



Unsupervised Multi-Task Domain Adaptation

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Unsupervised domain adaptation aims to generalize a model's capability applied on the target domain (without labels) with the model trained using labeled data from the source domain.
Multi-task learning aims to learn multiple tasks jointly by exploiting their relatedness to improve the generalization performance for each task.

Does MTL further improve the generalization ability of a model for domain adaptation?

MTL-DA SETTING

Classification

Semantic Segmentation

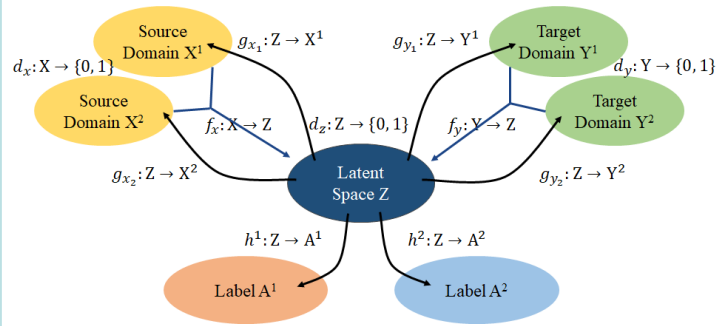


VidDA2017 dataset

- The dataset contains samples and ground truth labels for more than one task.
- Each task contains samples of the source and the target domains.

X. Peng, B. Usman, N. Kaushik, J. Hoffman, D. Wang and K. Saenko, "VisDA: The Visual Domain Adaptation Challenge," 2017.

APPROACH



Developed upon the I2I Adapt framework

- Not designed for a specific task; should accommodate more tasks such as object detection.
- Allow the customization of the model's complexity to meet specific needs.
- Simultaneously adapt multiple tasks using a single adaptation architecture.

Z. Murez, S. Kolouri, D. Kriegman, R. Ramamoorthi, and K. Kim, "Image to Image Translation for Domain Adaptation," *IEEE CVPR*, 2018.

RESULTS

Image Classification

Setup	Source only	MTL	Single-task adaptation	Multi-task adaptation
aeroplane	70.39	65.32	69.71	71.21
bicycle	26.91	26.91	80.79	69.71
bus	52.51	43.07	65.03	75.75
car	69.40	60.43	65.72	66.47
horse	77.67	75.64	83.26	87.10
knife	4.22	5.18	28.19	39.88
motorcycle	82.06	84.69	74.99	81.16
person	38.31	46.69	55.19	64.56
plant	77.25	71.10	79.34	82.25
skateboard	21.60	26.10	25.77	22.59
train	83.24	86.37	78.47	75.52
truck	9.10	13.83	16.53	15.45
accuracy	51.05	50.44	60.25	62.64

- Source only method performs the worst, MTL does not reduce domain shift. Domain adaptation can help.
- Unsupervised multi-task domain adaptation can further enhance the ability of domain adaptation.

Semantic Segmentation

Setup	Source only	MTL	Single-task adaptation	Multi-task adaptation
road	23.42	20.06	71.26	79.17
sidewalk	22.32	20.68	27.76	34.69
building	40.54	53.89	70.82	78.40
wall	2.88	5.39	9.75	20.30
fence	4.99	8.55	11.07	14.08
pole	10.50	19.36	19.29	30.69
traffic light	12.79	16.14	8.01	20.21
traffic sign	0.26	0.16	0.34	1.14
vegetation	73.40	77.95	77.09	75.95
terrain	26.91	21.62	24.23	19.91
sky	35.01	72.04	67.13	76.45
person	43.88	30.94	37.91	52.95
rider	0.08	0.07	0.02	0.07
car	68.44	31.59	65.84	75.26
truck	9.83	5.41	7.35	13.99
bus	3.86	6.51	9.10	17.64
train	0.00	0.06	0.15	0.53
motorcycle	0.18	0.41	0.07	1.14
bicycle	0.00	0.00	0.00	0.00
mIoU	19.96	20.57	26.69	32.24