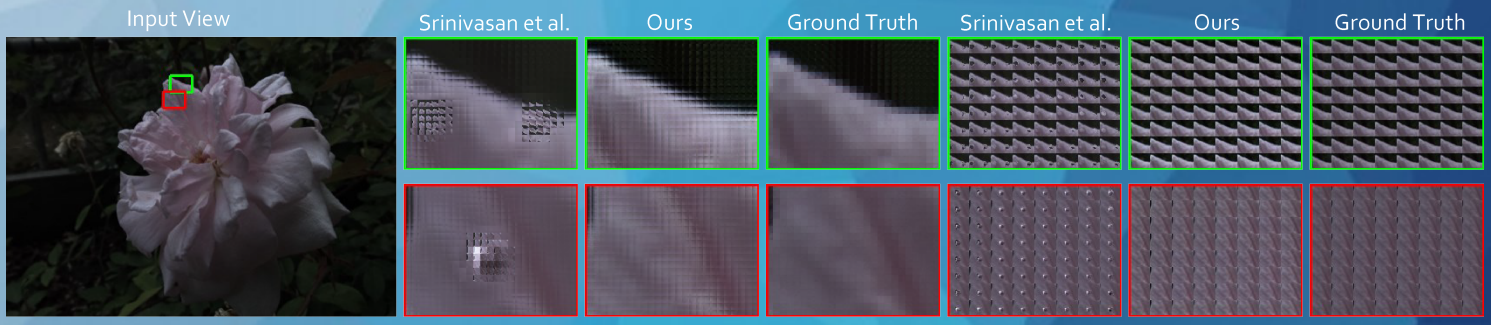
Light Field Synthesis from a Single Image using Improved Wasserstein Generative Adversarial Network

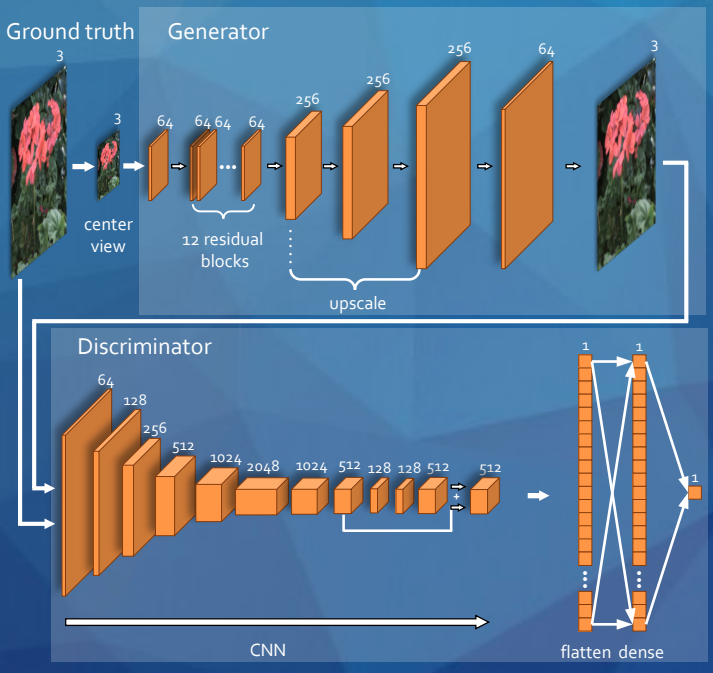
Lingyan RUAN, Bin CHEN, Miu-Ling LAM

School of Creative Media, City University of Hong Kong



We present a deep learning-based method to synthesize a 4D light field from a single 2D RGB image. We consider the light field synthesis problem equivalent to image super-resolution, and solve it by using the improved Wasserstein Generative Adversarial Network with gradient penalty (WGAN-GP).

The network architecture is similar to the SRGAN [LTH* 17], but WGAN-GP [GAA* 17] is used instead of DCGAN, and 8× upscaling factor is used instead of 4×.

