Deep Correlated Image Set Compression Based on Distributed Source Coding and Multi-Scale Fusion

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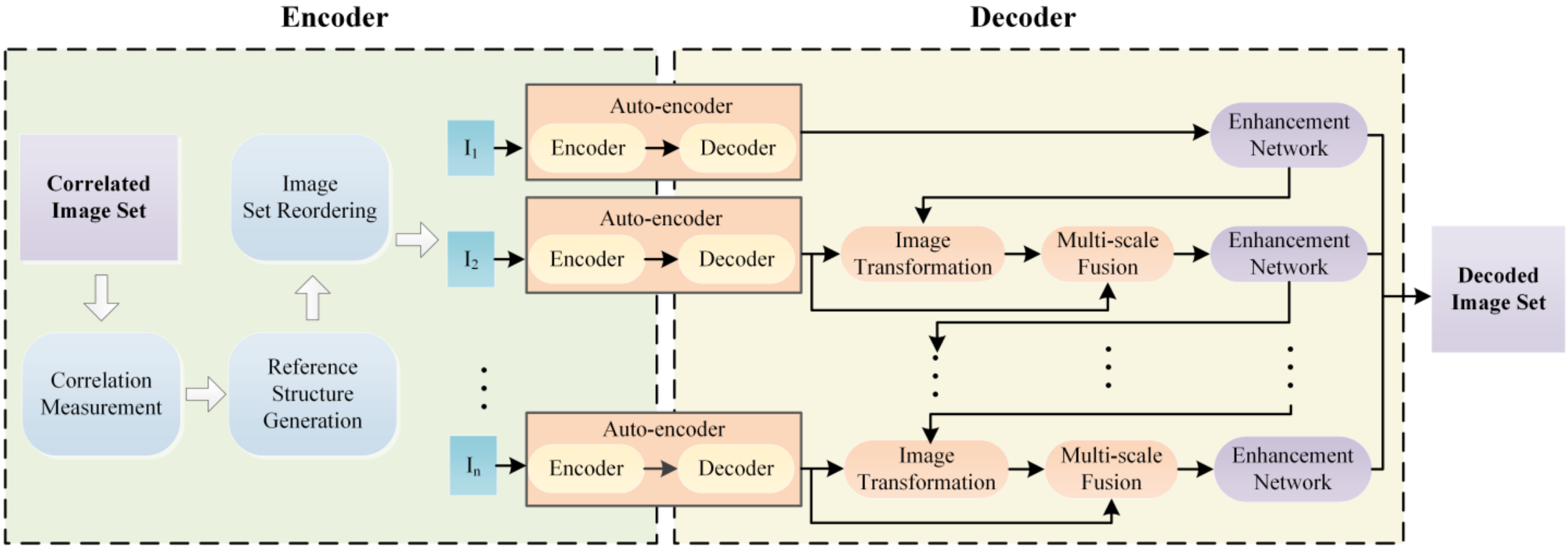
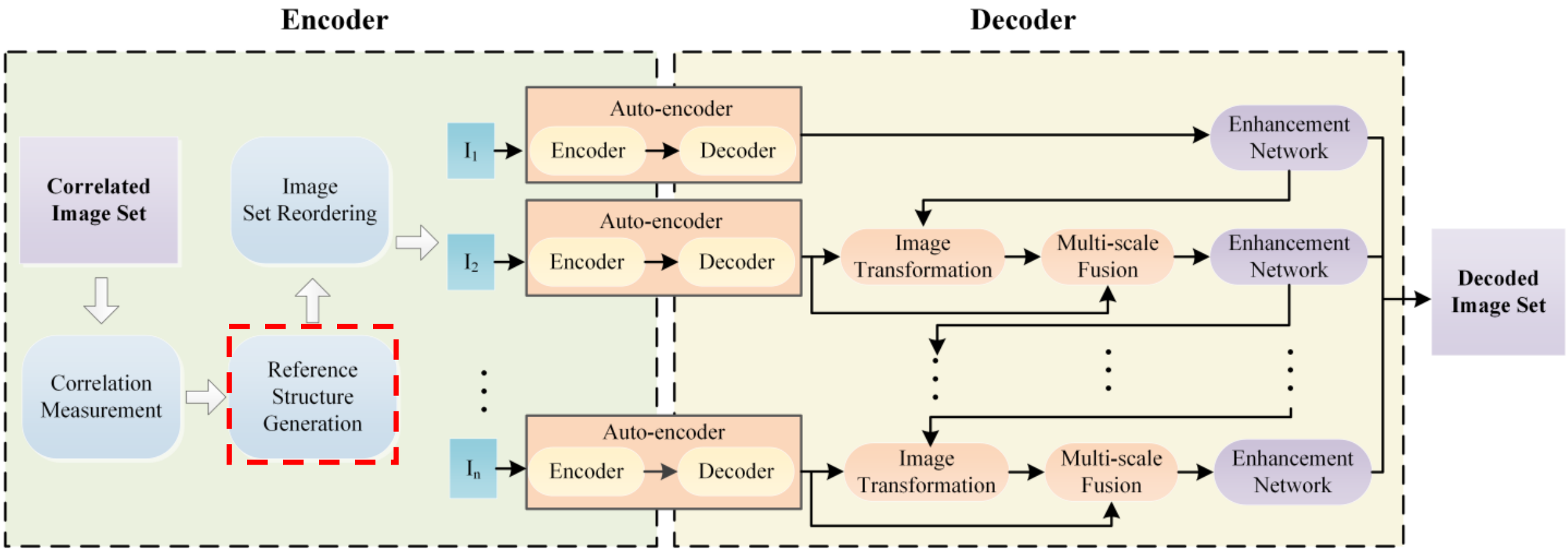
Contributions

