

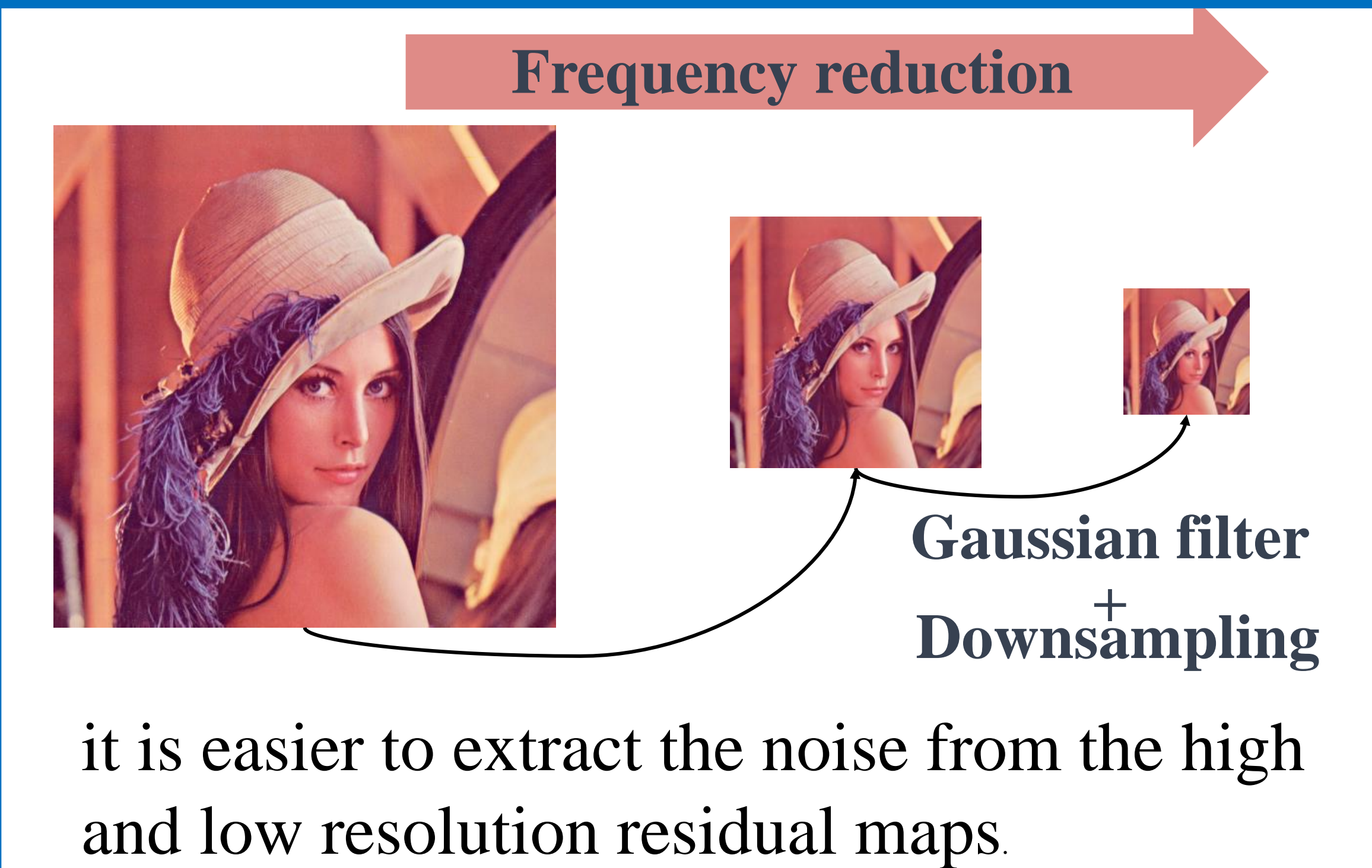
Challenge: Existing methods are difficult to enhance extremely dark areas or tend to amplify noise.

