JD AI Research at Visual Domain Adaptation Challenge 2018 — Open-set Image Classification

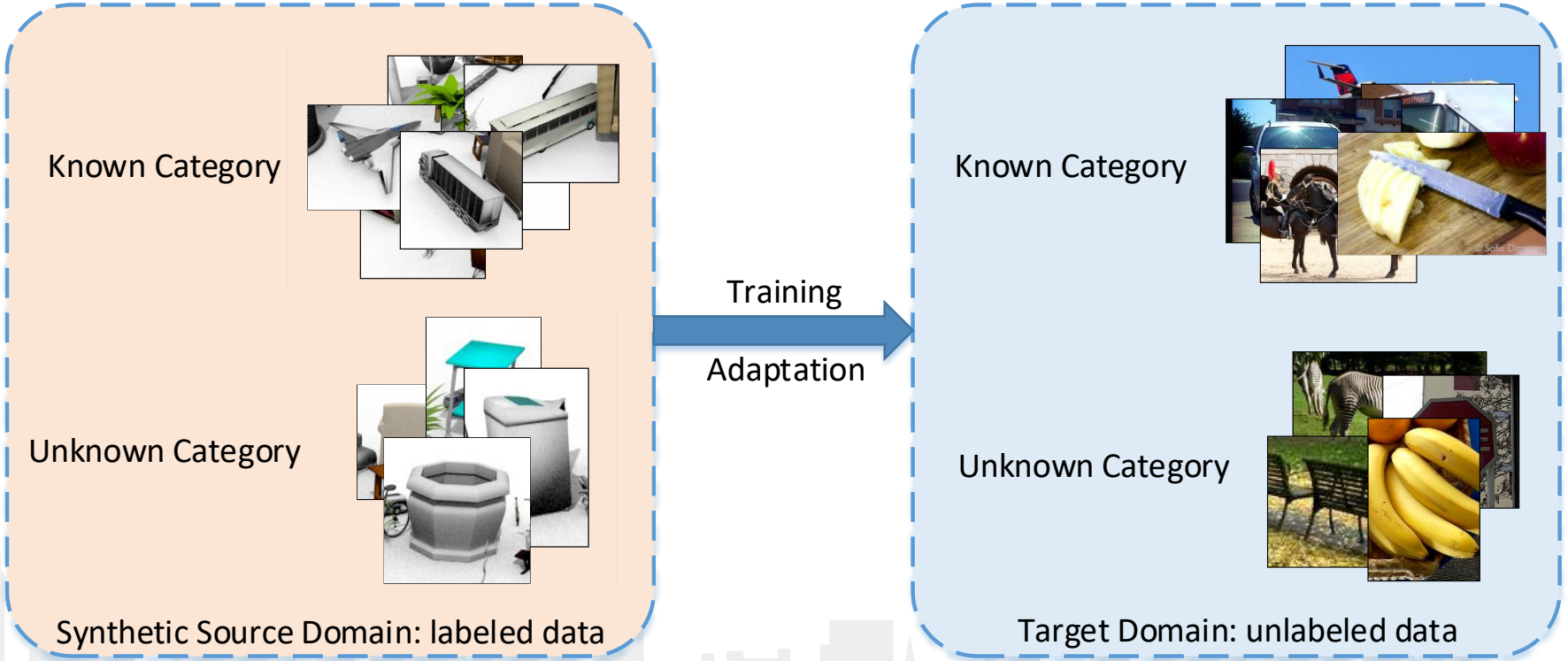
Yingwei Pan, Yehao Li, Qi Cai, Yiheng Zhang, Zhaofan Qiu, Ting Yao and Tao Mei

