Domain Adaptation

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You have learned a lot about ML. Training a classifier is not a big deal for you. ☺

Training Data

Testing Data

99.5%

57.5%

The results are from: http://proceedings.mlr.press/v37/ganin15.pdf

Domain shift: Training and testing data have different distributions.

→ **Domain adaptation**

迁移学习

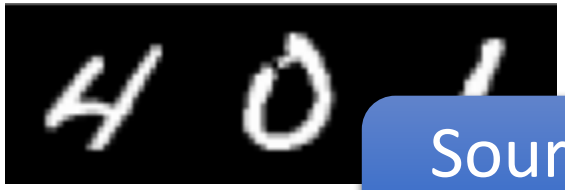
Transfer learning: https://youtu.be/qD6iD4TFsdQ

Domain adaptation可以被看作是transfer learning的一种。

Domain Shift

1. 输入分布有变化

Training Data



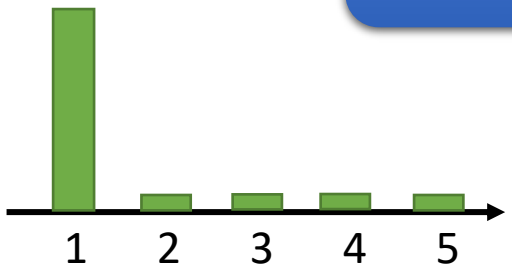
Source Domain

Testing Data

Target Domain

这节课关注这种类型

2. 输出分布有变化



3. 输入和输出的关系不一样

This is “0”.

This is “1”.

Domain Adaptation

Source Domain
(with labeled data)

“4” “0” “1”

Knowledge of target domain

“8”

Little but labeled

- Idea: training a model by source data, then fine-tune the model by target data
- Challenge: only limited target data, so be careful about overfitting

Domain Adaptation

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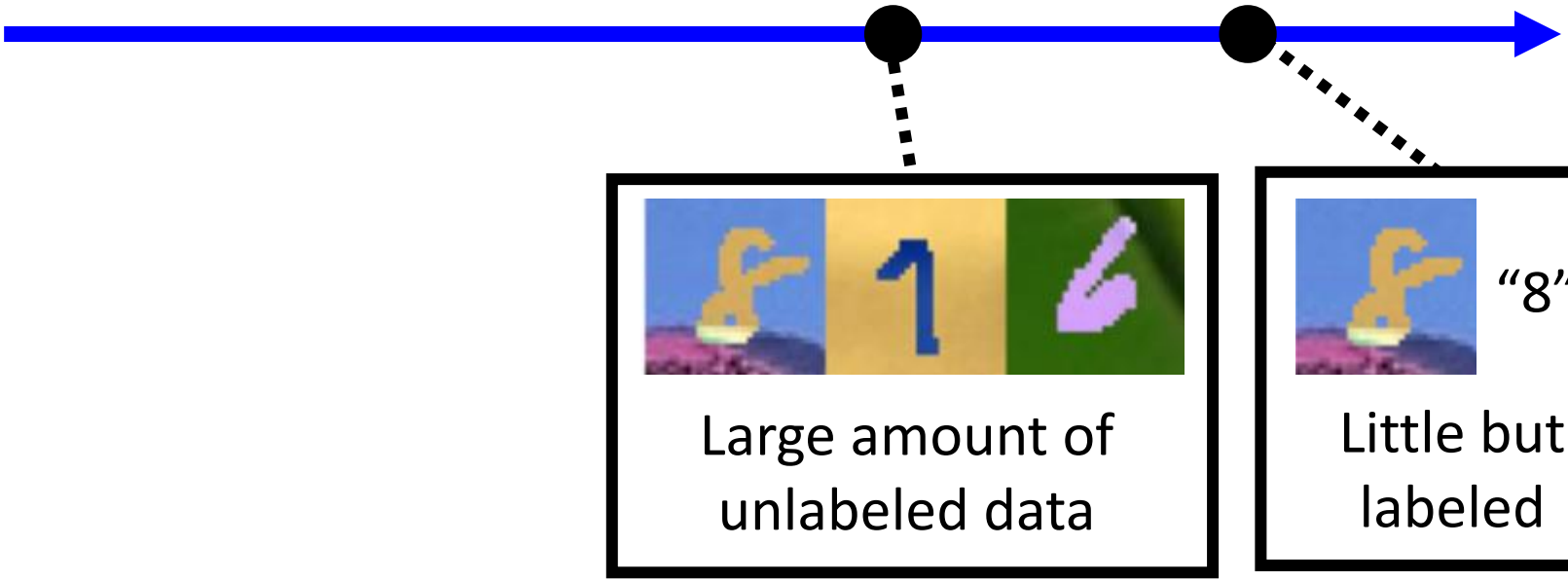
(with labeled data)