- A deep similar image set compression scheme based on DSC and multi-scale fusion is proposed
- A side information generation scheme is proposed based on the decoded reference image
- An image enhancement network is proposed to further improve the quality of reconstructed image
- Experimental results validate the superior performance of both subjective and objective quality

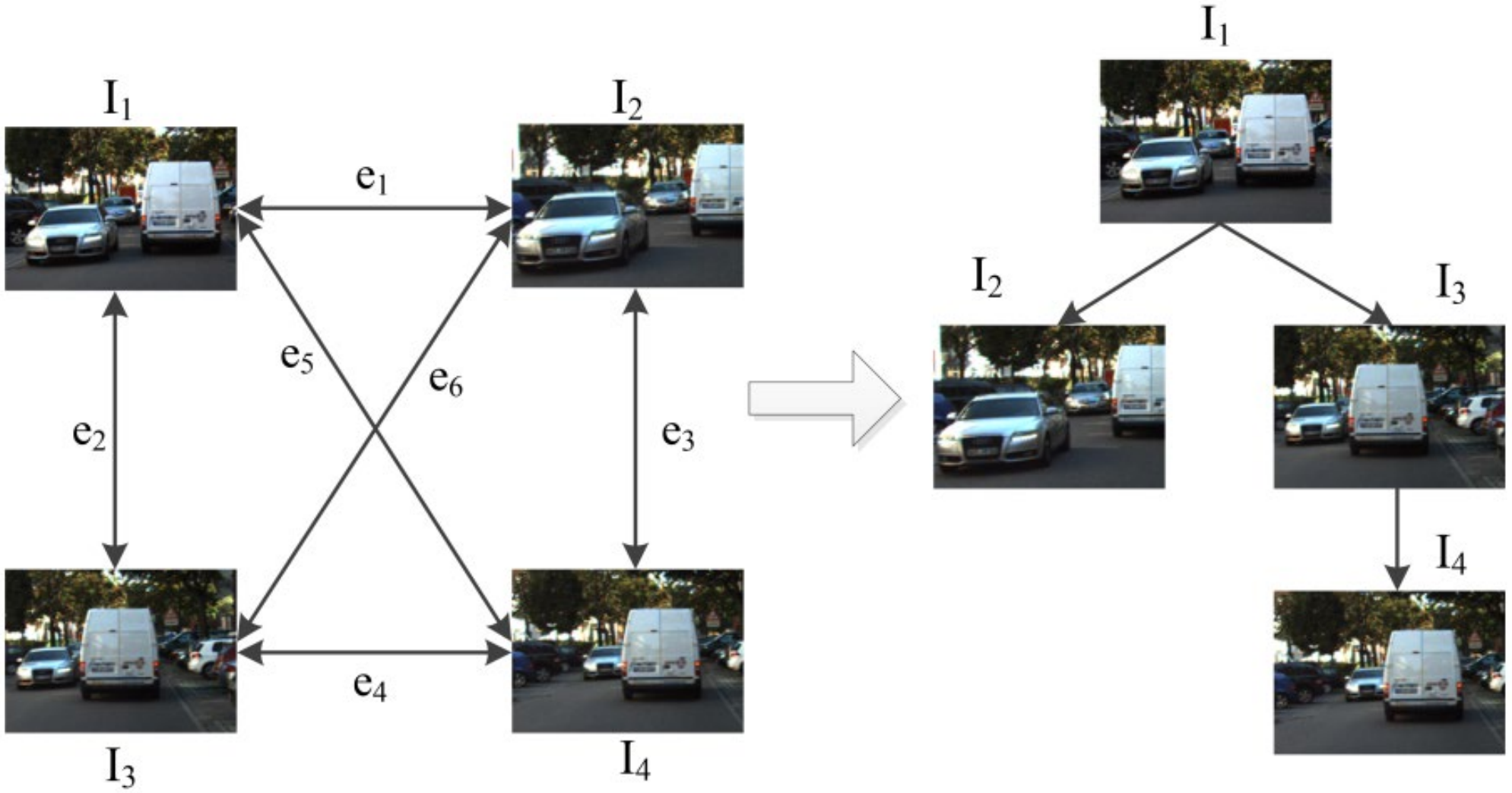
Network Architecture



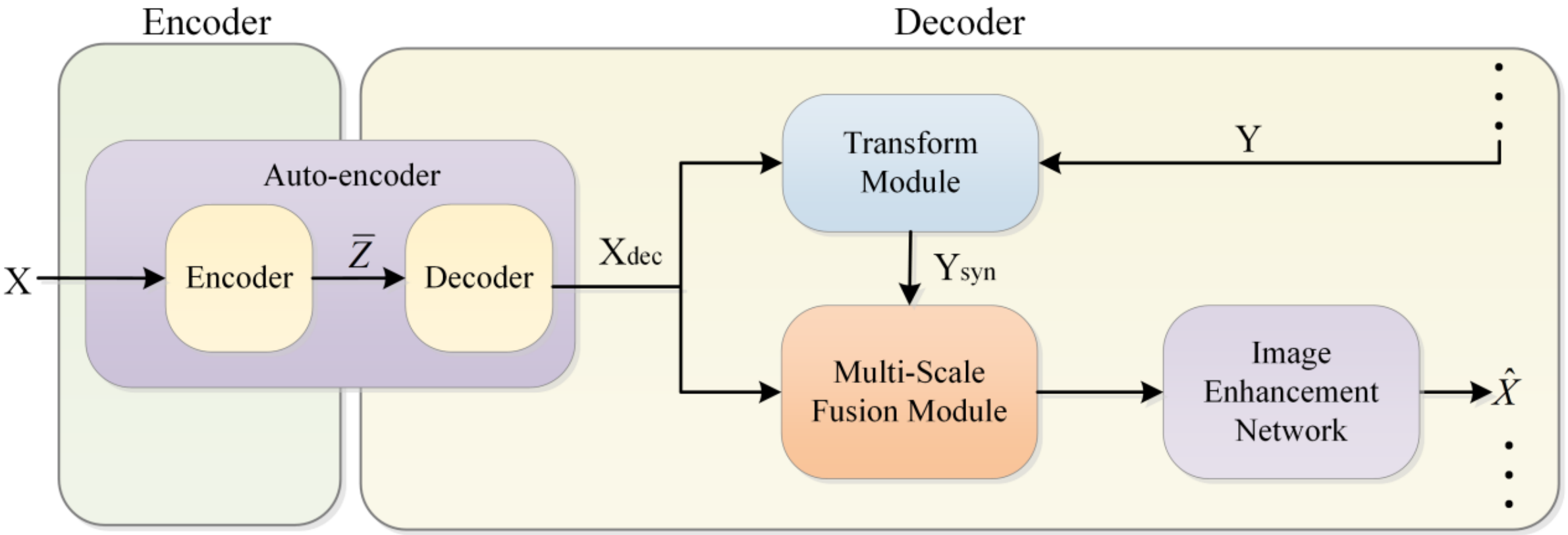
