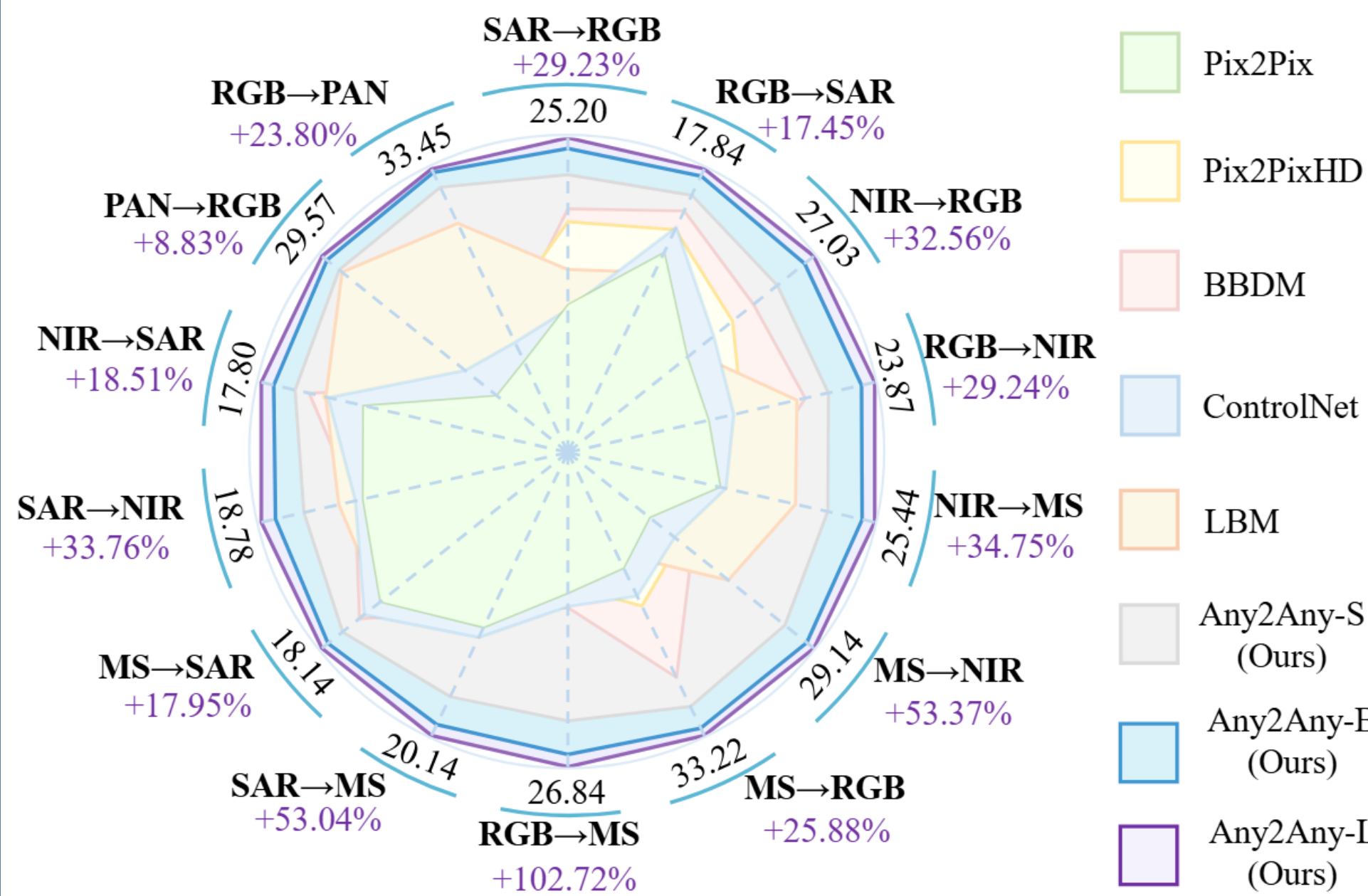




1. Introduction



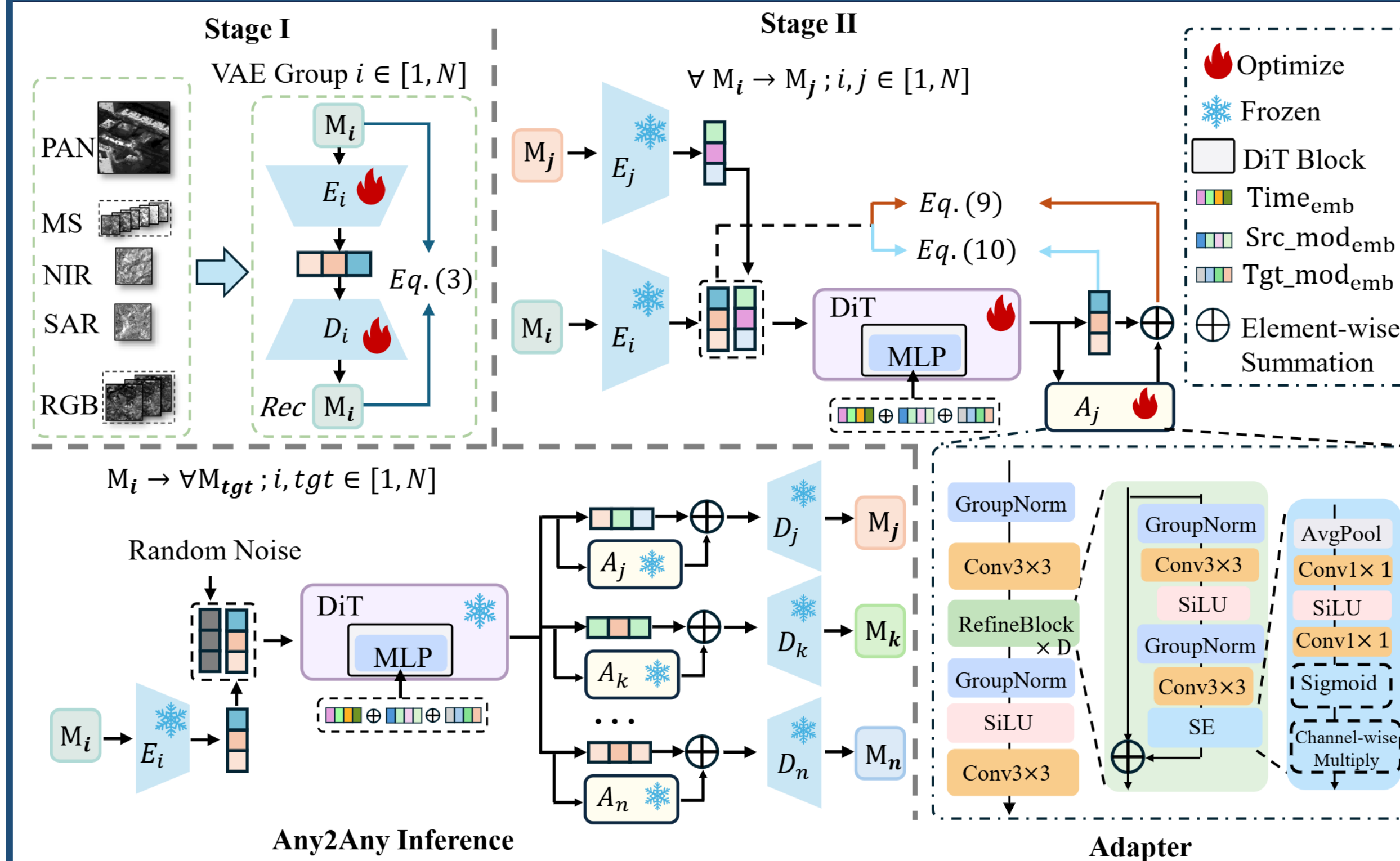
➤ **Novel “Any-to-Any” Task & Paradigm:** First to propose and formalize the Any-to-Any remote sensing image translation task, enabling mutual translation between arbitrary modality pairs.

➤ **First Million-Scale Dataset (RST-1M):** Curated a large-scale dataset with 1.2M image pairs across five core sensing modalities. It provides dense inter-modality connectivity to support multi-modal alignment and cross-modal transfer learning.

