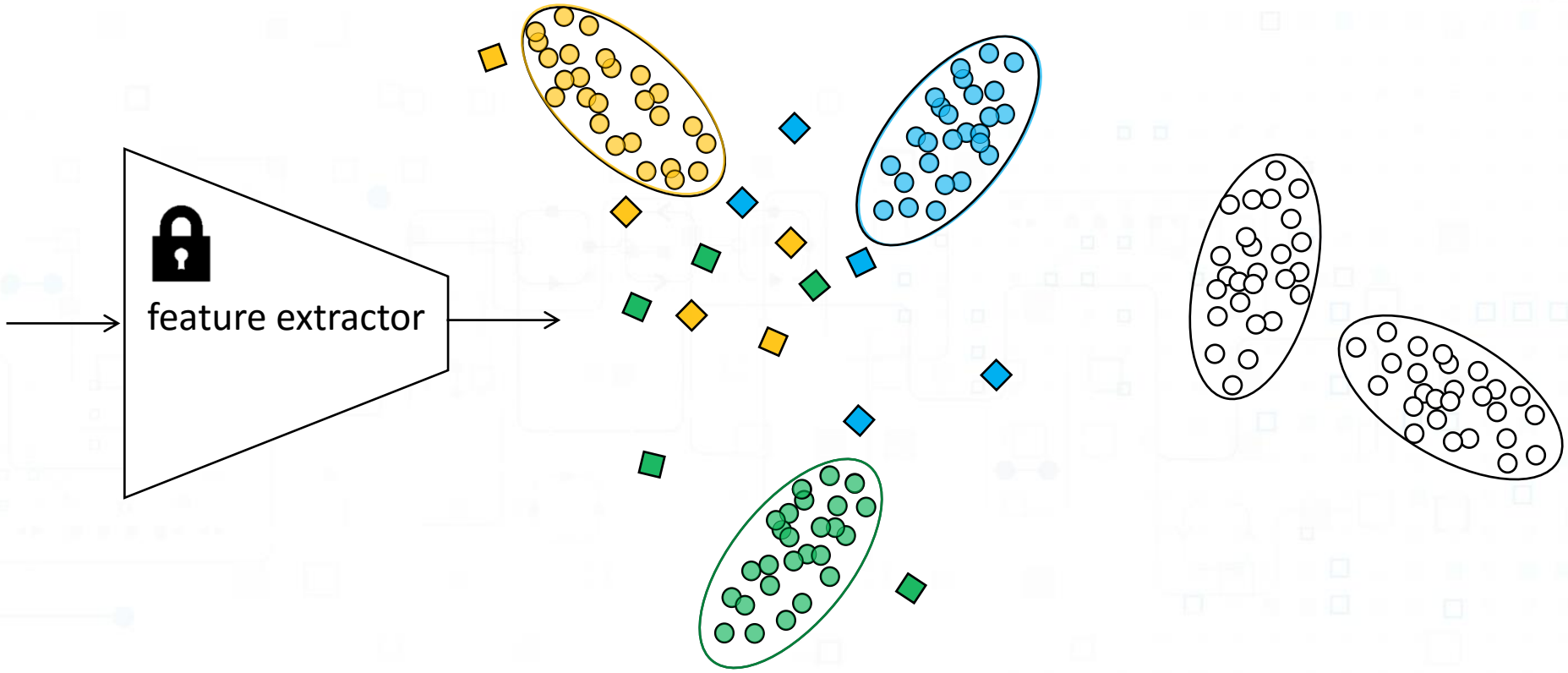
Stage 2: fine-tuning



Detecting related bases

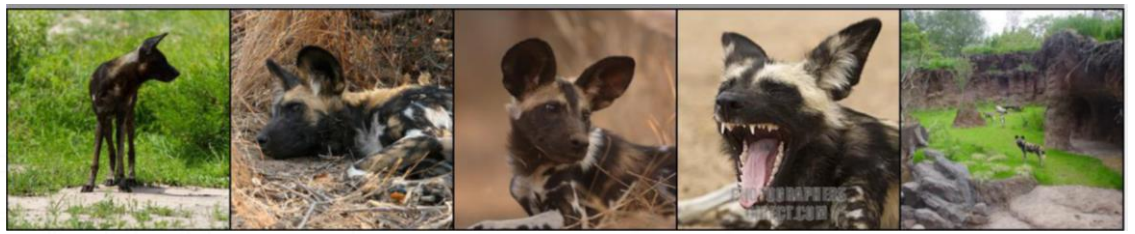


