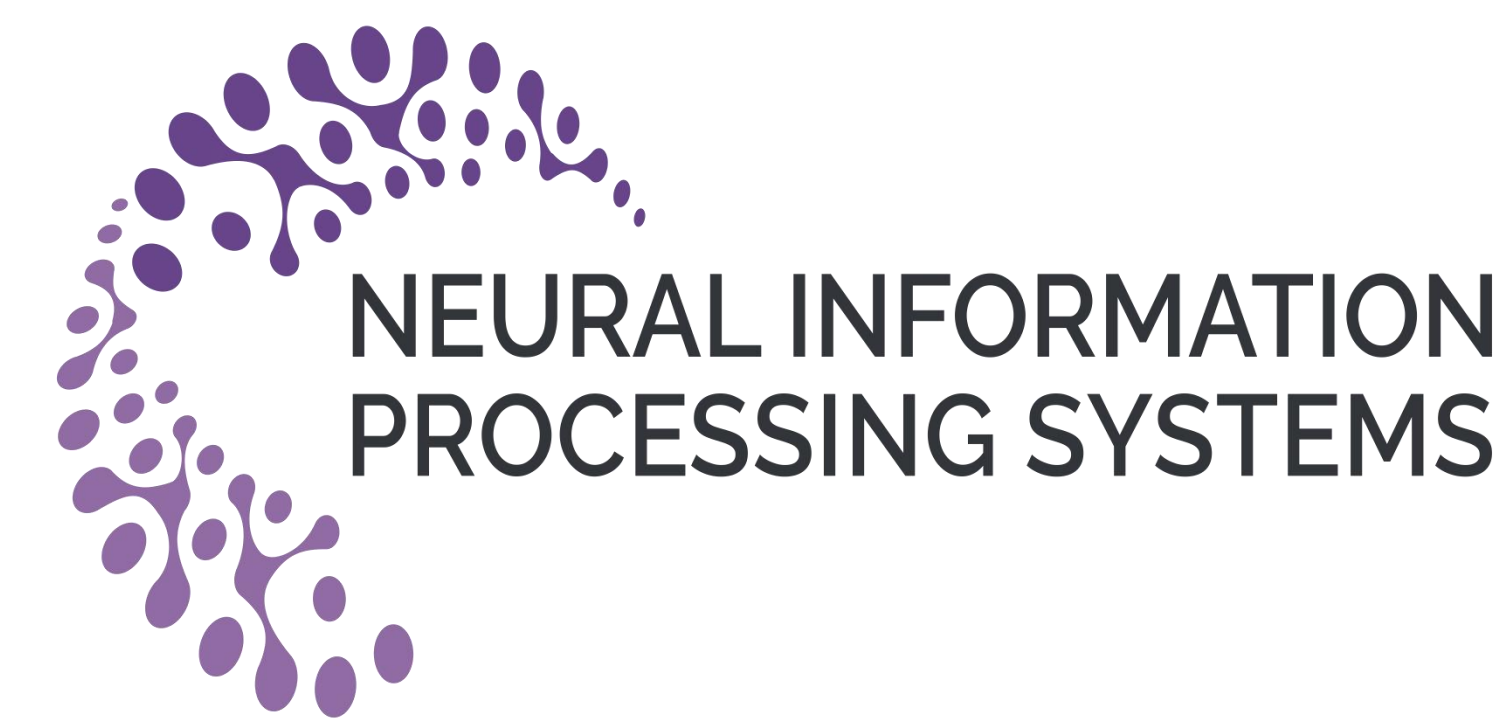


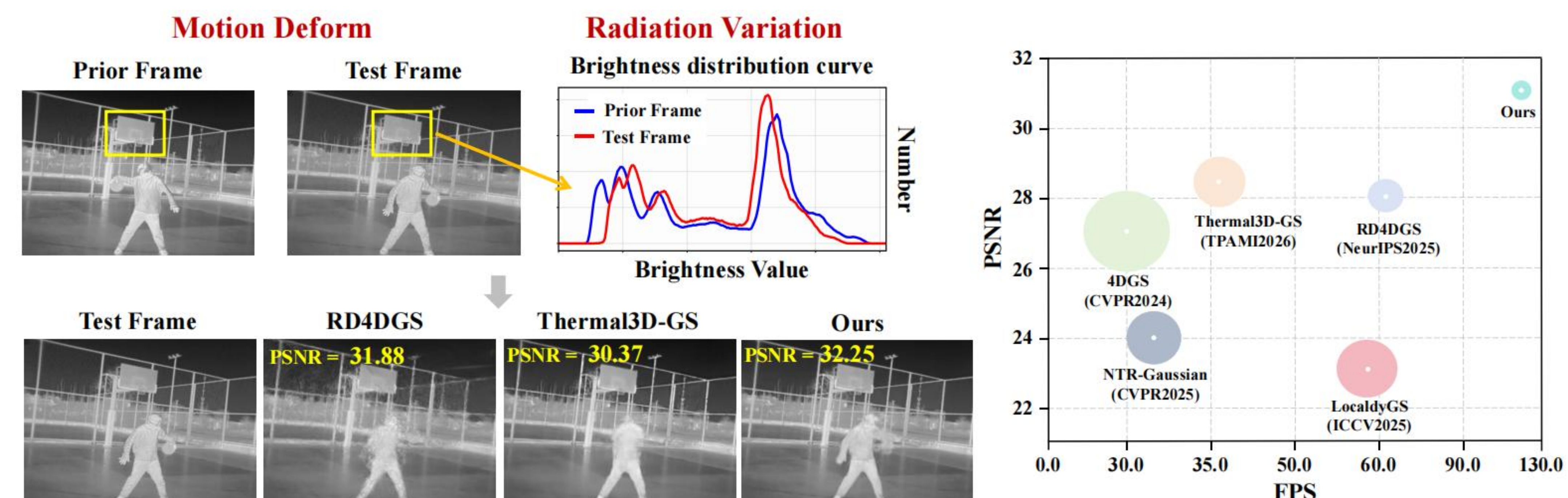


DTGS: Physics-Embedded Dynamic Thermal 3D Reconstruction with Gaussian Splatting