Introduction

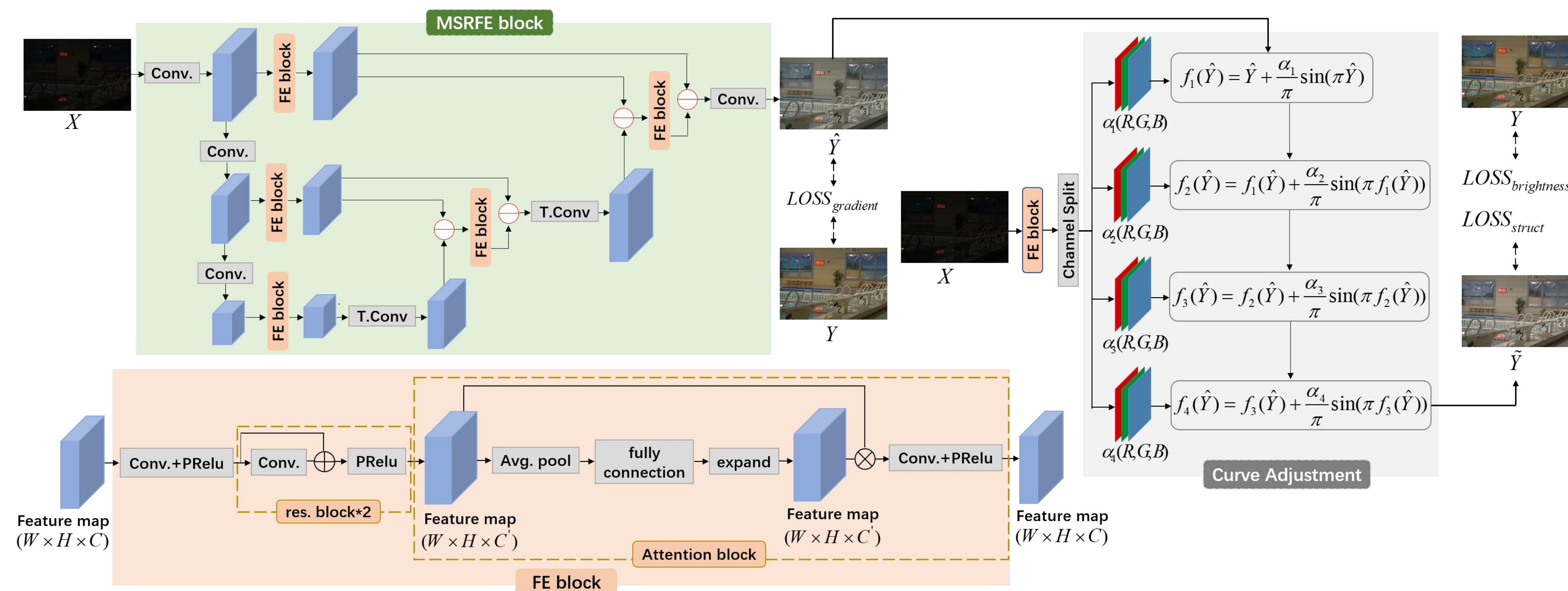
The main contributions of this paper are as follows:

- propose a simultaneous enhancement and denoising network-MSRFE network, which enhances images from low to full resolution and iteratively removes noise from multiple resolution residual maps.
- A deep recursive curve block is designed to fine-tune the enhanced image by MSRFE network, which restores the colour and detail of the image.

