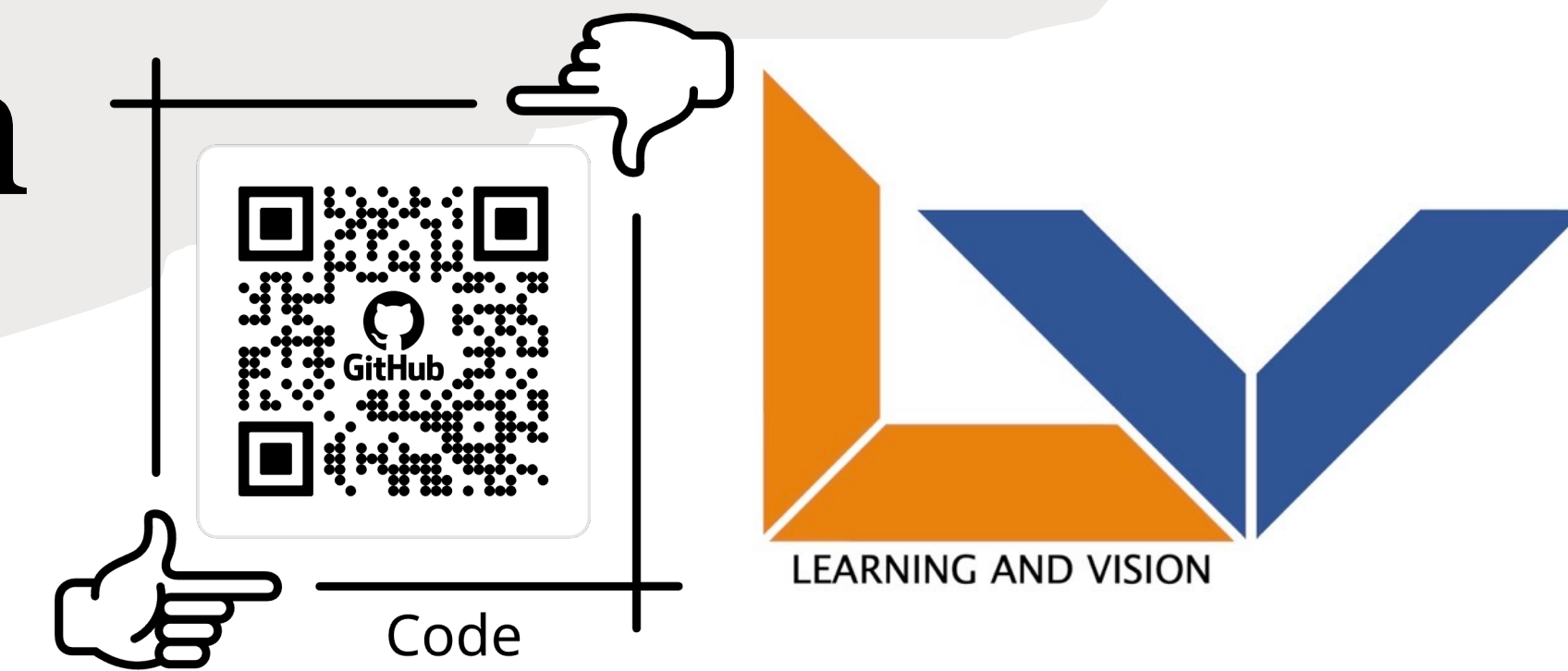


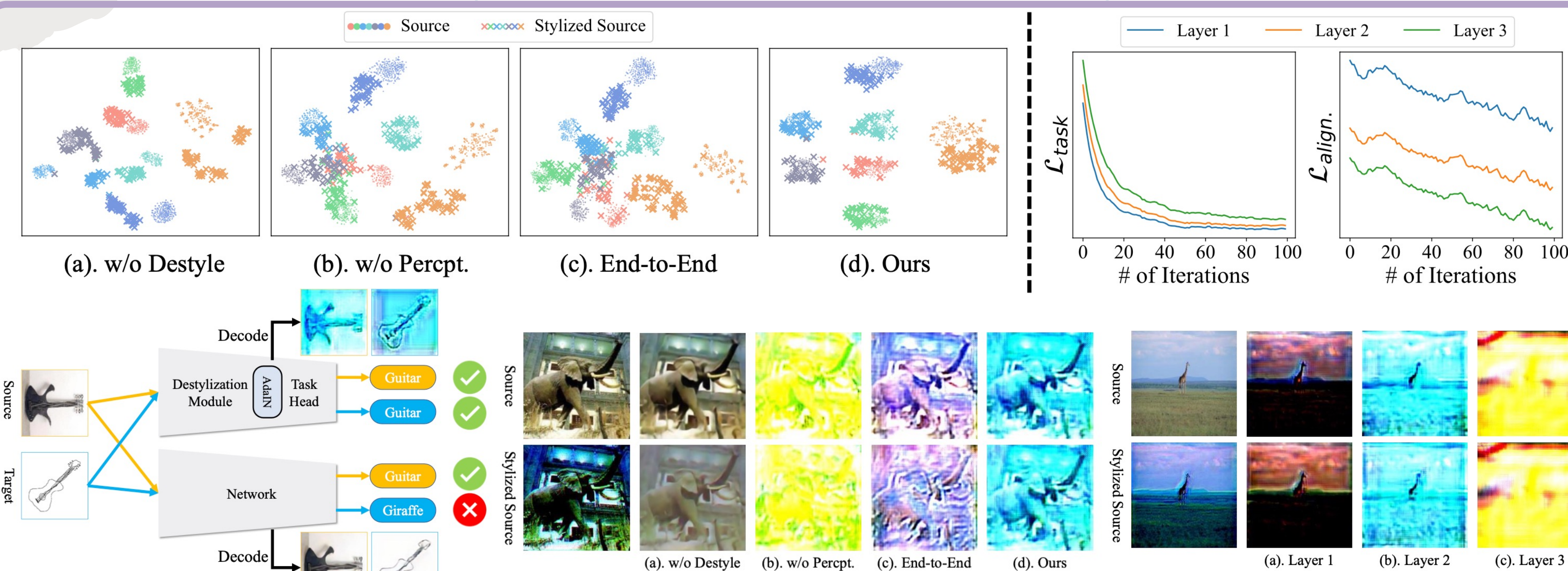
# StyDeSty: Min-Max Stylization and Destylization for Single Domain Generalization

Songhua Liu<sup>1</sup>, Xin Jin<sup>1,2</sup>, Xingyi Yang<sup>1</sup>, Jingwen Ye<sup>1</sup>, and Xinchao Wang<sup>1</sup>  
National University of Singapore<sup>1</sup> Eastern Institute of Technology<sup>2</sup>



TL;DR: We delve into three questions for single DG:  
1) **why** to destyle; 2) **how** to destyle; and 3) **where** to destyle.