“4” “0” “1”

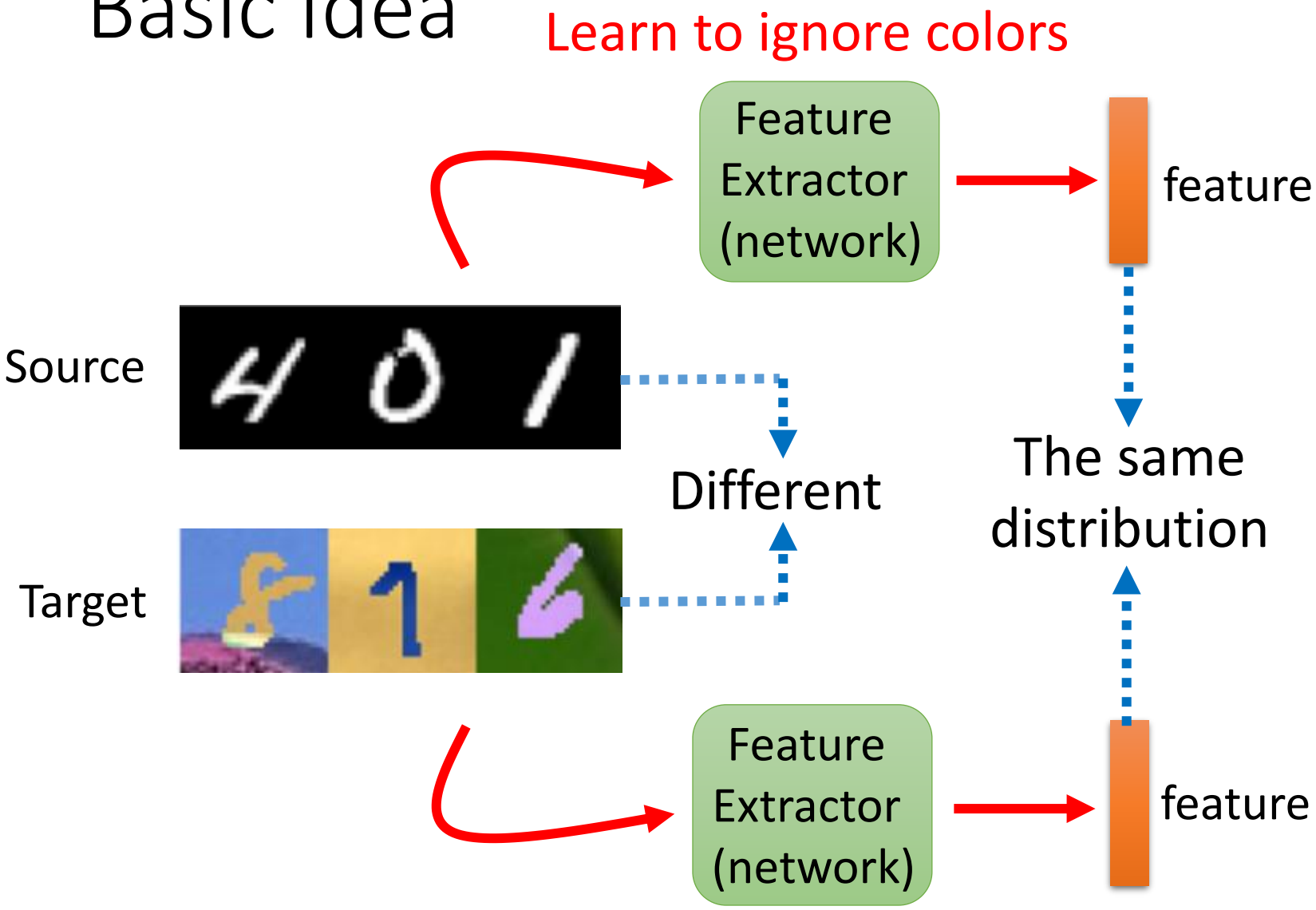
Knowledge of target domain



要解决这种情景，符合实际情况

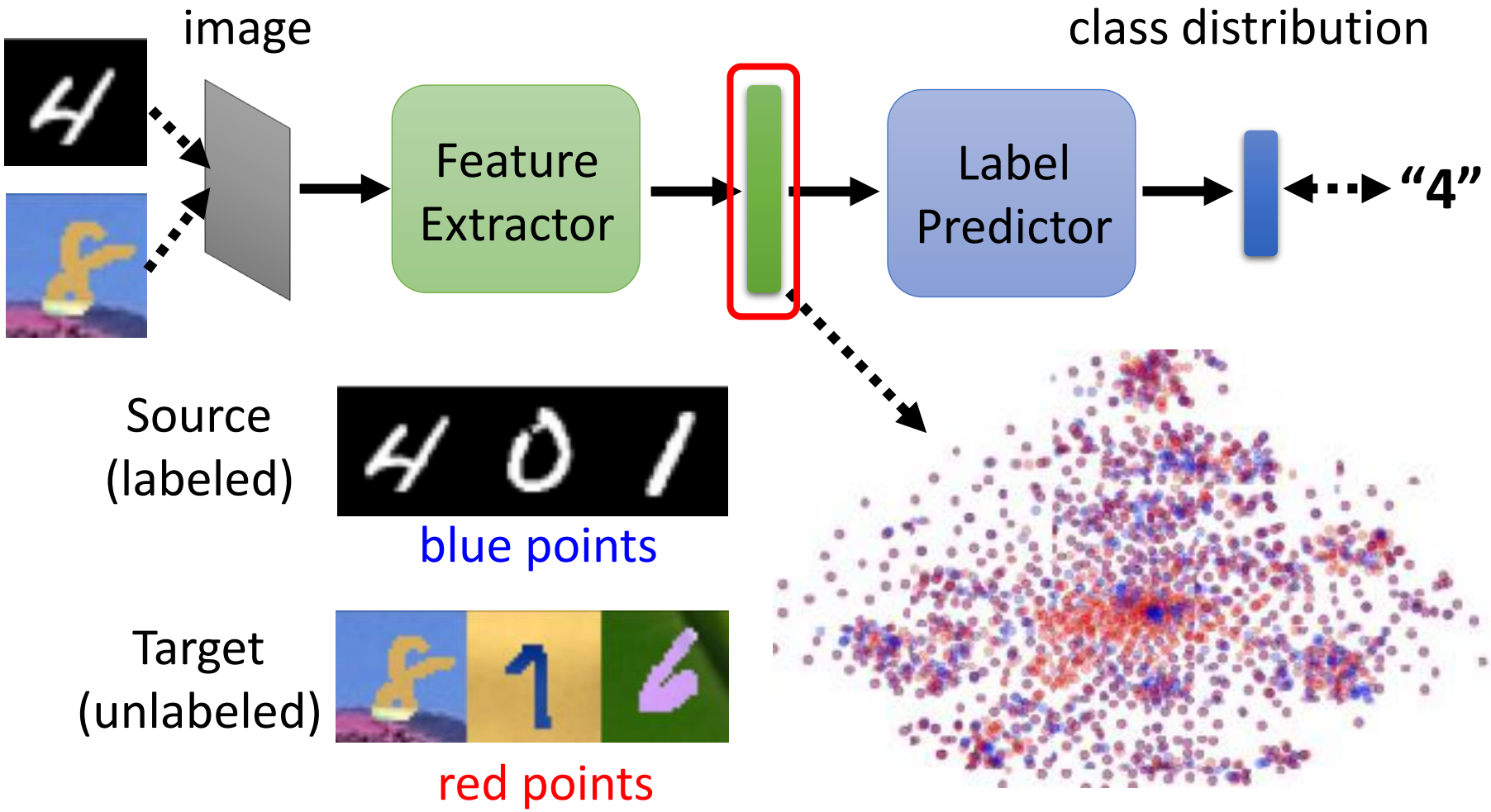