Detecting related bases

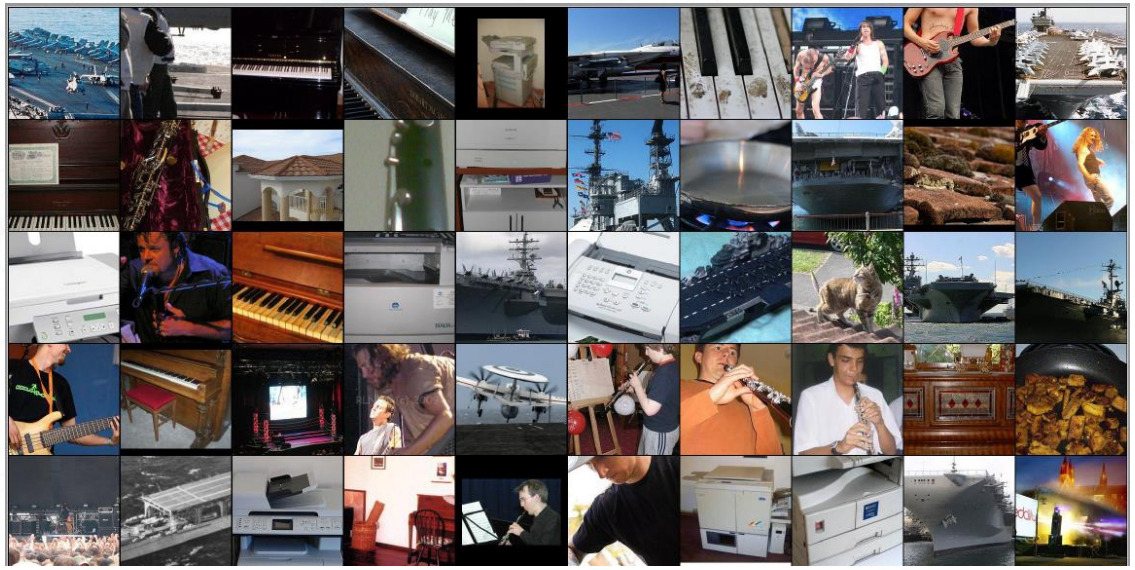


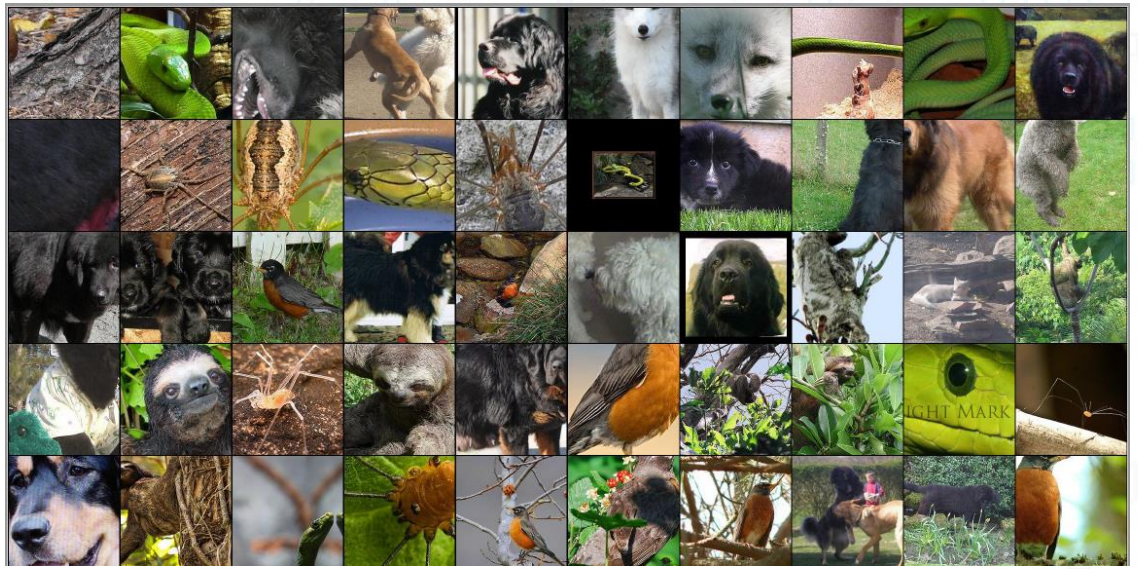
Example of related bases

novel