JD AI Research

Outline

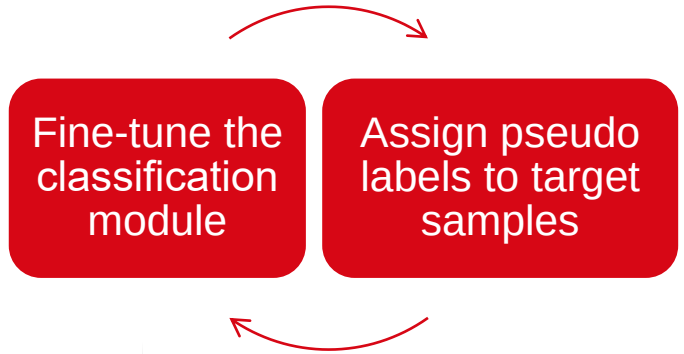
- Task
- Framework
- Results

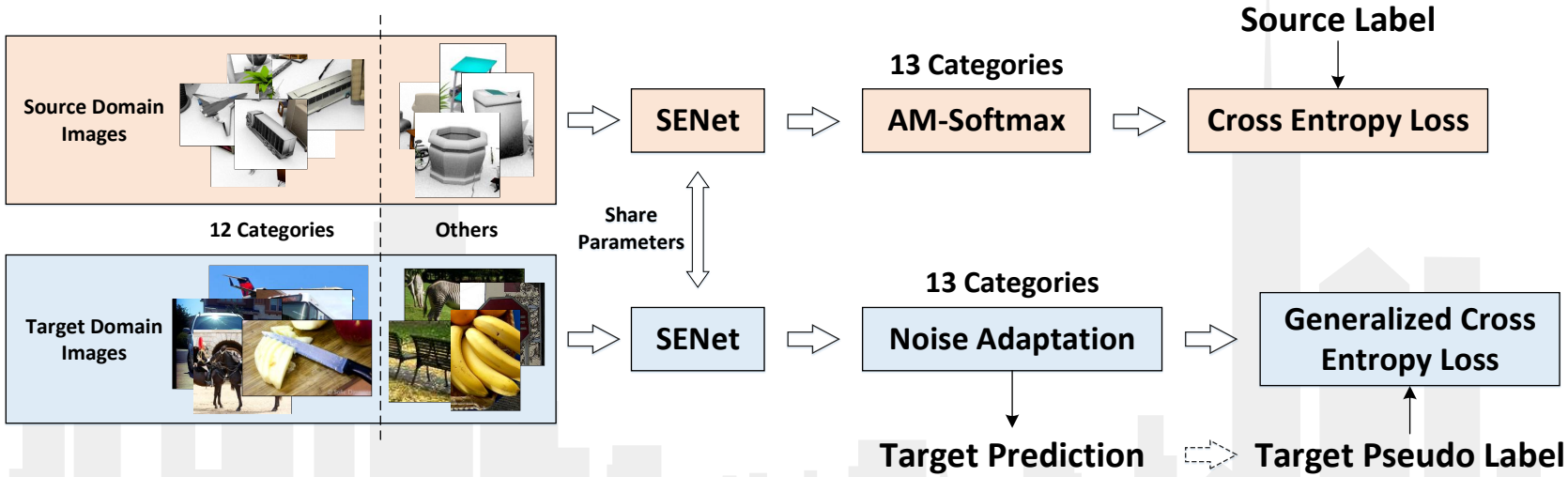
Task — Open-set Image Classification



Framework

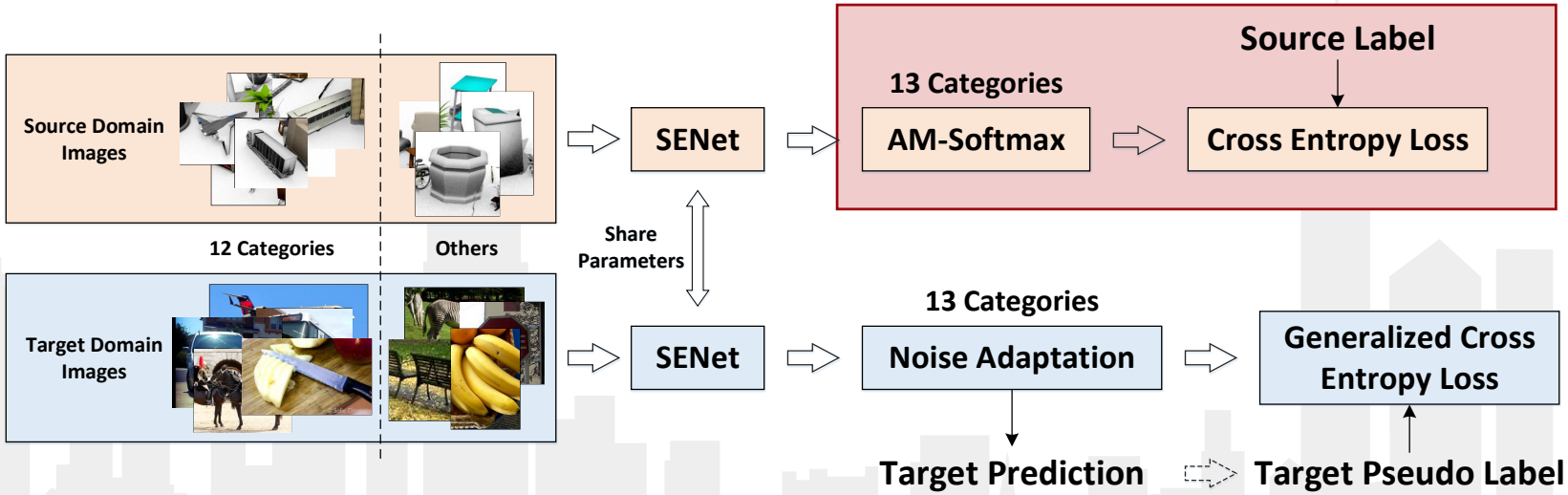
- Two-stage system
  - Assign pseudo labels to unlabeled target samples
  - Fine-tune the classification module over labeled source data and target samples with pseudo labels





Classification Module

- Backbone: SE-ResNeXt101 (ImageNet pre-trained)
- AM-Softmax [1]: Learn large-margin feature representations
- Noise adaptation layer [2]: Make the classifier resistant to the noise of pseudo labels