feature extractor

Basic Idea

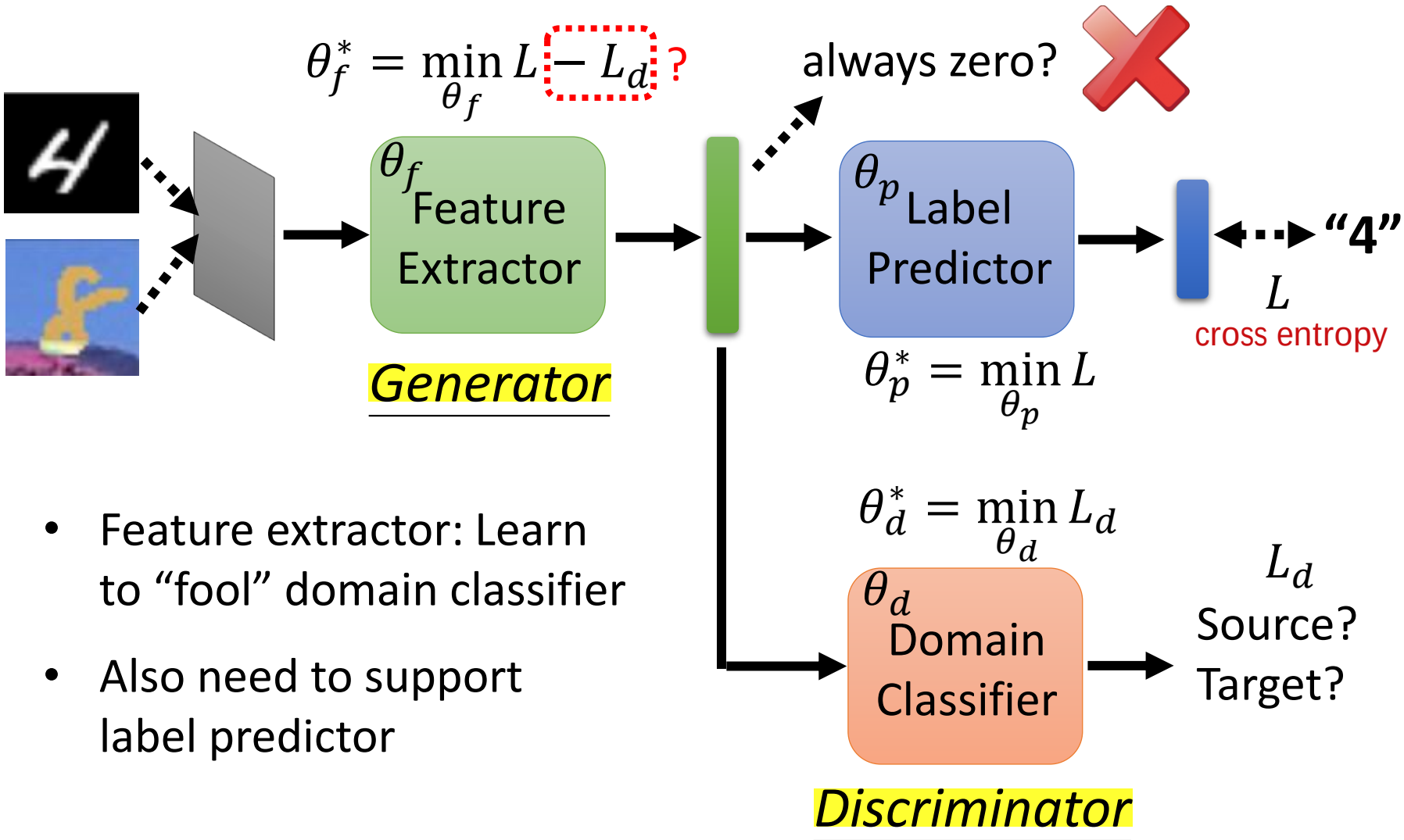


1. feature extractor
2. label predictor

Domain Adversarial Training



Domain Adversarial Training



- Feature extractor: Learn to "fool" domain classifier
- Also need to support label predictor