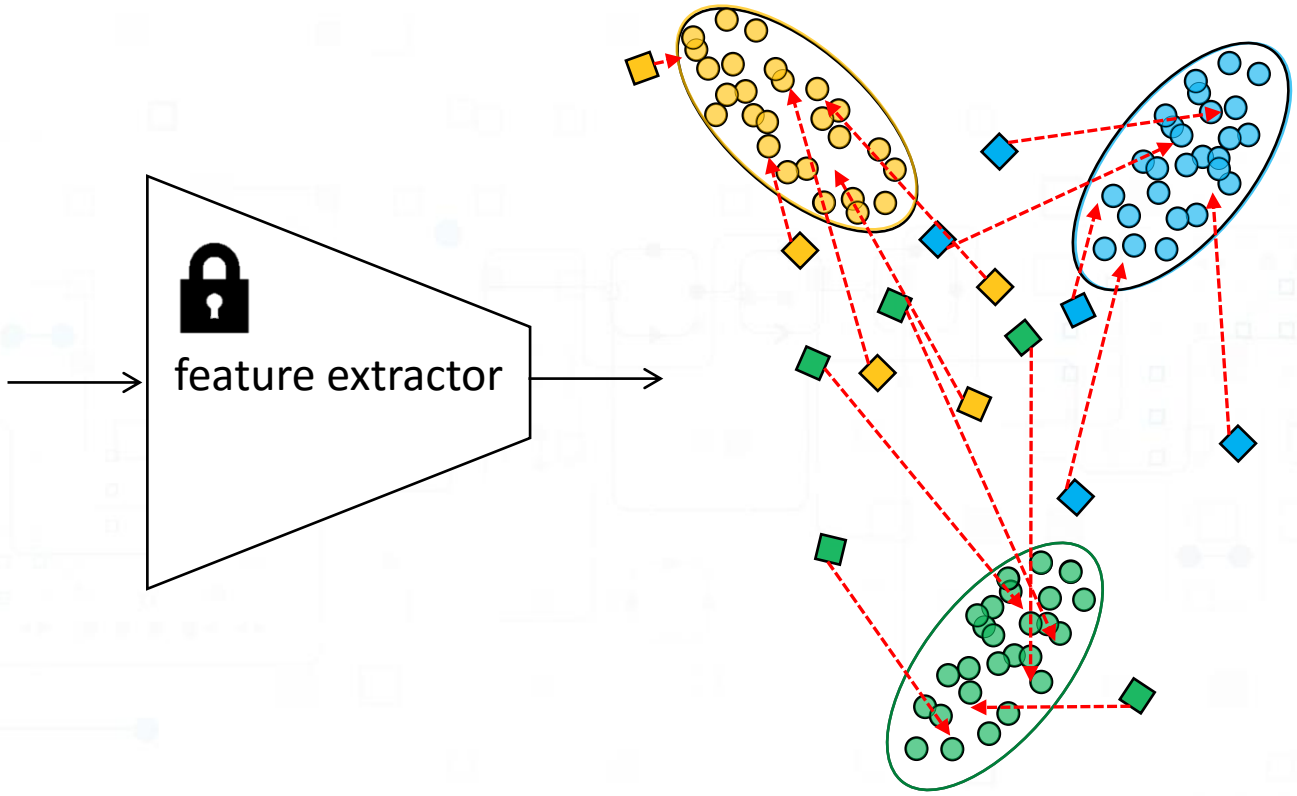


related bases





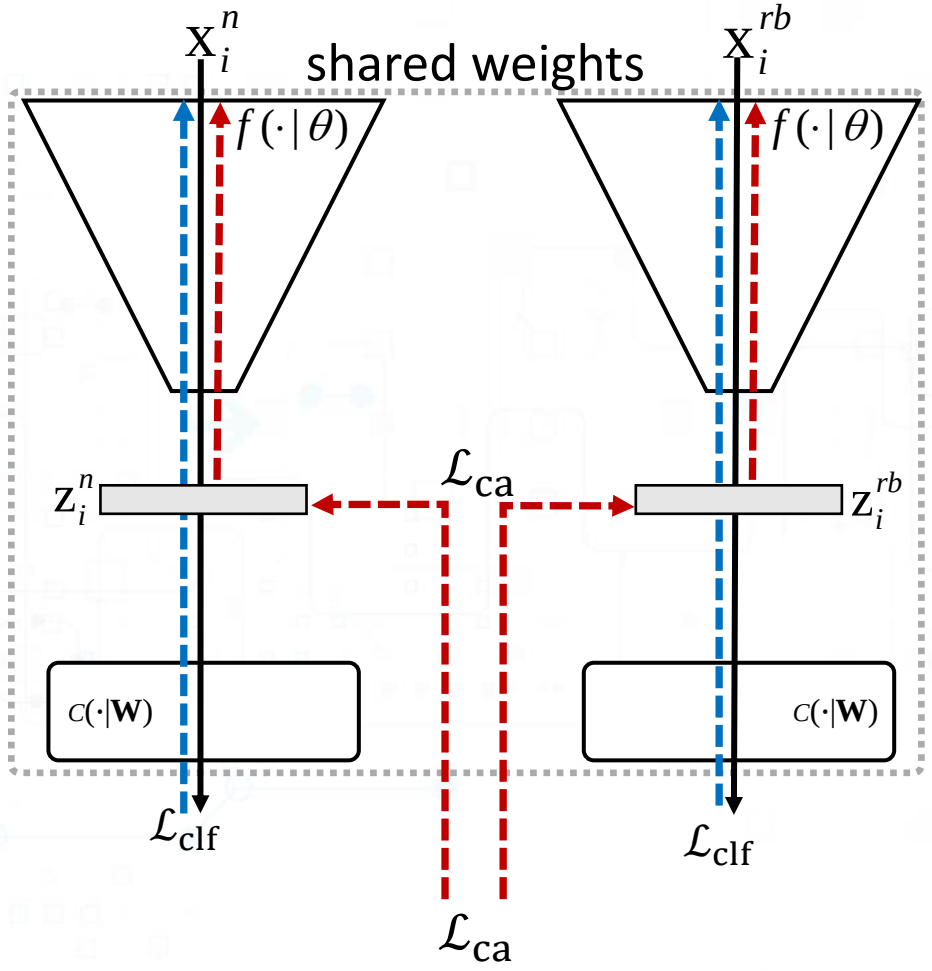
Associative alignment