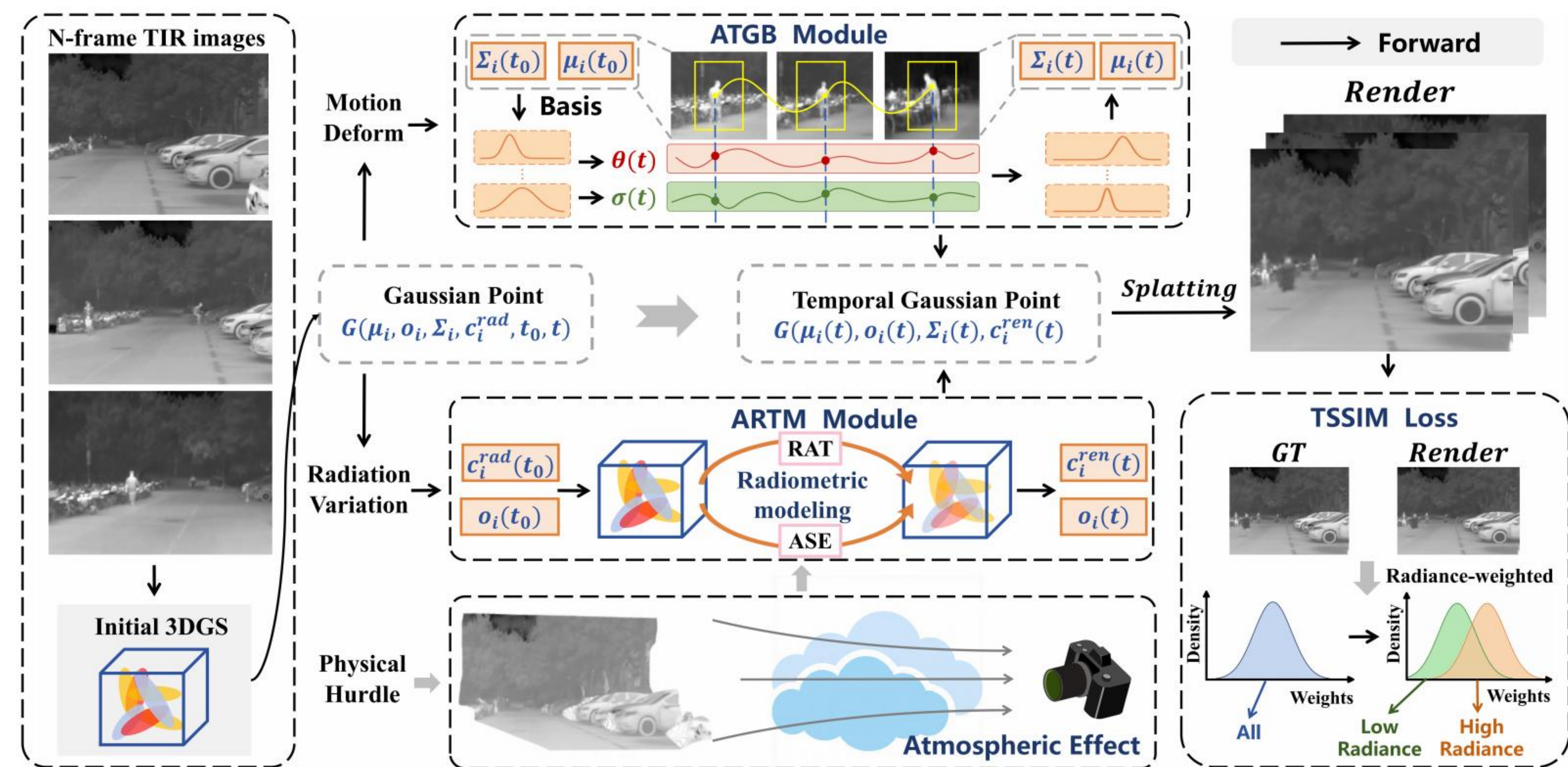
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Thermal dynamic scene reconstruction faces Motion Deformation and Radiation Variation.