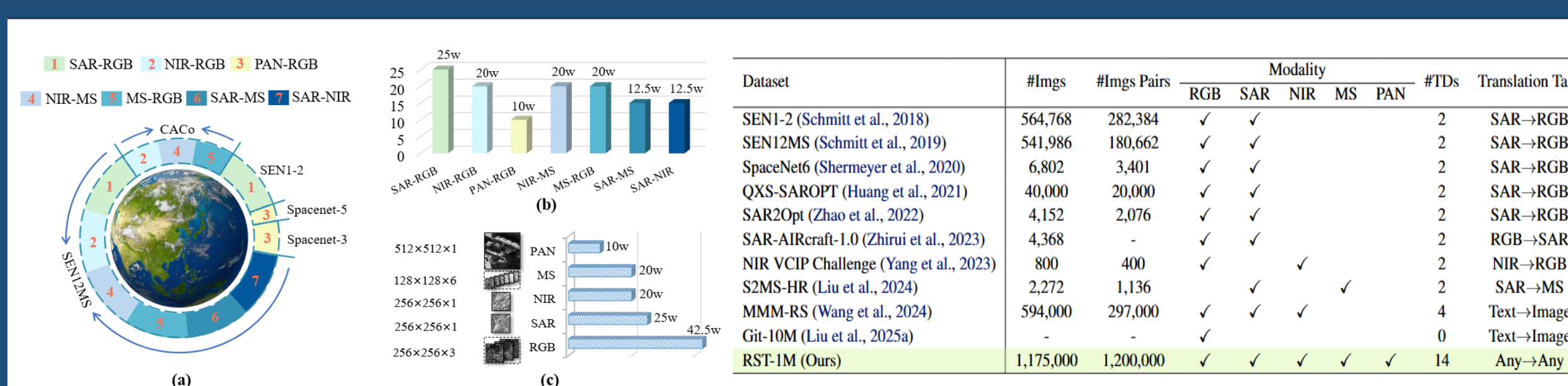
➤ **Unified Generative Framework & SOTA Performance**

Any2Any, the first unified framework for remote sensing modality translation, consistently outperforms existing paired methods across 14 known directions and demonstrates robust zero-shot generalization on unseen modality pairs.