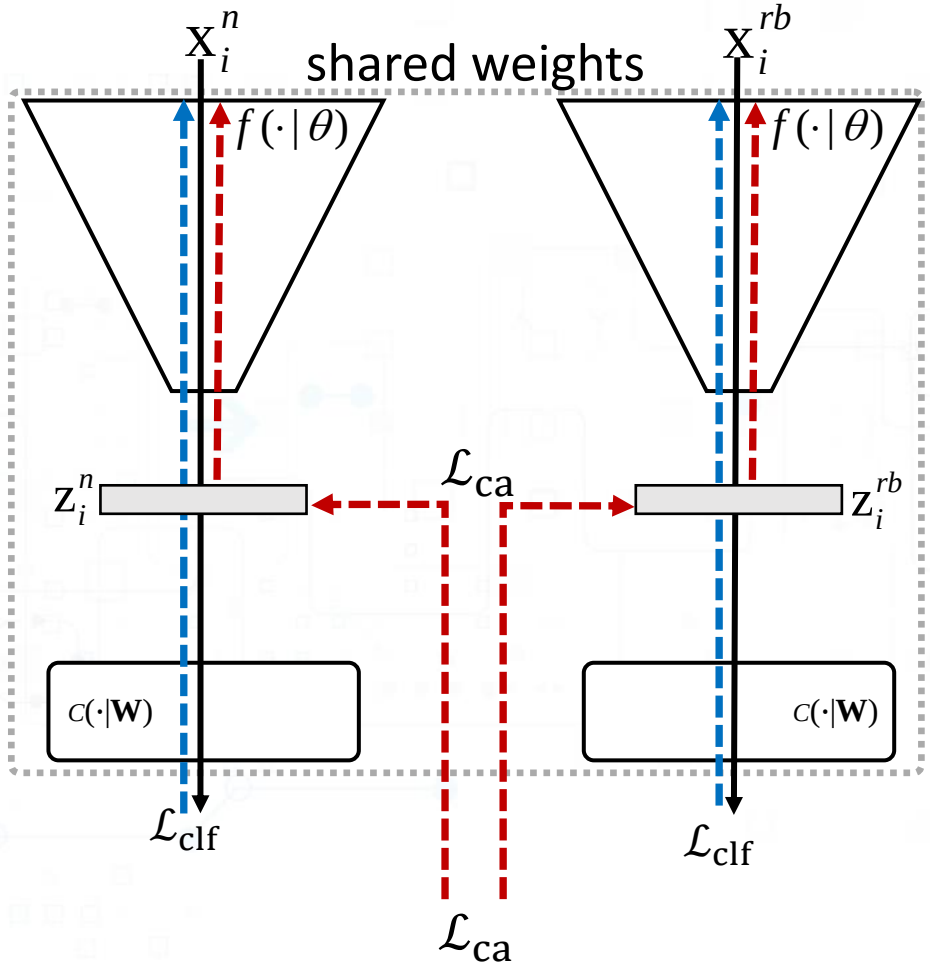
Associative alignment

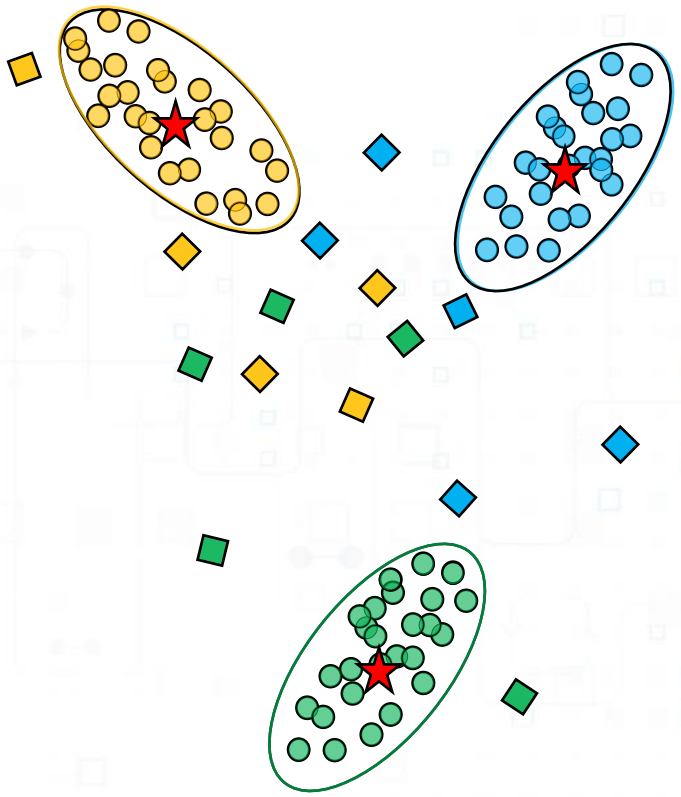
- Centroid Alignment
- Adversarial Alignment