Generation of Reference Structure



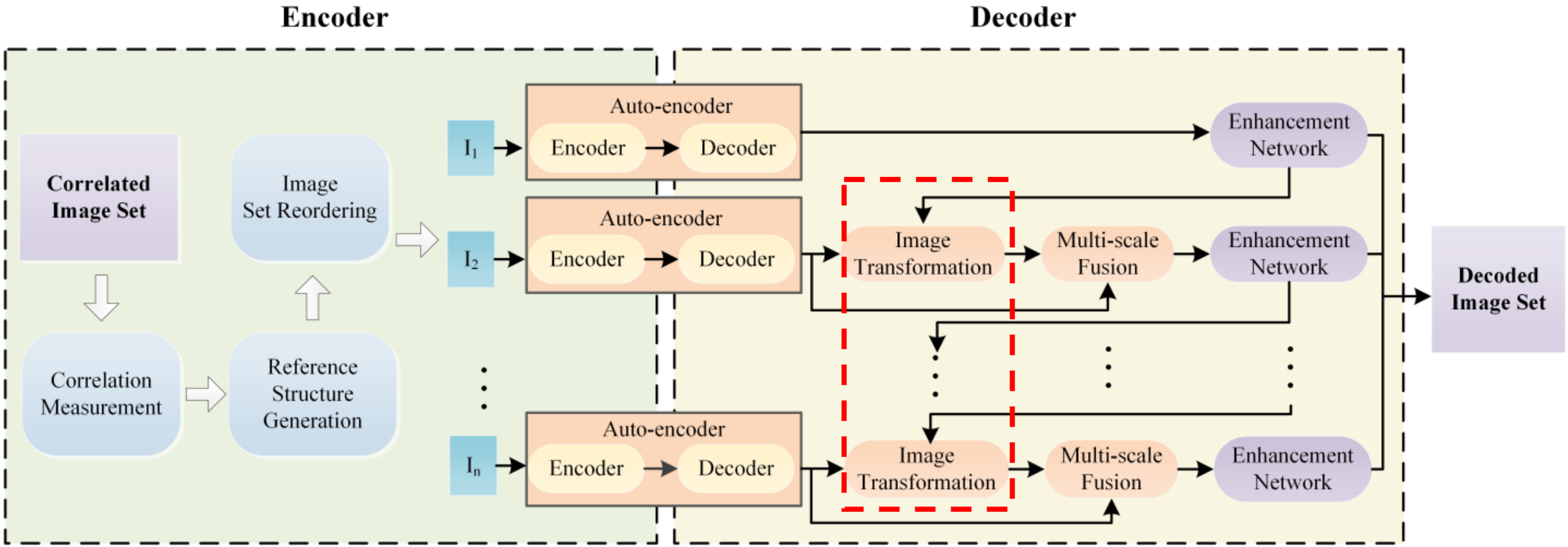
Feature-based MST Generation



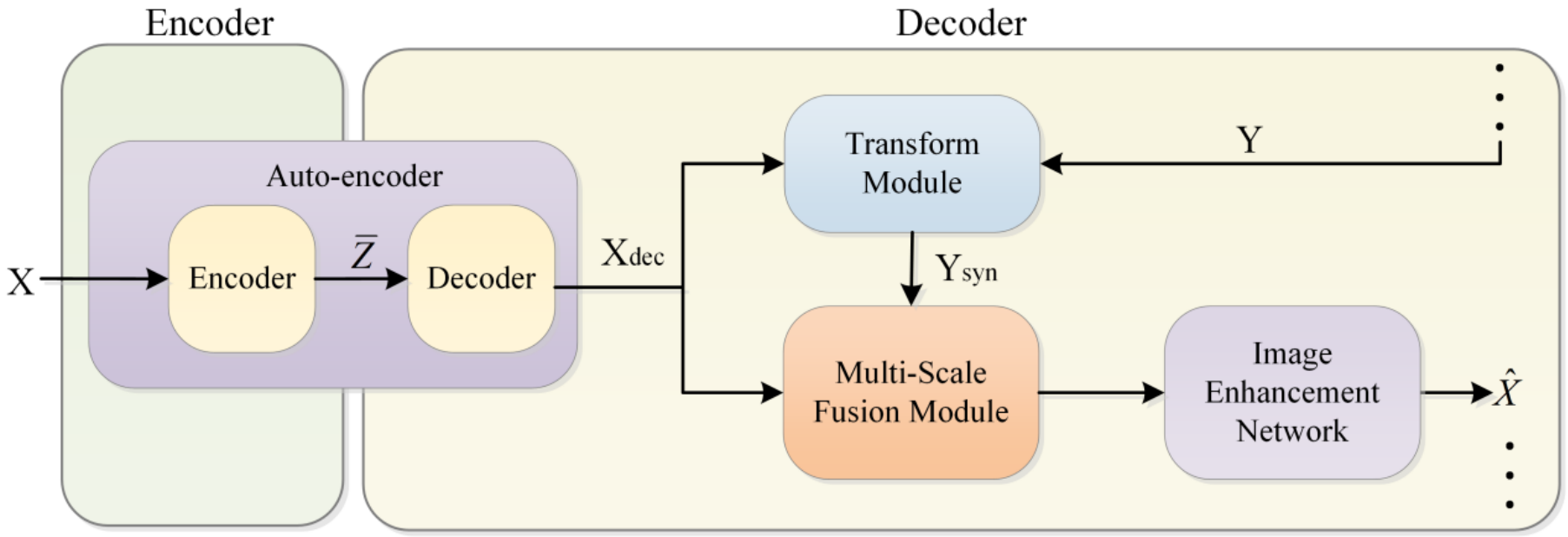
Detailed Image Compression Module



Reference Image Transform Module