Motivation



Overall Framework



Visual Comparison

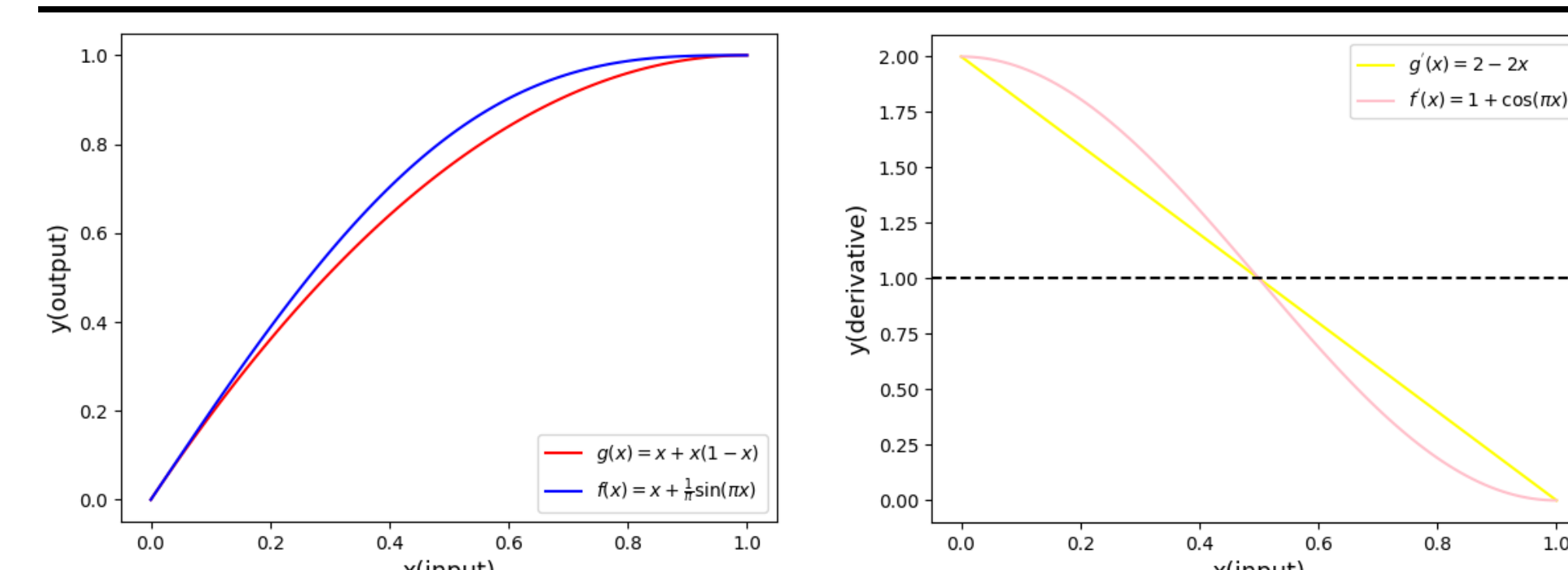


Quantitative Comparison

Method	PSNR	SSIM	NIQE
RetinexNet	16.774	0.425	8.872
TBEFN	17.351	0.777	3.436
RUAS	16.405	0.503	6.349
EnlightenGAN	17.556	0.666	4.581
LIME	17.182	0.562	4.992
DRBN	18.798	0.829	5.109
SGRDR	17.707	0.798	5.095
Kind	20.379	0.825	5.358
Zero-DCE	14.861	0.562	7.766
Ours	22.643	0.838	4.284

Ablation Study

Model	PSNR	SSIM
MSRFE	20.438	0.815
MSRFE+High order	20.141	0.812
MSRFE+Recursive	22.643	0.838



(a) Recursive curve versus high order curve by Zero-DCE; (b) Their derivatives comparison (i.e., $f'(x)$ versus $g'(x)$).

CONCLUSION

Inspired by the Gaussian pyramid, we propose an MSRFE network. It extracts and enhances the feature information at each scale and recursively subtracts the noise in the adjacent resolution residual map from the high-resolution feature map, thus implementing a network that simultaneously enhances and denoises the image. And we design the deep recursive curve to further fine-tune the initially enhanced image to recover image detail. Experiments demonstrate the superiority of our proposed method.