Centroid alignment

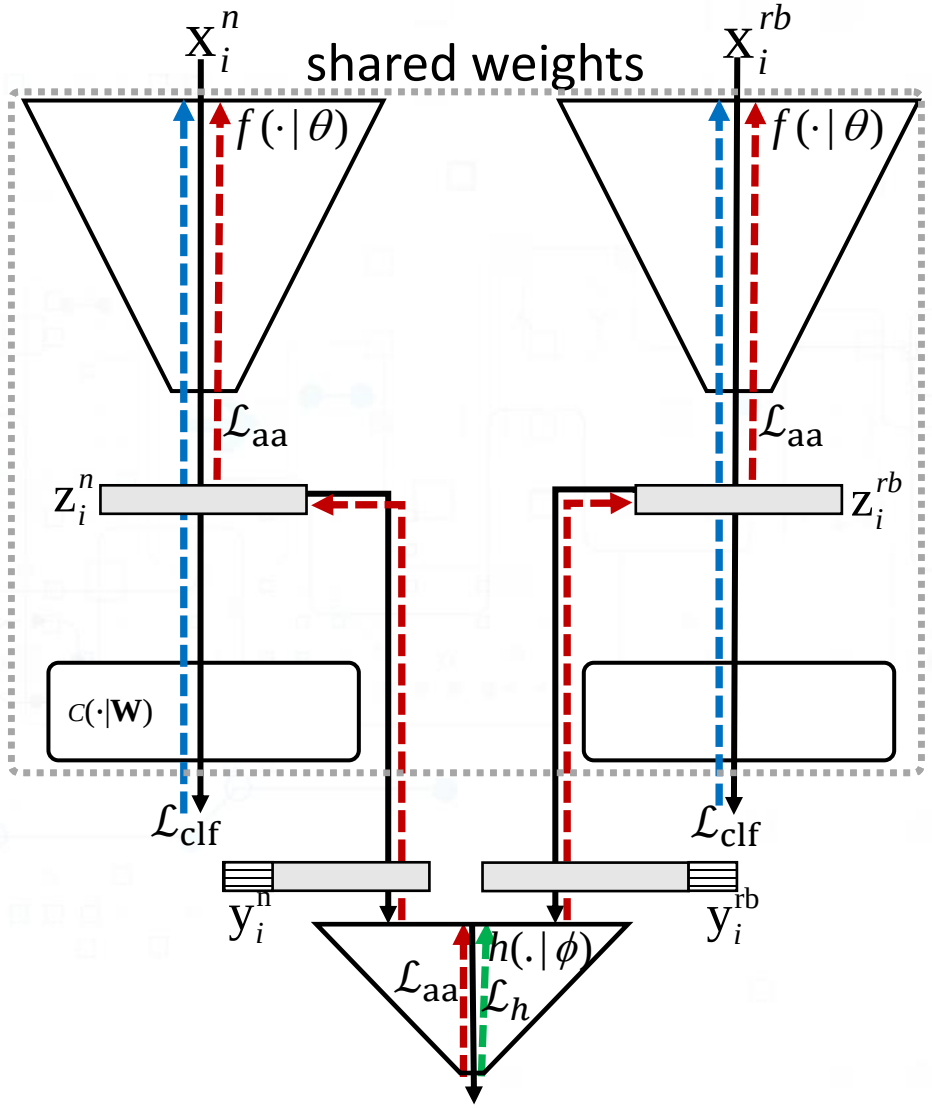


Centroid alignment

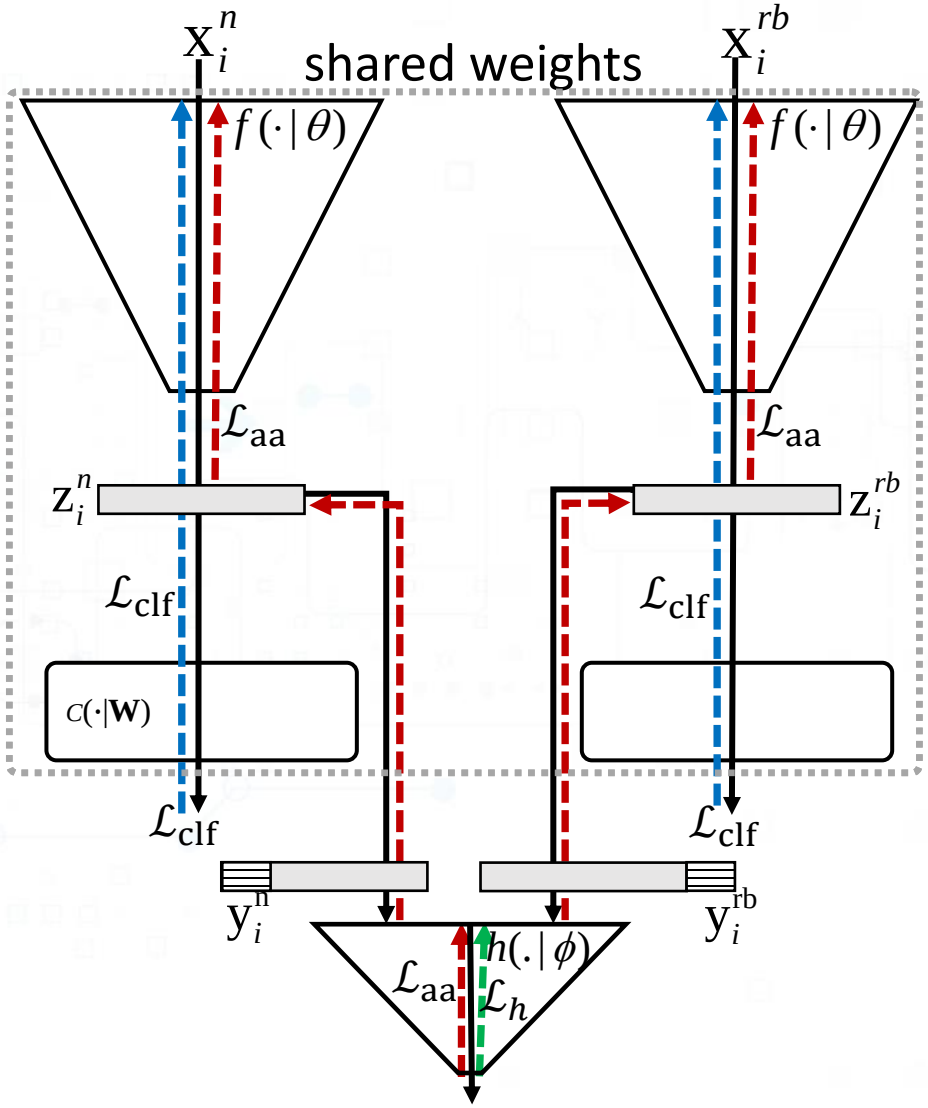


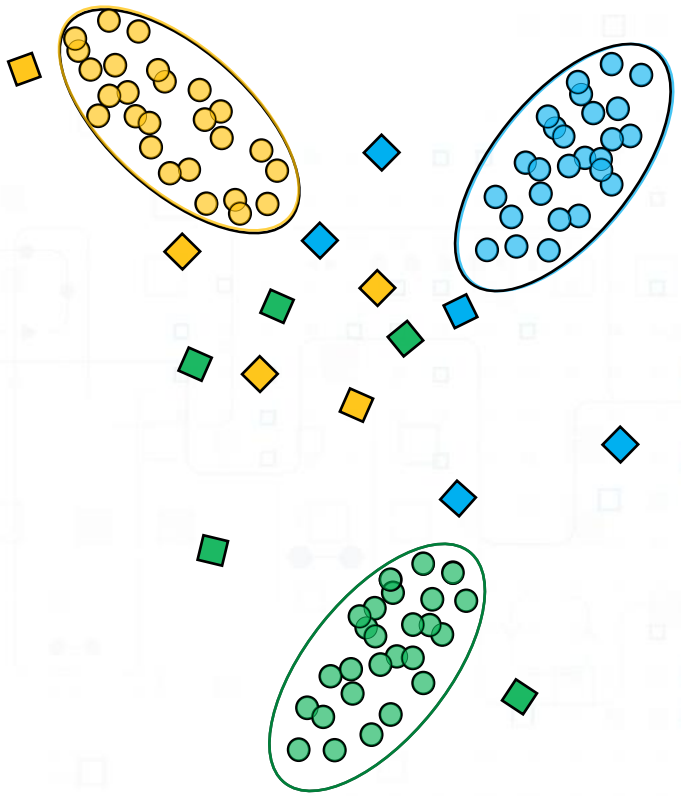


Adversarial alignment

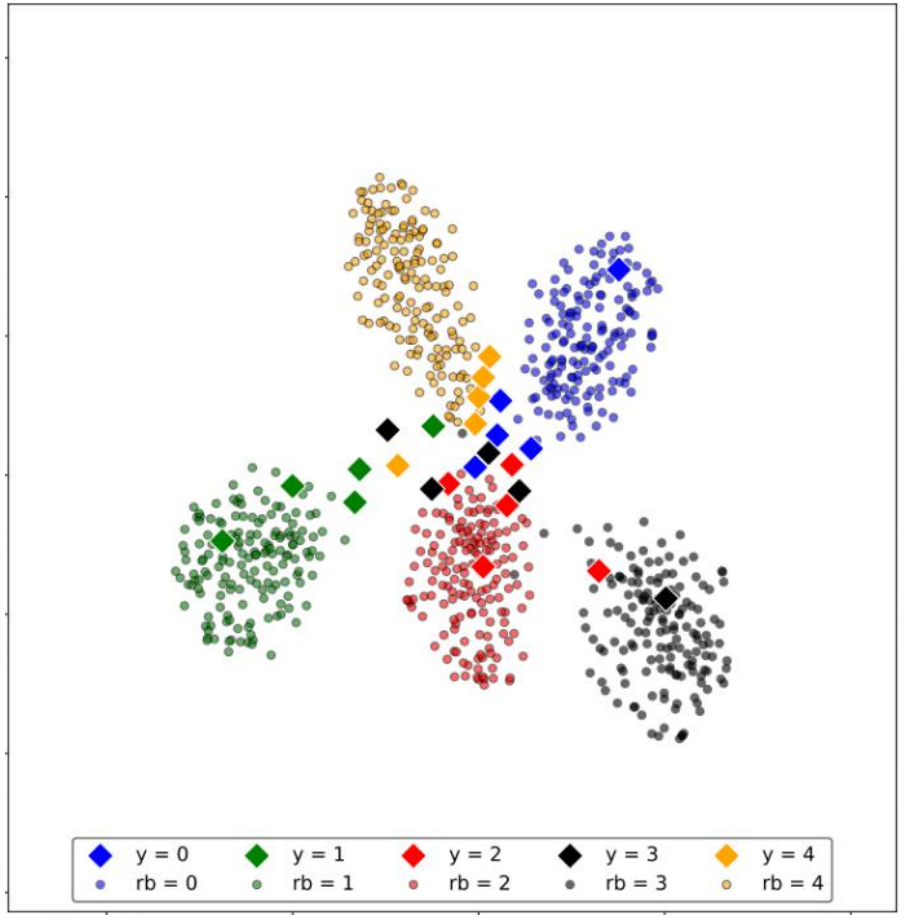


Adversarial alignment

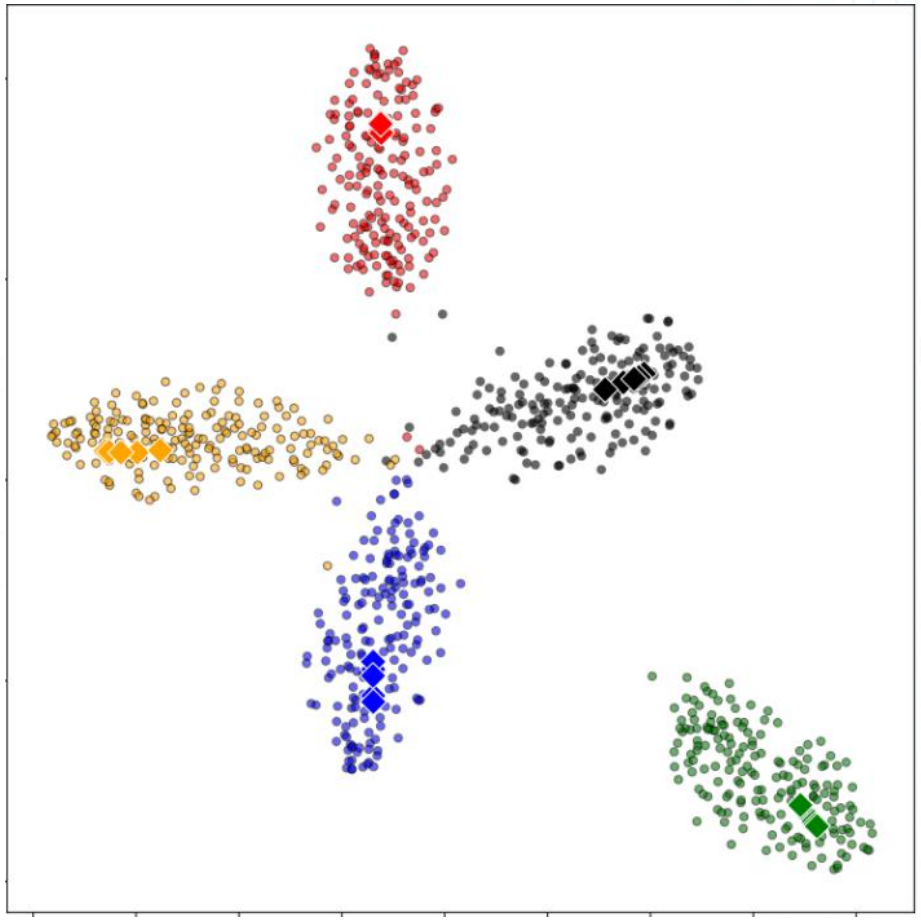




t-SNE visualization

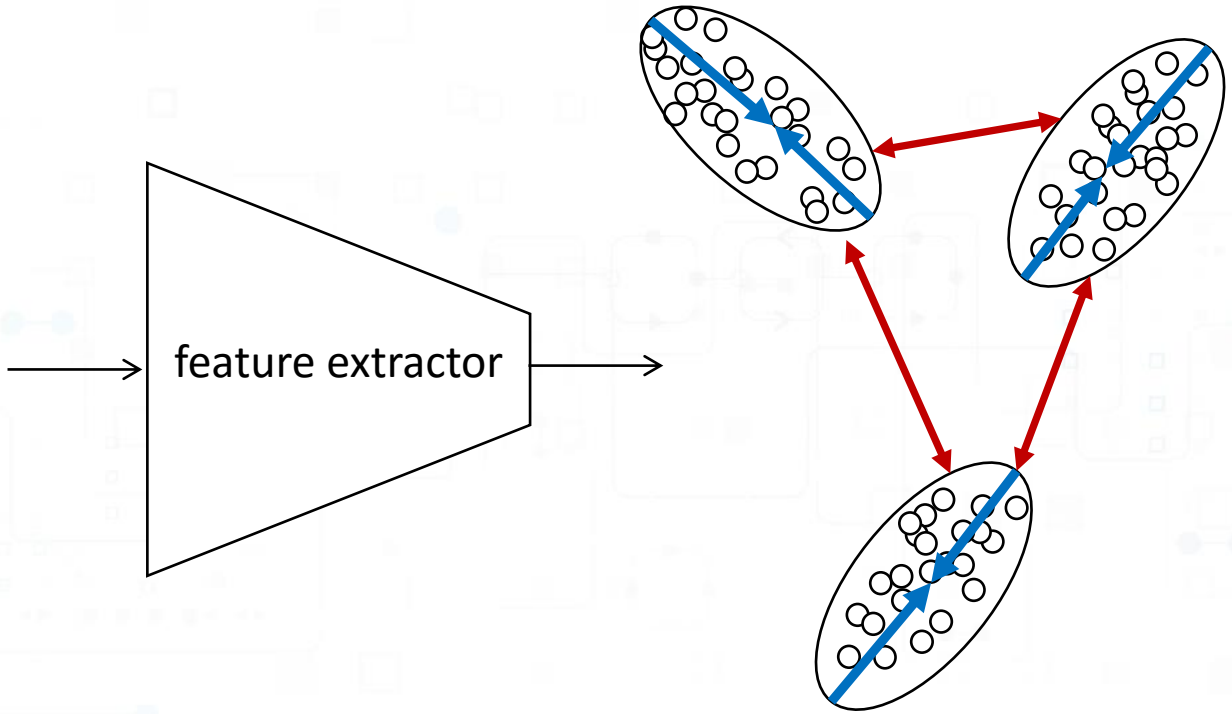


before alignment



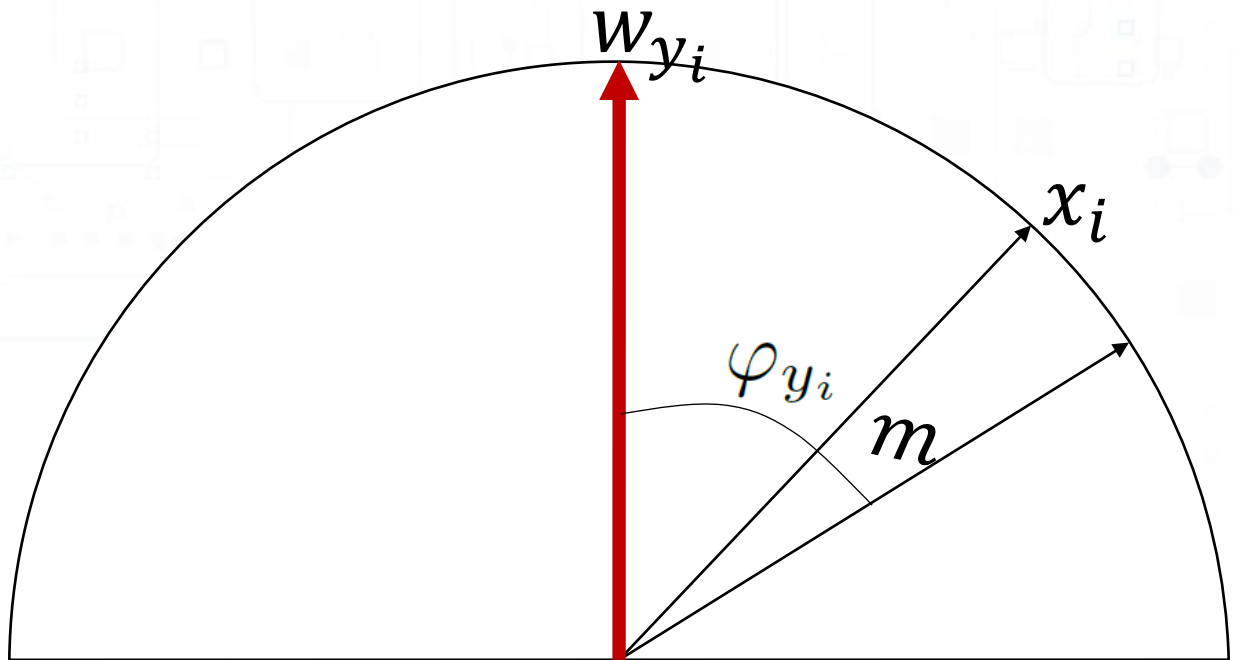
after alignment

Strong baseline



Strong baseline

$$\mathcal{L}_{\text{clf}} = \frac{-1}{N}\sum_{i=1}^{N}\log\frac{\exp(s\cos(\varphi_{y_i}+m))}{\exp(s\cos(\varphi_{y_i}+m))+\sum_{\forall j\neq y_i}\exp(s\cos\varphi_j)}$$



Experiments

Datasets

- Object recognition
  - *mini*ImageNet
  - tieredImageNet
  - FC100