## Why, How, and Where to Destyle?

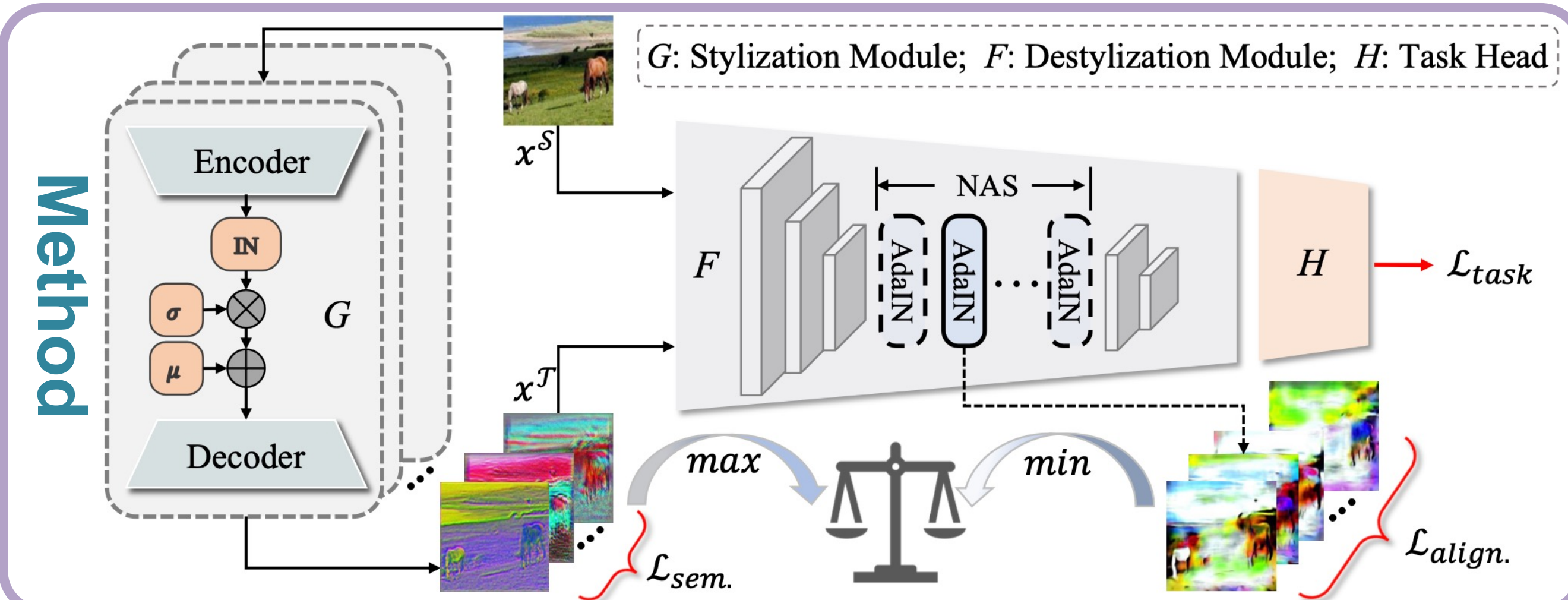
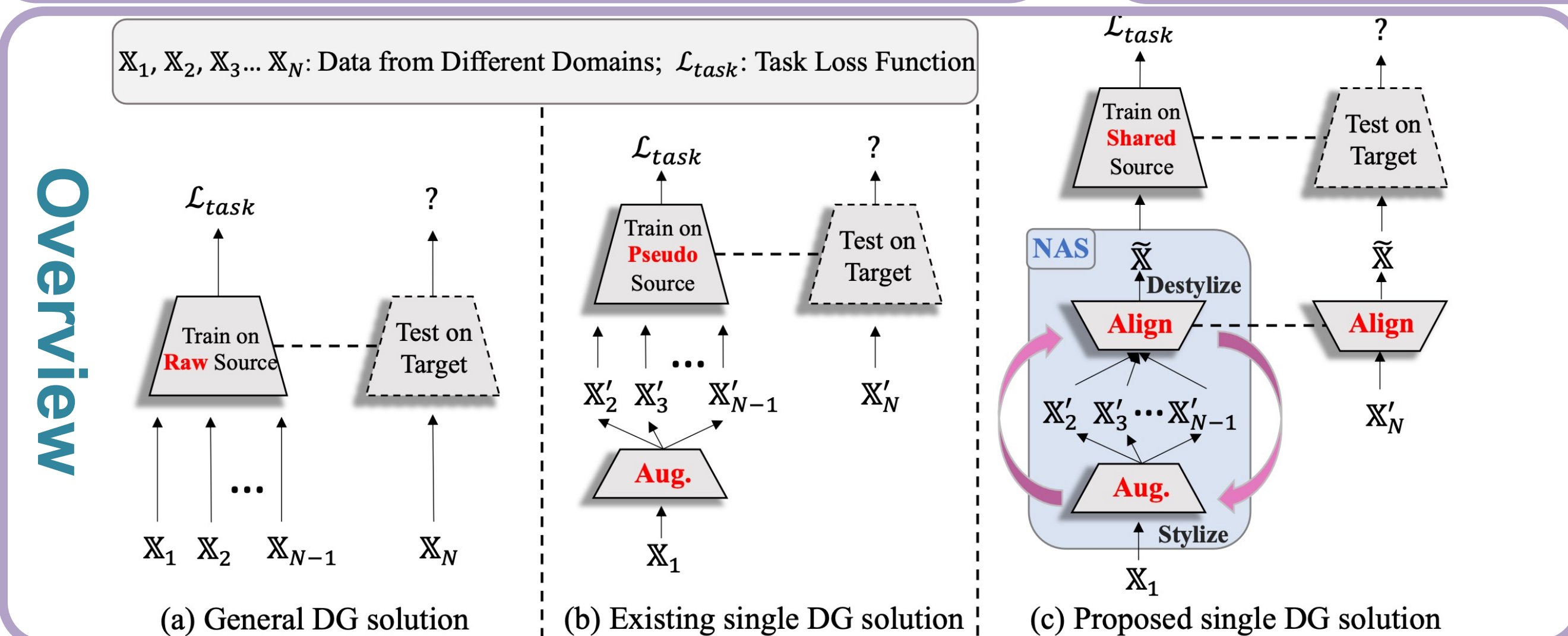


