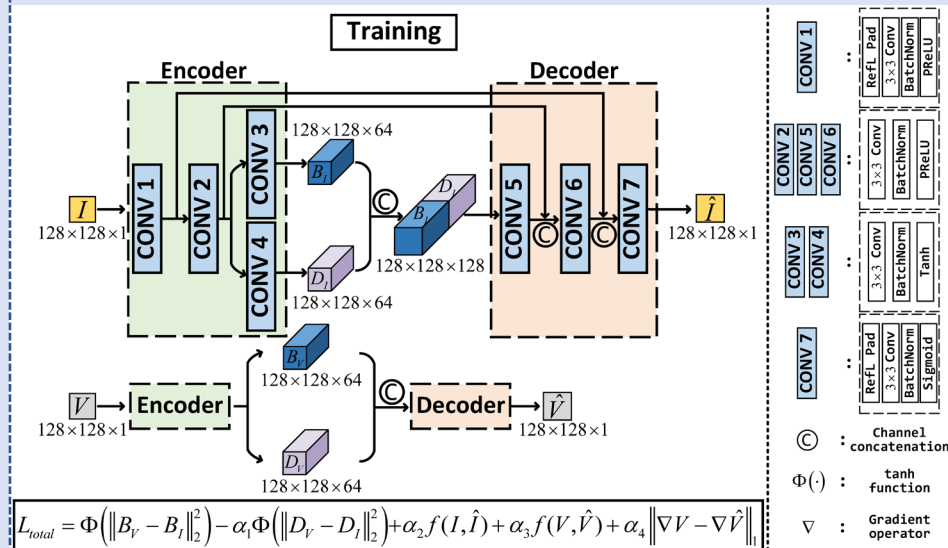


Introduction

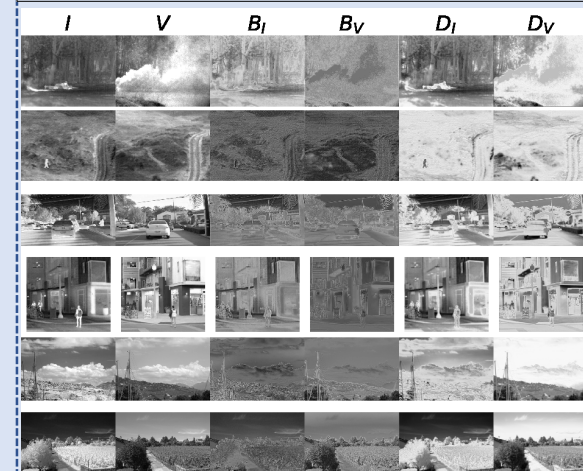
- Infrared and visible images:
 - ✓ infrared images: discriminative thermal radiations & ignoring illumination
 - ✓ visible images: textural details & high spatial resolution
- Fusion images:
 - ✓ highlight radiation information (brightness and contrast)
 - ✓ detailed texture information (gradients and edges)
 - ✓ a clear, complete and accurate description of the targets
- Current deep learning-based methods:
 - ✓ GAN based methods;
 - ✓ Pre-trained network based methods;
 - ✓ Auto-Encoder based methods;
- Our contributions:
 - ✓ The first deep image decomposition model with both fusion and decomposition accomplished via an AE network
 - ✓ Satisfactory results in the extended test sets including various scenes, illumination conditions and objects

Method



- Loss function
 - ✓ Total loss: $L_{total} = L_{dec} + L_{rec}$
 - ✓ Decomposition loss: $L_{dec} = \Phi\|B_V - B_I\|_2^2 - \alpha_1 \Phi\|D_V - D_I\|_2^2$, where $\Phi(\cdot)$ is tanh function.
 - ✓ Reconstruction loss: $L_{rec} = \alpha_2 f(I, \hat{I}) + \alpha_3 f(V, \hat{V}) + \alpha_4 \|\nabla V - \nabla \hat{V}\|_1$, where $f(X, \hat{X}) = \|X - \hat{X}\|_2^2 + L_{SSIM}(X, \hat{X})$.
- Fusion layer
 - $B_F = \text{Fusion}(B_I, B_V)$, $D_F = \text{Fusion}(D_I, D_V)$.
- Merging strategy
 - ✓ Summation method;
 - ✓ Weighted average method;
 - ✓ ℓ_1 -norm method;
 - ✓ The selection of merging strategy is conducted in the validation sets.