DTGS: Designed from Physical Mechanism Perspective



Atmospheric Radiative Transport Modeling

$$C_p(t) = \sum_{i \in \mathcal{N}_p} c_i^{\text{ren}}(t) \alpha'_i(t) \prod_{j=1}^{i-1} (1 - \alpha'_j(t)) + L_p(t)$$

Adaptive Temporal Gaussian Basis

$$\tilde{t}b_e(t; \theta_j(t), \sigma_j(t)) = \exp\left(-\frac{(t - \theta_j(t))^2}{2\sigma_j(t)^2}\right)$$

Experimental results

- Reconstruction Accuracy Comparison on the Dynamic_LTR Dataset

Method	SOD_indoor			SOD_outdoor			MOID_indoor			MOID_outdoor		
	PSNR↑	SSIM↑	LPIPS↓	PSNR↑	SSIM↑	LPIPS↓	PSNR↑	SSIM↑	LPIPS↓	PSNR↑	SSIM↑	LPIPS↓
4DGS	28.34	0.895	0.298	26.96	0.812	0.306	22.52	0.843	0.349	27.65	0.877	0.301
LocalDyGS	26.72	0.881	0.335	21.14	0.751	0.343	22.17	0.822	0.379	23.72	0.814	0.374
RD4DGS	31.16	0.908	0.280	28.14	0.831	0.261	24.75	0.844	0.322	28.11	0.873	0.292
NTR-Gaussian	25.24	0.864	0.347	22.89	0.790	0.342	21.31	0.805	0.415	24.39	0.828	0.366
Thermal3D-GS	31.80	0.925	0.247	27.81	0.874	0.218	24.43	0.872	0.285	28.76	0.900	0.251
DTGS (Ours)	34.26	0.953	0.191	30.58	0.926	0.175	26.62	0.903	0.203	31.59	0.934	0.173

- Ablation results

ARTM	Gaussian_basis	ATGB	SSIM	TSSIM	Avg_PSNR↑	Avg_SSIM↑	Avg_LPIPS↓
		✓		✓	30.27	0.923	0.203
✓	✓	✓		✓	29.78	0.914	0.216
✓		✓	✓		30.69	0.920	0.245
✓		✓		✓	31.32	0.932	0.178

- Qualitative results