## Introduction:

- Domain Generalization (DG):
- Input: **Multiple source** domains
- Output: A model that performs well on **unknown target** domains
- Single Domain Generalization (Single DG):
- Input: A **single** source domain

## Highlight:

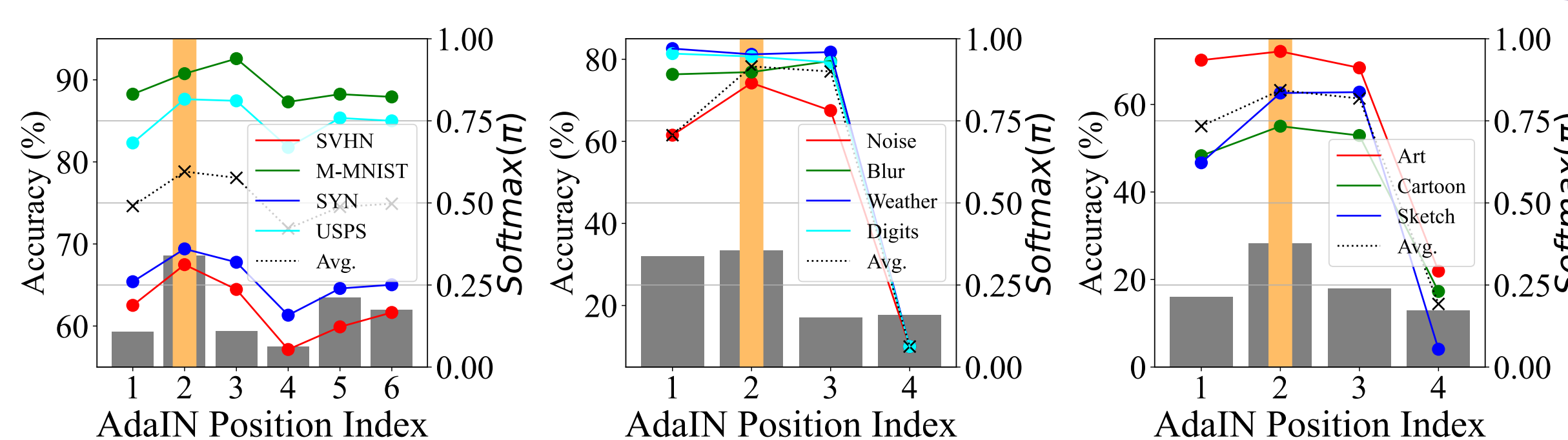
- Previous Methods:
- Data/Domain **Augmentation/Stylization**
- Ignore the **underlying coherence** within augmented pseudo domains
- Our Method:
- **Explicit Alignment/Destylization**