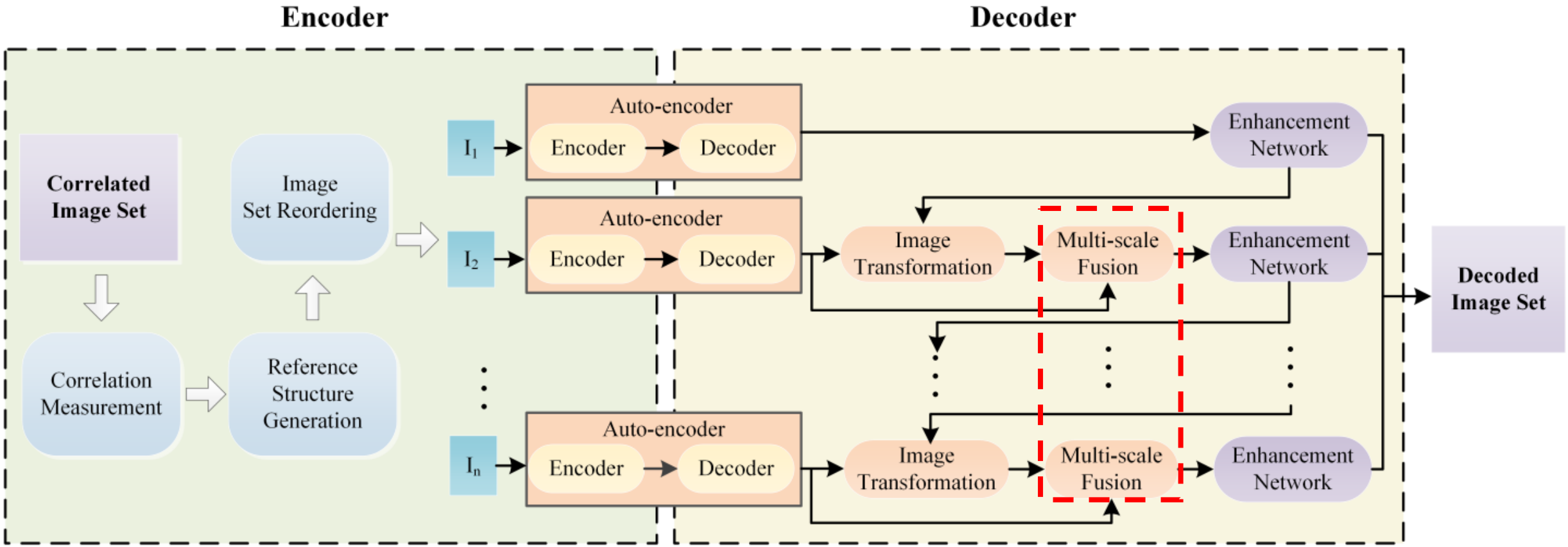
Reference Image Transform Module



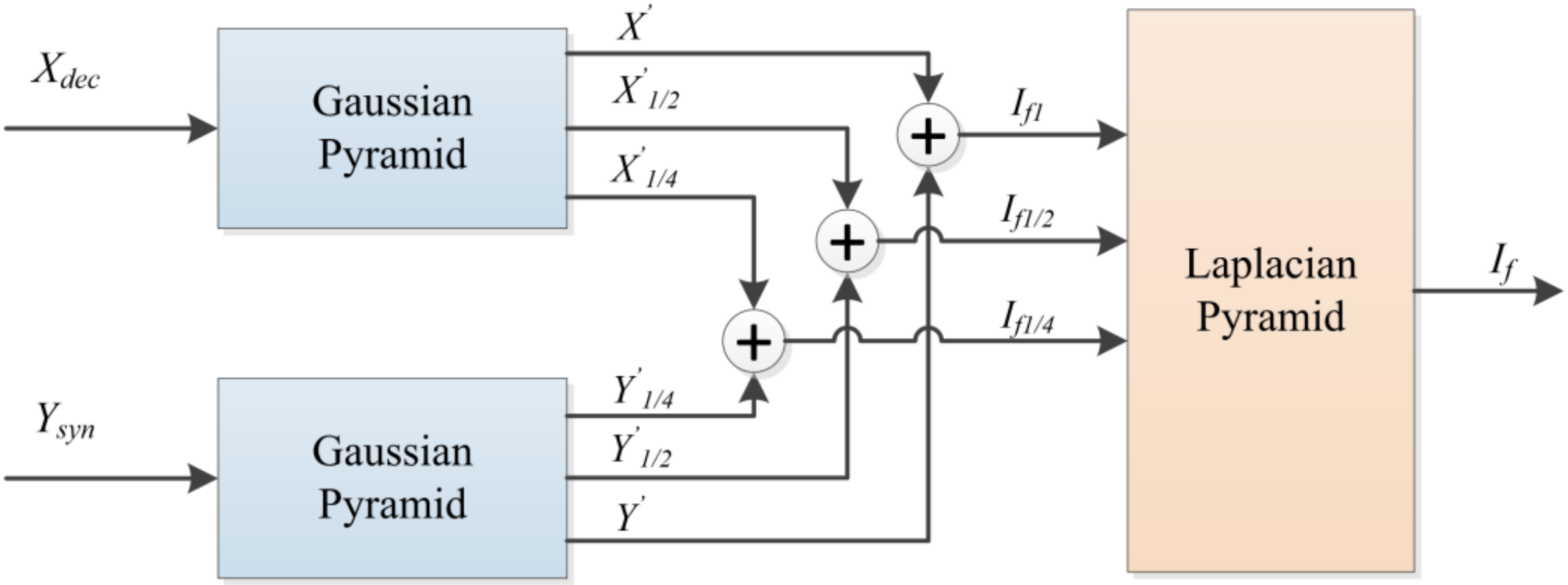
$$f(i) = \arg\max_{j} \operatorname{corr}\left(\pi\left(X_{dec}(i)\right), \pi\left(Y_{\mathrm{dec}}(j)\right)\right) \tag{1}$$