Experiments



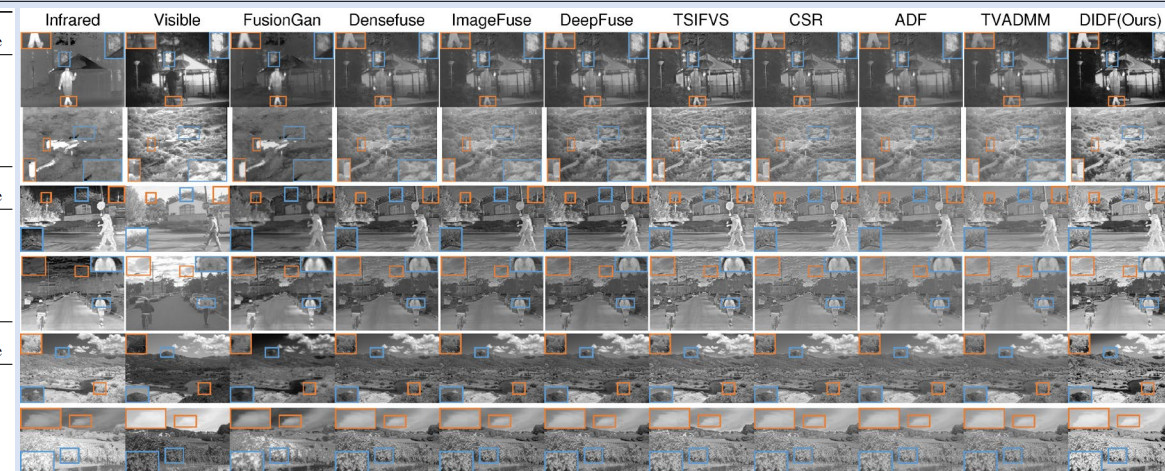
Decomposition effectiveness

Dataset: TNO image fusion dataset									
Metrics	FusionGAN	DenseFuse	ImageFuse	DeepFuse	TSIFVS	TVADMM	CSR	ADF	DIDFuse
EN	6.576	6.842	6.382	6.860	6.669	6.402	6.428	6.399	7.006
MI	2.341	2.302	2.155	2.298	1.717	2.041	1.990	2.007	2.347
SD	29.035	31.817	22.938	32.249	28.036	23.007	23.603	22.963	42.657
SF	8.762	11.095	9.800	11.125	12.598	9.034	11.445	10.782	13.126
VIF	0.258	0.572	0.306	0.581	0.456	0.284	0.312	0.286	0.623
AG	2.417	3.597	2.719	3.599	3.980	2.518	3.367	2.988	4.294

Dataset: FLIR image fusion dataset									
Metrics	FusionGAN	DenseFuse	ImageFuse	DeepFuse	TSIFVS	TVADMM	CSR	ADF	DIDFuse
EN	7.017	7.213	6.992	7.213	7.152	6.797	6.909	6.798	7.344
MI	2.684	2.727	2.783	2.725	2.312	2.473	2.569	2.721	2.882
SD	34.383	37.315	32.579	37.351	35.889	28.071	30.529	28.371	46.888
SF	11.507	15.496	14.519	15.471	18.794	14.044	17.128	14.480	18.835
VIF	0.289	0.498	0.419	0.498	0.503	0.325	0.373	0.337	0.538
AG	3.205	4.822	4.150	4.802	5.568	3.524	4.799	3.564	5.574

Dataset: RGB-NIR Scene Dataset									
Metrics	FusionGAN	DenseFuse	ImageFuse	DeepFuse	TSIFVS	TVADMM	CSR	ADF	DIDFuse
EN	7.055	7.304	7.217	7.303	7.300	7.129	7.170	7.105	7.357
MI	3.003	4.045	3.967	4.040	3.285	3.673	3.699	3.944	3.795
SD	34.912	45.850	42.307	45.815	43.743	40.469	40.383	38.978	57.557
SF	14.309	18.718	18.360	18.627	20.646	16.685	20.370	17.313	26.529
VIF	0.424	0.677	0.613	0.676	0.688	0.530	0.583	0.538	0.937
AG	4.564	6.228	5.920	6.178	6.823	5.319	6.488	5.381	8.741

Quantitative comparisons



Qualitative comparisons