2. Method: Any2Any



3. Dataset: RST-1M



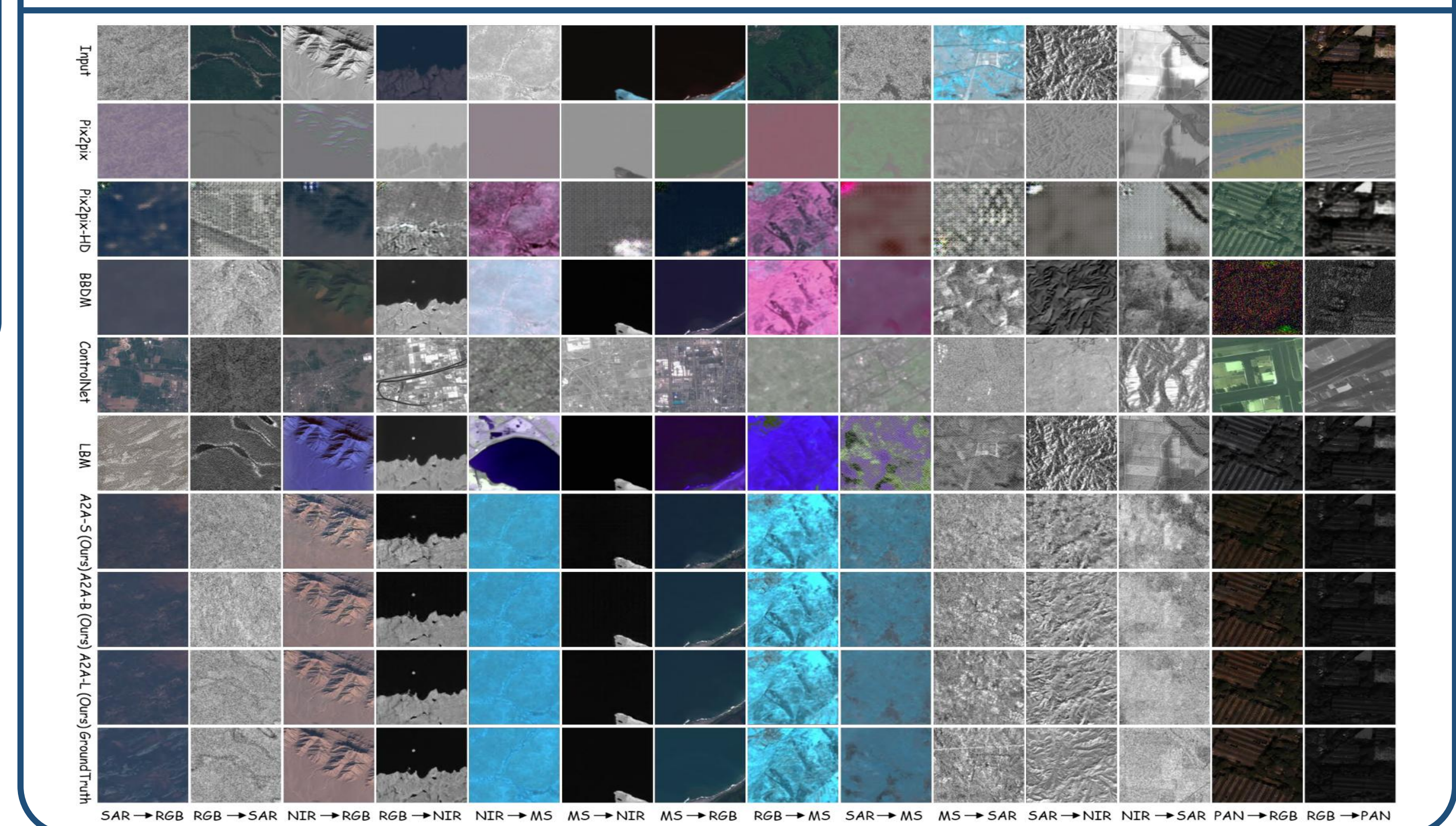
4. Ablation Study

		Training Data		Network Architecture		Training Strategy		SAR → RGB		#Translation Directions
		SAR → RGB	RGB → SAR	w/o Adapter	w/ Adapter	Scratch	Incremental	PSNR ↑	RMSE ↓	
Set 1	Setting 1	✓		✓		✓		20.68	28.51	1
	Setting 2	✓			✓	✓		20.88	27.89	1
Set 2	Setting 3	✓	✓		✓	✓		19.63	32.83	2
	Setting 4	✓	✓		✓		✓	21.44	25.87	2
		SAR → Other	Other → RGB	w/o Adapter	w/ Adapter	Scratch	Incremental	PSNR ↑	RMSE ↓	
Set 3	Setting 5	✓			✓	✓		22.06	24.00	3
	Setting 6		✓		✓	✓		21.36	26.32	4
		Any → Any		w/o Adapter	w/ Adapter	Scratch	Incremental	PSNR ↑	RMSE ↓	
Ours	Setting 7	✓			✓	✓		22.25	23.45	14

5. Main Results

Method	SAR → RGB			NIR → RGB			NIR → MS			MS → RGB			SAR → MS			SAR → NIR			PAN → RGB		
	PSNR ↑	SSIM ↑	RMSE ↓	PSNR ↑	SSIM ↑	RMSE ↓	PSNR ↑	SSIM ↑	RMSE ↓	PSNR ↑	SSIM ↑	RMSE ↓	PSNR ↑	SSIM ↑	RMSE ↓	PSNR ↑	SSIM ↑	RMSE ↓	PSNR ↑	SSIM ↑	RMSE ↓
Pix2Pix (Isola et al., 2017)	11.84	0.08	68.57	13.14	0.08	60.35	12.65	0.38	62.62	13.58	0.12	55.81	12.46	0.32	64.29	12.57	0.08	64.94	8.57	0.00	96.26
Pix2PixHD (Wang et al., 2018)	18.48	0.50	35.81	18.08	0.46	36.66	11.18	0.51	73.39	18.02	0.52	39.72	10.39	0.27	80.67	10.86	0.15	78.10	19.07	0.64	33.69
BBDM (Li et al., 2023)	19.50	0.66	31.02	20.39	0.70	29.59	14.60	0.56	53.04	26.39	0.91	12.76	11.13	0.30	81.22	13.76	0.29	68.51	10.06	0.03	81.78
ControlNet (Zhang et al., 2023)	11.47	0.03	41.72	16.02	0.41	46.16	13.11	0.21	65.65	16.88	0.41	42.09	13.16	0.24	65.32	13.01	0.21	62.64	12.35	0.23	65.88
LBM (Chadebec et al., 2025)	14.64	0.07	48.86	13.76	0.49	58.42	18.88	0.66	34.15	11.89	0.45	71.91	13.10	0.09	58.62	14.04	0.08	51.85	27.17	0.82	13.75
Any2Any-S (Pairwise)	20.81	0.58	28.17	23.01	0.66	21.50	22.01	0.78	24.80	29.74	0.84	9.13	16.20	0.34	46.27	14.43	0.23	55.77	27.69	0.81	12.20
Any2Any-S (Ours)	22.25	0.56	23.45	23.01	0.64	21.25	21.55	0.73	25.35	29.81	0.82	9.23	17.37	0.38	39.47	16.17	0.26	45.15	27.51	0.80	13.02
Any2Any-B (Ours)	24.35	0.60	18.42	26.02	0.70	15.27	24.40	0.79	18.25	32.35	0.86	7.07	19.35	0.44	31.73	17.92	0.32	37.65	28.97	0.84	11.28
Any2Any-L (Ours)	25.20	0.62	16.85	27.03	0.72	13.70	25.44	0.81	16.51	33.22	0.88	6.45	20.14	0.47	29.43	18.78	0.35	34.85	29.57	0.85	10.41