Domain Adversarial Training

Yaroslav Ganin, Victor Lempitsky, Unsupervised Domain Adaptation by Backpropagation, ICML, 2015

Hana Ajakan, Pascal Germain, Hugo Larochelle, François Laviolette, Mario Marchand, Domain-Adversarial Training of Neural Networks, JMLR, 2016

METHOD	SOURCE / TARGET	MNIST / MNIST-M	SYN NUMBERS / SVHN	SVHN / MNIST	SYN SIGNS / GTSRB
SOURCE ONLY		.5749	.8665	.5919	.7400
TRAIN ON TARGET		.9891	.9244	.9951	.9987

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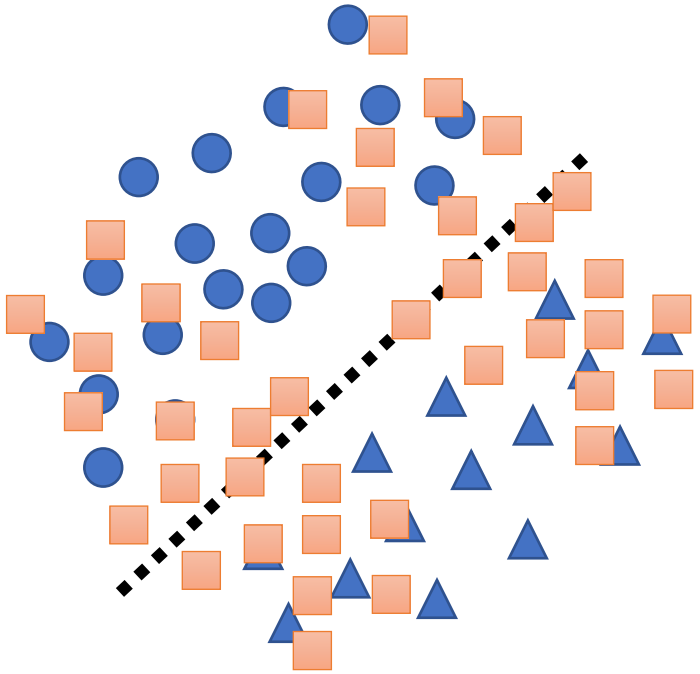
Limitation

class 1 (source)

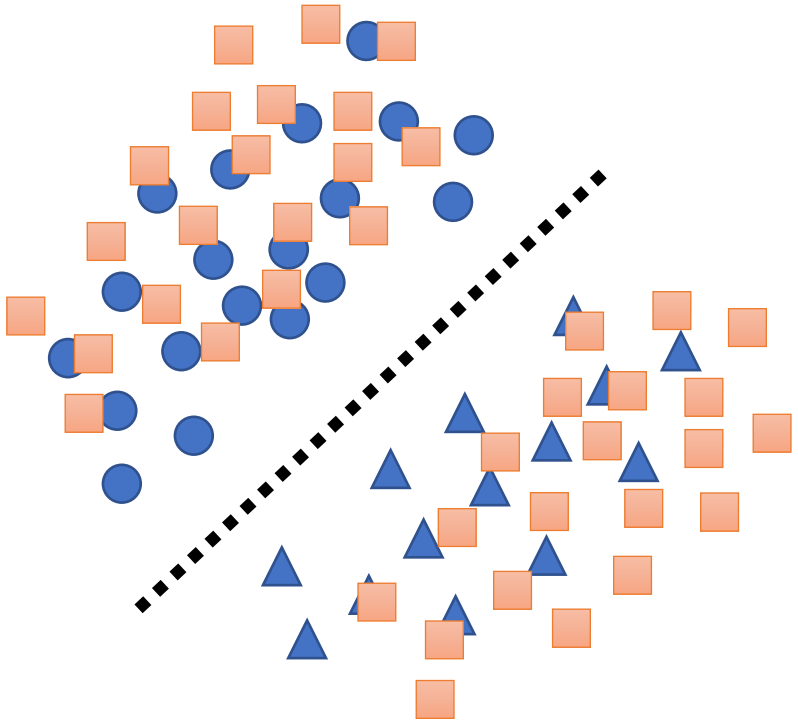
class 2 (source)