- Fine-grained classification
  - CUB
- Cross-domain adaptation
  - from *mini*ImageNet to CUB

Backbones

- Conv4
- ResNet-18
- WRN-28-10

*mini*ImageNet and CUB

Conv4

	Method	*mini*-ImageNet 1-shot	*mini*-ImageNet 5-shot	CUB 1-shot	CUB 5-shot
meta learning	Meta-LSTM [36]	43.44	55.31		
	MatchingNet‡ [47]	43.56	55.31	60.52	75.29
	ProtoNet‡ [42]	49.42	68.20	51.31	70.77
	MAML‡ [10]	48.07	63.15	55.92	72.09
	RelationNet‡ [44]	50.44	65.32	62.45	76.11
tr. learning	softmax†	46.40	64.37	47.12	64.16
	softmax†◇	46.99	65.33	45.68	66.94
	cosmax†	50.92	67.29	60.53	79.34
	cosmax†◇	52.04	68.47	60.66	79.79
	our baseline (sec. 5)	51.90	69.07	60.85	79.74
align.	adversarial	52.13	70.78	**63.30**	**81.35**
	centroid	**53.14**	**71.45**	62.71	80.48

*mini*ImageNet and tieredImageNet

Wide ResNet 28-10

	mini-ImageNet		tieredImageNet	
Method	**1-shot**	**5-shot**	**1-shot**	**5-shot**
LEO [39]	61.76	77.59	66.33	81.44
wDAE [15]	61.07	76.75	68.18	83.09
CC+rot [13]	62.93	79.87	70.53	84.98
Robust-dist++ [39]	63.28	81.17		
Transductive-ft [7]	65.73	78.40	73.34	85.50
our baseline (sec. 5)	63.28	78.31	68.47	84.11
adversarial alignment	64.79	82.02	73.87	84.95
centroid alignment	**65.92**	**82.85**	**74.40**	**86.61**

FC100 and CUB

ResNet18

Method	FC100 1-shot	FC100 5-shot	CUB 1-shot	CUB 5-shot
Robust-20 [8]	–	–	58.67	75.62
GNN-LFT [45]	–	–	51.51	73.11
RelationNet‡ [44]	–	–	67.59	82.75
ProtoNet‡ [42]	40.5	55.3	71.88	87.42
TADAM [33]	40.1	56.1	–	–
MetaOptNet† [24]	41.1	55.5	–	–
MTL [43]	45.1	57.6	–	–
Transductive-ft [7]	43.2	57.6	–	–
our baseline (sec. 5)	40.84	57.02	71.71	85.74
adversarial	43.44	58.69	70.80	88.04
centroid	**45.83**	**59.74**	**74.22**	**88.65**

Cross domain: from *mini*ImageNet to CUB

ResNet18

Method	1-shot	5-shot	10-shot
ProtoNet‡ [49]	–	62.02	–
MAML‡ [10]	–	51.34	–
RelationNet‡ [44]	–	57.71	–
Diverse 20 [8]	–	66.17	–
cosmax† [3]	43.06	64.38	67.56
our baseline (sec. 5)	45.60	64.93	68.95
adversarial	44.37	70.80	79.63
centroid	46.85	70.37	**79.98**

Summary

Our approach:

- **prevents overfitting without restricting the learning capacity** of the network
- does **not need any additional data**
- **can easily apply to any backbones** without any extra learning modules

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Thank you for your attention!