Method	RGB → SAR			RGB → NIR			MS → NIR			RGB → MS			MS → SAR			NIR → SAR			RGB → PAN		
	PSNR ↑	SSIM ↑	RMSE ↓	PSNR ↑	SSIM ↑	RMSE ↓	PSNR ↑	SSIM ↑	RMSE ↓	PSNR ↑	SSIM ↑	RMSE ↓	PSNR ↑	SSIM ↑	RMSE ↓	PSNR ↑	SSIM ↑	RMSE ↓	PSNR ↑	SSIM ↑	RMSE ↓
Pix2Pix (Isola et al., 2017)	12.59	0.04	61.97	10.97	0.01	77.24	9.70	0.06	91.19	12.04	0.34	67.13	13.85	0.07	58.02	11.90	0.04	67.60	10.76	0.04	74.52
Pix2PixHD (Wang et al., 2018)	14.02	0.07	52.30	13.55	0.32	59.30	13.25	0.28	60.45	11.36	0.48	72.24	13.68	0.08	54.44	14.18	0.08	51.64	16.24	0.38	43.03
BBDM (Li et al., 2023)	15.19	0.11	46.53	18.47	0.72	36.82	14.69	0.27	55.18	13.24	0.62	60.62	15.38	0.12	45.28	15.02	0.12	47.52	14.66	0.10	49.12
ControlNet (Zhang et al., 2023)	14.17	0.09	69.23	12.91	0.19	63.06	12.64	0.17	64.50	13.17	0.24	65.53	15.03	0.10	48.39	13.92	0.10	54.13	12.98	0.32	61.36
LBM (Chadebec et al., 2025)	11.33	0.05	72.86	17.82	0.58	37.89	19.00	0.58	34.33	9.93	0.41	87.27	13.86	0.08	53.79	14.06	0.06	52.10	27.02	0.80	13.30
Any2Any-S (Pairwise)	16.44	0.15	39.51	20.53	0.49	27.72	25.92	0.74	13.94	24.19	0.77	18.27	17.20	0.17	36.07	15.84	0.15	42.66	32.46	0.83	10.22
Any2Any-S (Ours)	16.19	0.14	40.66	20.27	0.48	28.51	25.71	0.73	14.53	22.93	0.73	20.76	16.62	0.16	38.57	15.84	0.14	42.46	31.30	0.81	11.27
Any2Any-B (Ours)	17.40	0.19	35.07	22.85	0.60	21.90	28.28	0.83	11.20	25.78	0.81	15.13	17.69	0.20	33.92	17.08	0.18	36.55	33.03	0.84	9.87
Any2Any-L (Ours)	17.84	0.21	33.27	23.87	0.65	19.76	29.14	0.85	10.26	26.84	0.83	13.50	18.14	0.23	32.18	17.80	0.20	34.37	33.45	0.85	9.47



6. Recourses

Paper



Code



Wechat



If you are interested in cooperation, please contact me at haoyangchen@whu.edu.cn.