Target data (class unknown)

..... Decision boundaries learned from source domain

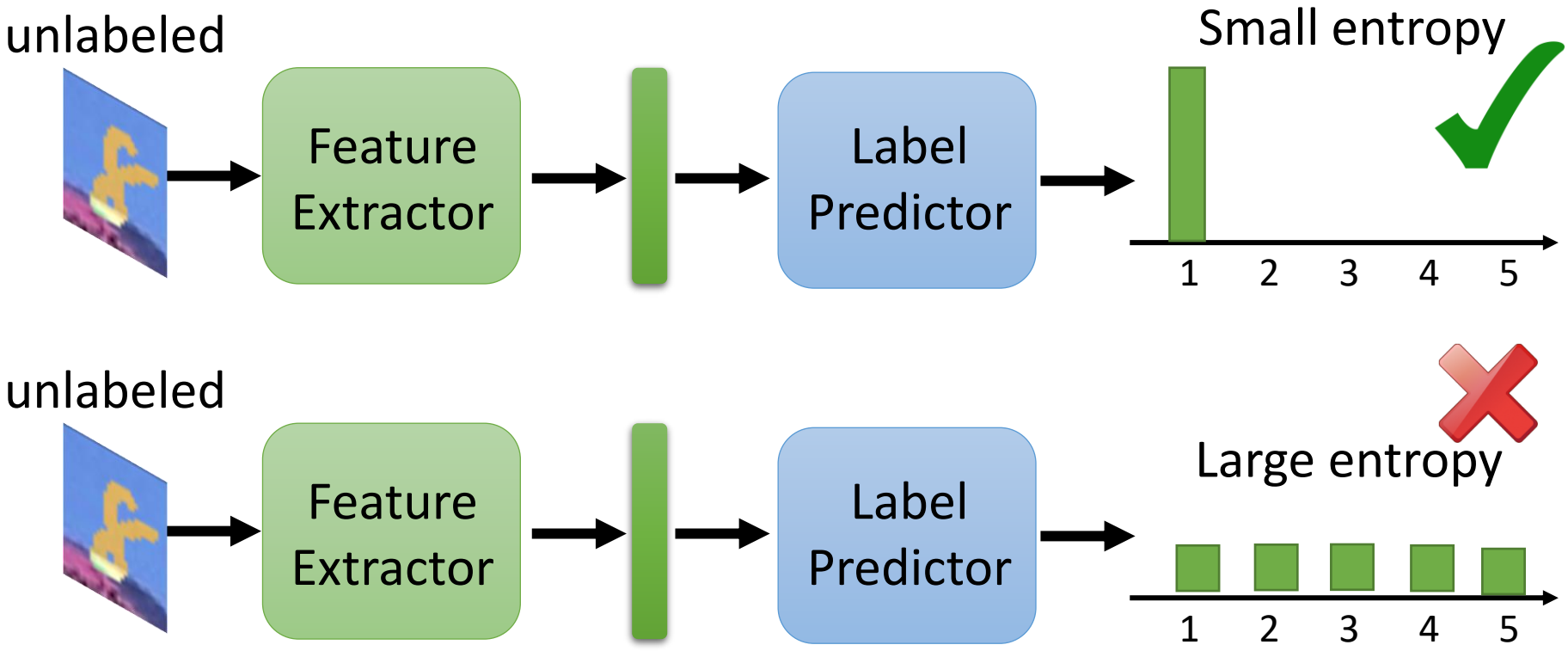


Source and target data are aligned, but ……



Target data (unlabeled far from boundary)