$$Y_{syn}(i) = Y(f(i)) \tag{2}$$

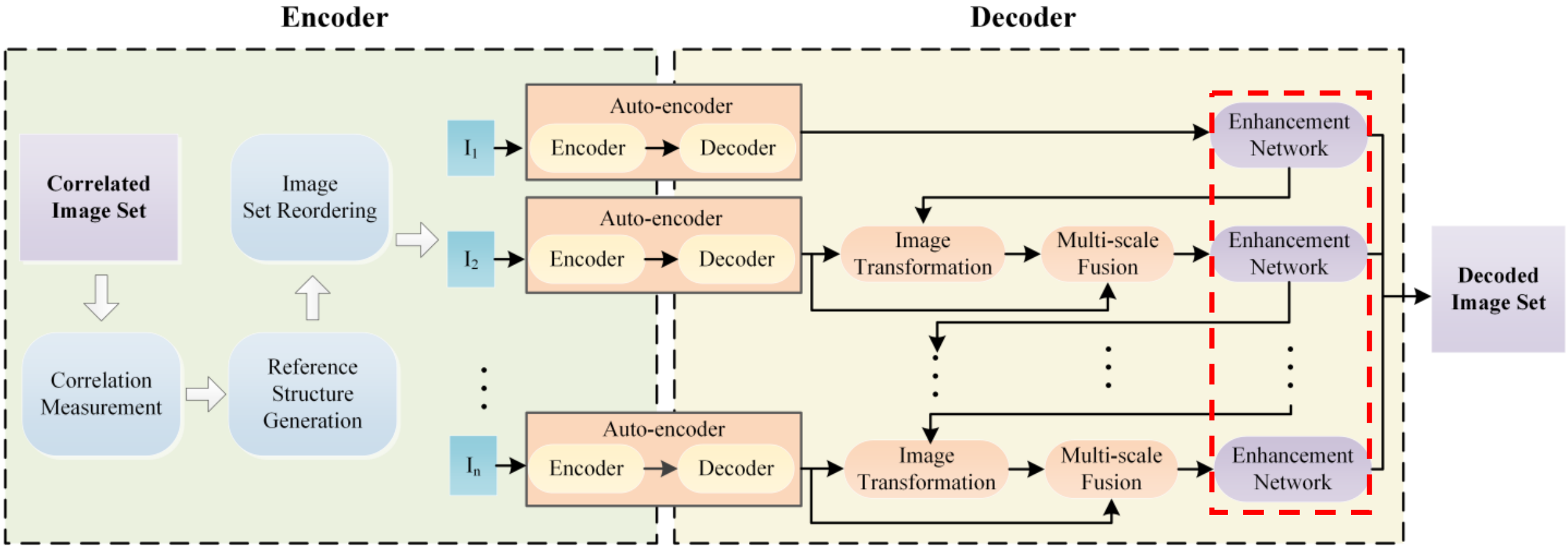
Multi-Scale Fusion



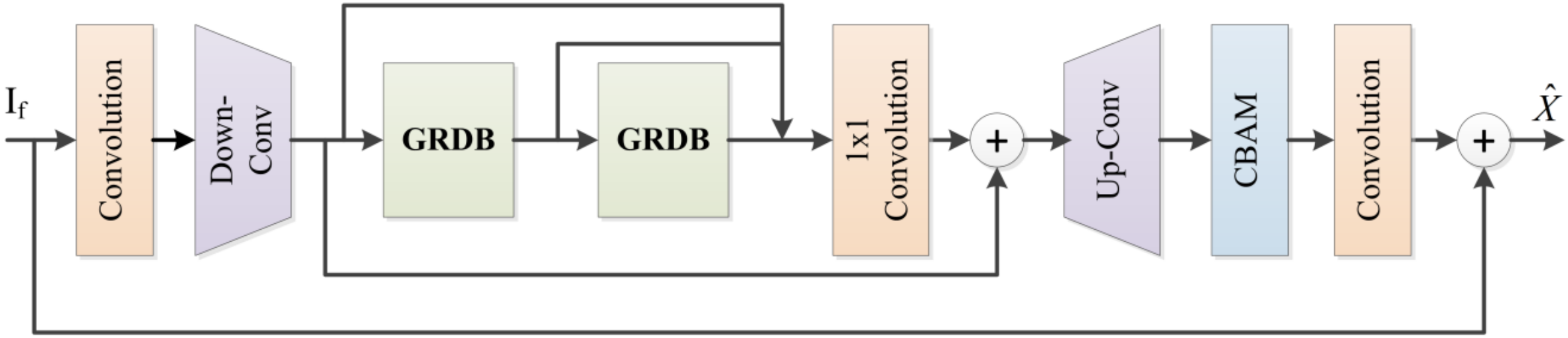
Multi-Scale Fusion



Decompressed Image Enhancement



Decompressed Image Enhancement



Experimental Settings

- Evaluated on the KITTI datasets, 789 scenes with 21 stereo image pairs per scene taken in sequence
- Implemented in TensorFlow
- Adam solver is adopted
- Initial learning rate of 10^{-4}, batch size of 1
- PSNR and MS-SSIM used as performance criteria

Visual Quality Comparison

Objective Quality Comparison

	0.02 bpp	0.04 bpp	0.06 bpp	0.08 bpp	0.10 bpp	0.20 bpp
JPEG2000	25.32	25.96	26.53	26.95	27.25	27.91
BPG	-	-	27.28	27.65	27.91	28.52
Lee[17]	26.24	27.13	27.65	28.02	28.25	28.84