- Generalized cross entropy loss [3]: Further make the optimization procedure more robust to noisy labels.



[1] Wang F, Liu W, Liu H, et al. Additive Margin Softmax for Face Verification, ICLR workshop, 2018.
[2] Goldberger, J., Ben-Reuven, E. Training deep neural-networks using a noise adaptation layer, ICLR, 2017.
[3] Zhang Z, Sabuncu M R. Generalized Cross Entropy Loss for Training Deep Neural Networks with Noisy Labels. arXiv preprint arXiv:1805.07836, 2018.

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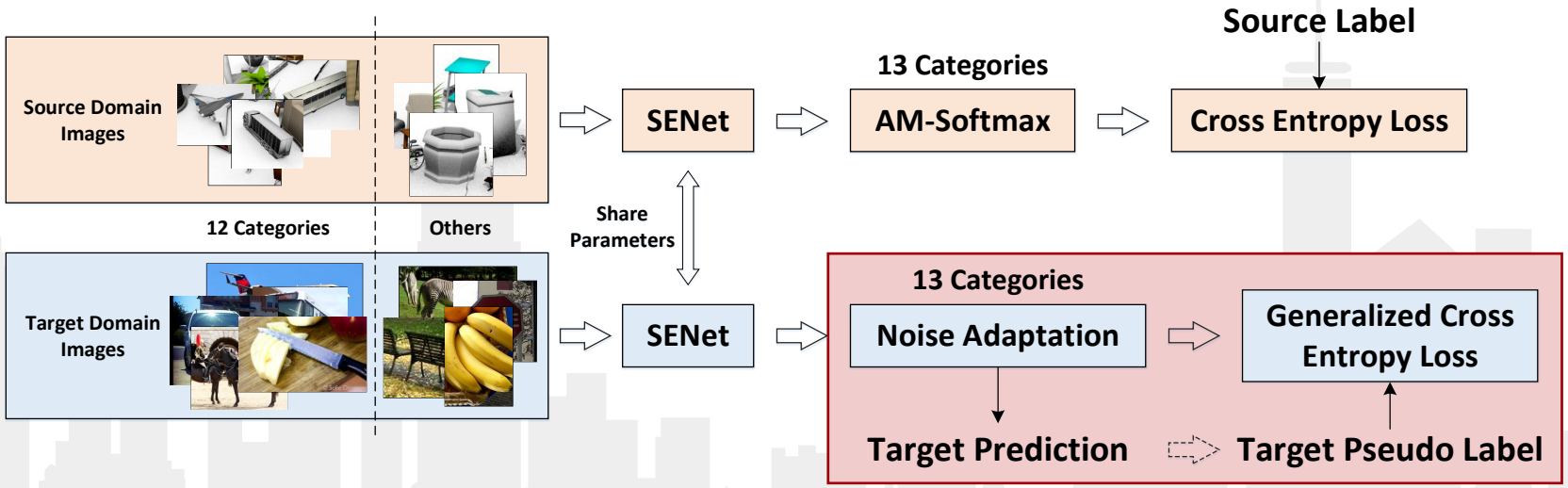