Considering Decision Boundary



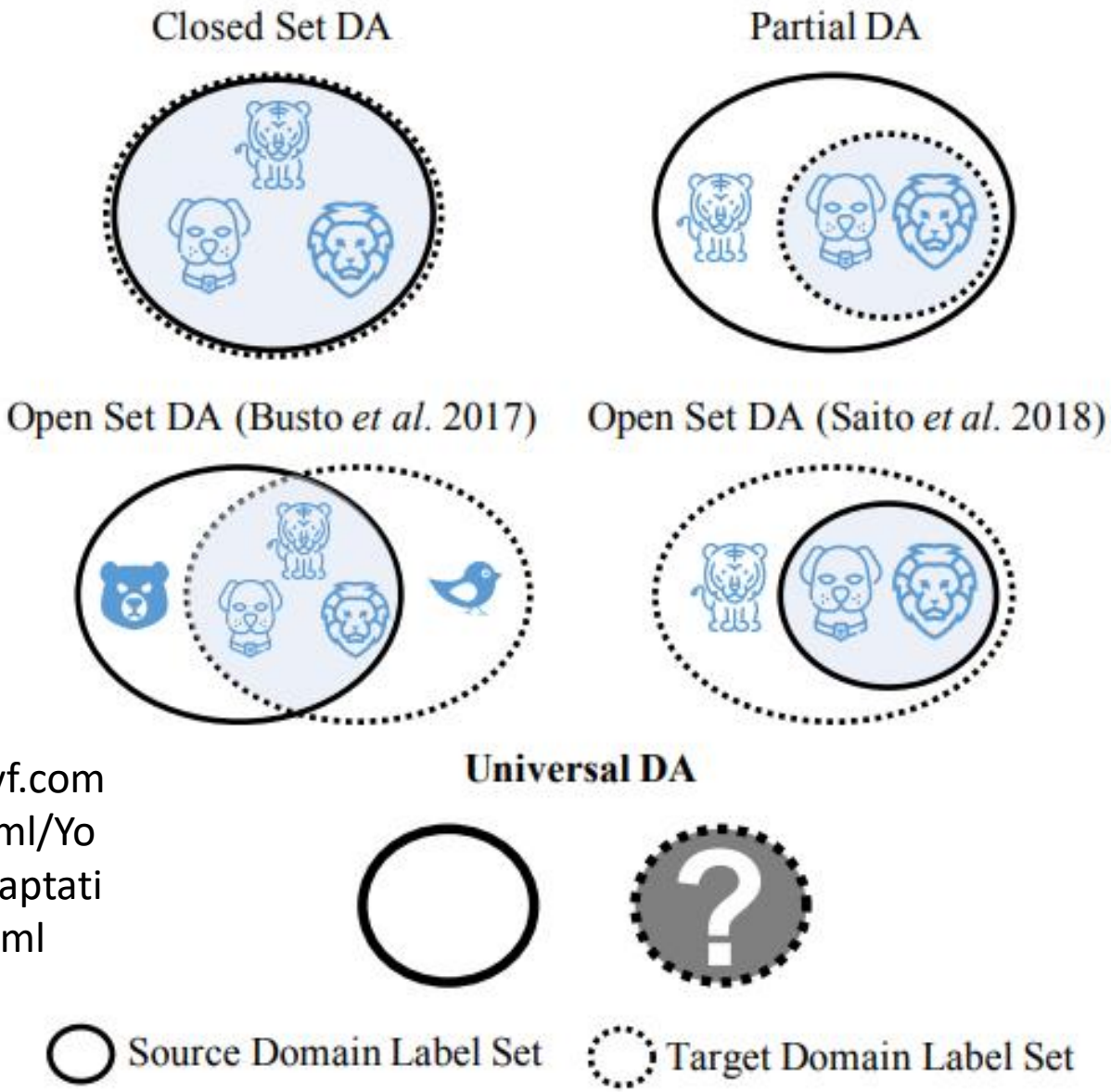
Used in Decision-boundary Iterative Refinement Training with a Teacher (DIRT-T)

https://arxiv.org/abs/1802.08735

Maximum Classifier Discrepancy

https://arxiv.org/abs/1712.02560

Outlook



Universal domain adaptation

https://openaccess.thecvf.com/content_CVPR_2019/html/You_Universal_Domain_Adaptation_CVPR_2019_paper.html