Proposed	**27.67**	**28.29**	**28.79**	**29.12**	**29.33**	**29.63**

PSNR comparison of different methods(dB)

	0.02 bpp	0.04 bpp	0.06 bpp	0.08 bpp	0.10 bpp	0.20 bpp
JPEG2000	0.9007	0.9130	0.9228	0.9289	0.9332	0.9400
BPG	-	-	0.9274	0.9342	0.9380	0.9465
Lee[17]	0.9103	0.9242	0.9324	0.9383	0.9420	0.9480
Proposed	**0.9230**	**0.9338**	**0.9415**	**0.9466**	**0.9494**	**0.9529**

MS-SSIM comparison of different methods

Ablation Studies: Multi-Scale Fusion

(a) 0.0435 bpp, w/o MSF

(b) 0.0413 bpp, with MSF

(c) 0.0487 bpp, w/o MSF

(d) 0.0512 bpp, with MSF

Visual quality comparison with and without multi-scale fusion module

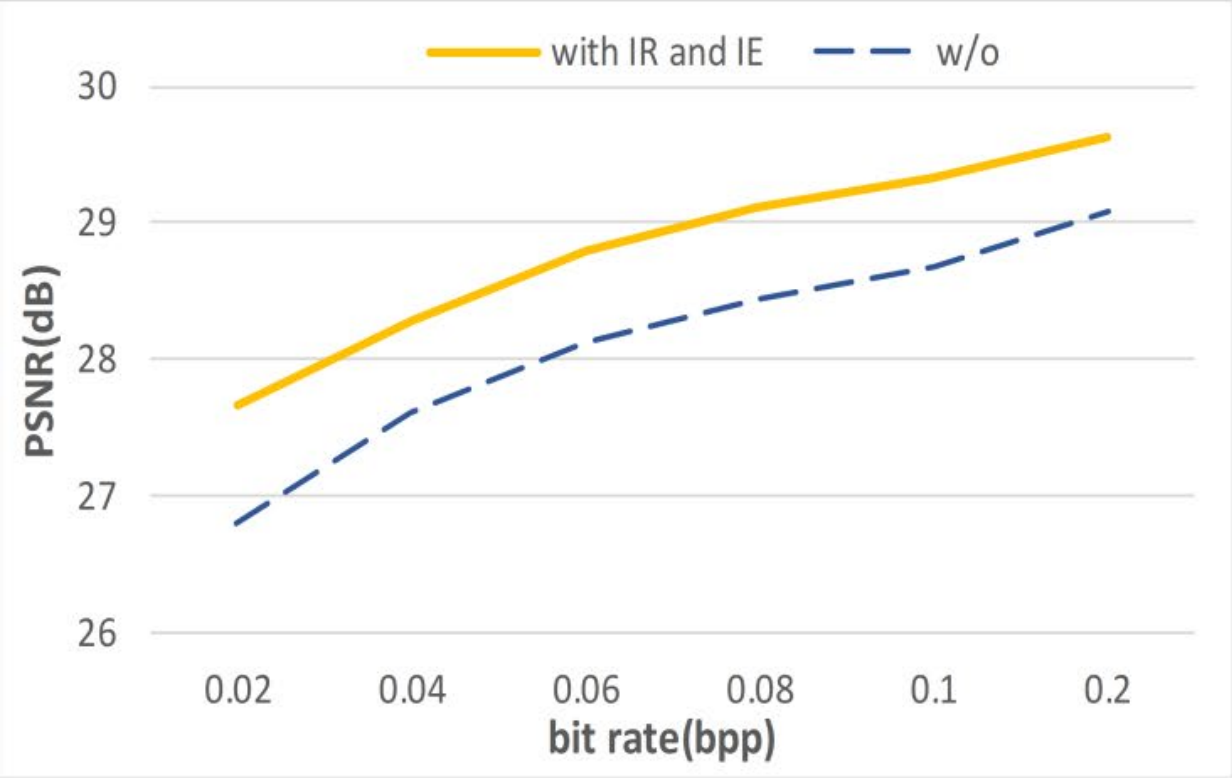
Ablation Studies: Image Reordering and Image Enhancement