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Pseudo Label Assignment

- Initial iteration: Train the Assign and Transform Iteratively (ATI) model [4] on open-set training data and achieve the pseudo labels of target samples through ATI

- Next iterations: Directly predict the pseudo labels through the fine-tuned classification module

[4] Busto, P.P., Gall, J. Open set domain adaptation, ICCV, 2017.

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- Initial iteration: Train the Assign and Transform Iteratively (ATI) model [4] on open-set training data and achieve the pseudo labels of target samples through ATI
- Next iterations: Directly predict the pseudo labels through the fine-tuned classification module
- A clustering based strategy for filtering the pseudo labels
  - K-means is firstly leveraged to produce 500 clusters over the whole target domain.
  - For each cluster, only the target samples with the same pseudo label whose proportion in this cluster is larger than a threshold are selected for training.

[4] Busto, P.P., Gall, J. Open set domain adaptation, ICCV, 2017.

Results

#	Setting	Per Category Accuracy													Known	Mean
		plane	bcycl	bus	car	horse	knife	mcycl	person	plant	sktbd	train	truck	unknown		
1	Source Only	6.3	10.5	20.7	32.1	53.0	1.5	66.8	13.4	17.5	6.5	59.0	3.7	66.0	24.3	27.5
2	Adapt, iteration 2	90.2	82.9	87.1	95.5	66.6	90.4	80.8	80.2	95.3	77.6	84.0	93.6	82.2	85.4	85.1
3	Adapt, iteration 4	89.0	86.7	88.5	95.6	80.1	89.5	84.2	**82.3**	94.2	87.0	87.6	93.6	78.9	88.2	87.5
4	Adapt, iteration 7	87.5	89.0	90.7	96.2	83.9	93.5	85.9	76.3	94.9	88.4	90.0	92.3	82.0	89.0	88.5
5	Adapt, iteration 10	92.5	90.0	92.5	96.8	86.1	94.7	89.0	81.5	96.5	88.4	91.6	**93.9**	**84.5**	91.1	90.6
6	Adapt, iteration 20	**95.8**	**93.5**	**94.3**	**98.6**	**93.5**	**98.5**	**91.5**	**82.3**	**97.2**	**91.7**	**93.3**	92.3	77.2	**93.5**	**92.3**

#	Team Name	Affiliation	Per Category Accuracy													Known	Mean
			plane	bcycl	bus	car	horse	knife	mcycl	person	plant	sktbd	train	truck	unknown		
1	VARMS	JD AI Research, CV Lab	**95.8**	**93.5**	**94.3**	**98.6**	**93.5**	**98.5**	**91.5**	**82.3**	**97.2**	**91.7**	**93.3**	**92.3**	**77.2**	**93.5**	**92.3**
2	Diggers	University of Electronic Science and Technology of China	91.0	76.6	86.5	94.5	83.1	36.9	83.4	69.8	90.0	40.8	69.1	65.4	9.8	73.9	69.0
3	THUML	Tsinghua University	94.0	79.2	90.5	97.4	63.2	36.0	81.1	45.6	93.0	35.4	84.5	46.2	42.2	70.5	68.3

- Source only: 27.5%, Full system: 92.3%
- Involving more iterations with pseudo labels tends to achieve better performance.

THANKS!