## Main Comparison

Settings		Source Only	JiGen	RSC	MMLD	ADA	ME-ADA	MixStyle	L2D	Ours
Photo	Art	62.26	60.74	67.72	64.59	64.31	65.62	67.42	68.07	<b>72.12</b>
	Cartoon	27.60	33.40	33.70	30.25	34.94	36.95	36.34	34.43	<b>55.03</b>
	Sketch	29.35	43.96	<b>48.00</b>	28.61	36.12	35.10	38.28	44.69	<b>62.61</b>
	Avg.	39.73	46.03	<b>49.81</b>	41.15	45.12	45.89	47.35	49.06	<b>63.25</b>
Art	Photo	96.29	<b>96.71</b>	92.75	96.47	95.81	95.69	<b>97.23</b>	96.11	94.13
	Cartoon	61.01	58.40	71.89	55.97	67.96	67.28	64.66	70.61	<b>71.97</b>
	Sketch	49.25	51.23	<b>69.43</b>	41.46	68.26	65.31	54.32	65.08	<b>74.09</b>
	Avg.	68.85	68.78	<b>78.02</b>	64.63	77.34	76.09	72.07	77.26	<b>80.06</b>
Cartoon	Photo	85.27	85.57	85.33	85.33	85.99	84.49	<b>87.72</b>	86.17	<b>87.78</b>
	Art	63.38	68.90	71.00	62.11	68.55	57.82	71.59	<b>75.24</b>	<b>75.93</b>
	Sketch	67.73	63.35	73.30	66.07	72.28	71.82	63.78	<b>73.40</b>	<b>75.87</b>
	Avg.	72.13	72.60	76.54	71.17	75.61	74.71	74.36	<b>78.27</b>	<b>79.86</b>
Sketch	Photo	24.73	36.65	44.25	21.13	25.33	26.53	27.10	48.63	<b>58.80</b>
	Art	22.61	28.61	<b>52.00</b>	18.36	27.88	28.61	26.20	48.38	<b>60.11</b>
	Cartoon	41.13	41.30	61.86	34.04	58.70	52.89	52.07	<b>62.88</b>	<b>67.75</b>
	Avg.	29.49	35.51	52.70	24.51	37.30	36.01	35.12	<b>53.40</b>	<b>62.22</b>
Avg.		52.55	55.73	64.27	50.37	58.84	58.18	57.23	<b>64.50</b>	<b>71.35</b>

## NAS Result



## Ablation Study

Method	Art	Cartoon	Sketch	Avg.
w/o Style	66.89	41.64	37.06	48.53
AutoAug	70.80	44.50	50.09	55.13
DCGAN	<b>73.54</b>	47.01	49.50	56.68
w/o Destyle	69.68	41.42	41.33	50.81
Separate Style Transfer	70.51	53.33	58.39	60.74
w/o $\mathcal{L}_{align.}$	72.51	49.70	56.20	59.47
w/o Percept.	69.53	47.35	52.25	56.38
end-to-end	68.85	45.65	55.41	56.63
w/o Adv.	71.58	53.63	59.63	61.61
Ours	72.12	<b>55.03</b>	<b>62.61</b>	<b>63.25</b>

## Use with Other Methods

Method	Photo	Art	Cartoon	Sketch	Avg.
Ours	63.25	80.06	79.86	62.22	71.35
(Lv et al., 2022)	46.21	75.64	78.29	58.44	64.65
(Lv et al., 2022)+Ours	54.36	79.33	78.99	60.77	68.36
(Chen et al., 2023)	57.99	76.18	77.91	58.11	67.55
(Chen et al., 2023)+Ours	64.36	78.46	79.62	59.63	70.52
(Choi et al., 2023)	62.89	76.98	78.54	57.11	68.88
(Choi et al., 2023)+Ours	<b>67.98</b>	<b>81.82</b>	<b>80.80</b>	<b>63.15</b>	<b>73.44</b>