Domain Adaptation

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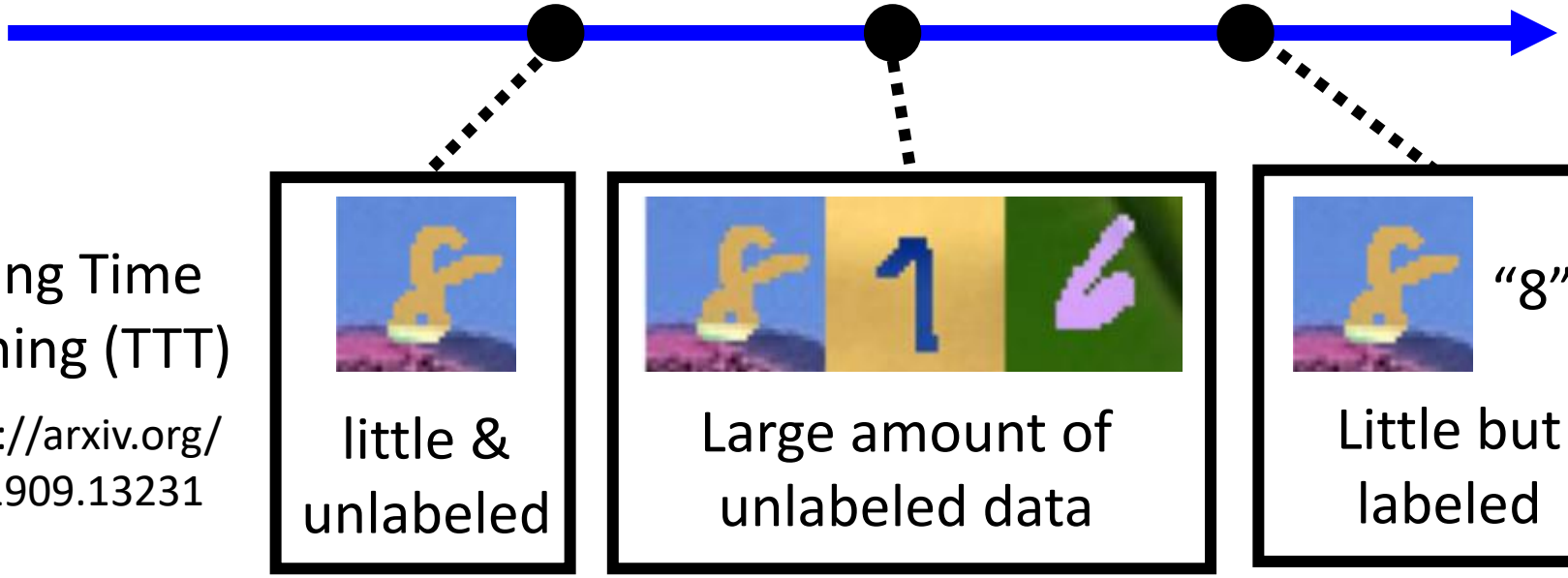
Knowledge of target domain



Domain Adaptation

Source Domain
(with labeled data)

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Knowledge of target domain

little &
unlabeled

Large amount of
unlabeled data

“8”

Little but
labeled

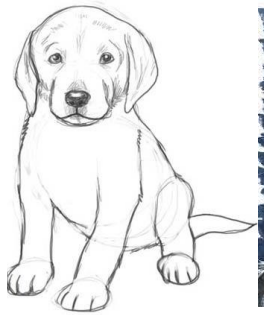
Domain Generalization

https://ieeexplore.ieee.org/document/8578664


cat


dog


cat


dog


cat


dog

Training


cat


dog

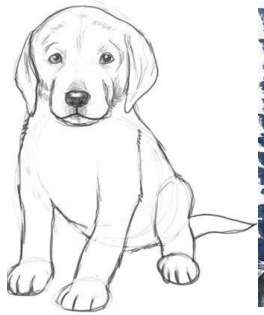
Testing


cat


dog

Training


cat


dog


cat


dog


cat


dog

Testing

https://arxiv.org/abs/2003.13216

Concluding Remarks

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