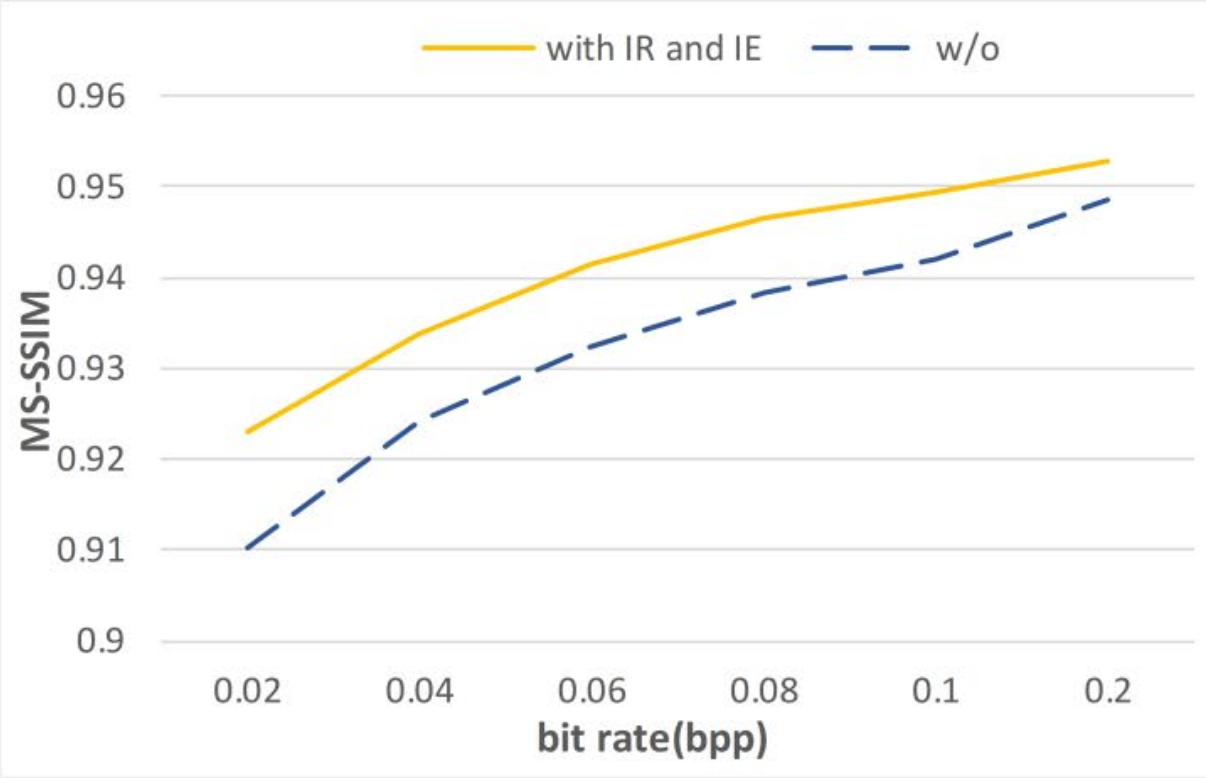
(a) 0.0601 bpp, w/o IR and IEN

(b) 0.0573 bpp, with IR and IEN

Visual quality comparison with and without IR and IE modules

Ablation Studies: Image Reordering and Image Enhancement





Objective quality comparison with and without IR and IEN modules

Ablation Studies: Image Reordering and Image Enhancement

	0.02 bpp	0.04 bpp	0.06 bpp	0.08 bpp	0.10 bpp	0.20 bpp
with GRDN	26.95	27.75	28.31	28.65	28.87	29.27
with IEN	**27.67**	**28.29**	**28.79**	**29.12**	**29.33**	**29.63**

PSNR comparison with different image enhancement modules(dB)

Conclusions

- A deep similar image set compression scheme based on Distributed Source Coding and multi-scale fusion is proposed
- Our method can efficiently learn the correlation between an image and its side information and fuse additional side information at different scales
- Extensive experimental results compared with other mainstream methods validate the superior performance of our scheme in both subjective and objective quality

Thank you!

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