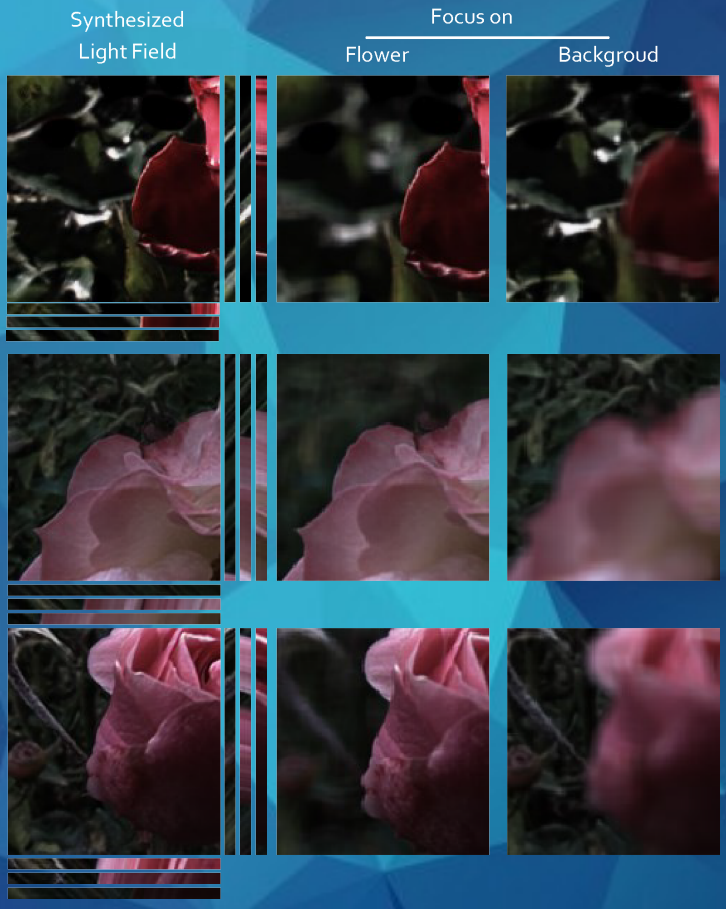


We used the light field image dataset provided by [SWS* 17]. We formulate the loss function as:

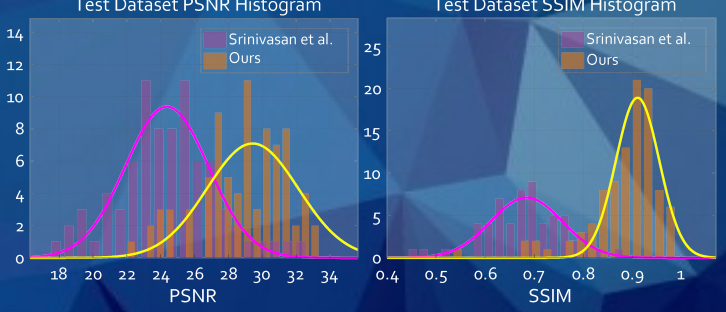
$$L = L_{wgan-gp} + \lambda_{mse}L_{mse} + \lambda_{vgg}L_{vgg} + \lambda_{vgg\_epi}L_{vgg\_epi}$$

We introduce both pixel-wise loss (MSE) and perceptual loss similar to SRGAN in [LTH* 17]. Moreover, we add the perceptual loss for image on epipolar plane to ensure the depth information can be generated properly.

[GAA* 17] Gulrajani, Ishaan, et al. "Improved training of wasserstein gans." 2017.
[LTH* 17] Ledig, Christian, et al. "Photo-realistic single image super-resolution using a generative adversarial network." 2016.
[SWS* 17] Srinivasan, Pratul P., et al. "Learning to synthesize a 4d rgbd light field from a single image." 2017.
[SZ15] Simonyan, Karen, et al. "Very deep convolutional networks for large-scale image recognition." 2014.



Experimental results demonstrate that our algorithm can predict complex occlusions and relative depths in challenging scenes. The light fields synthesized by our method has much higher PSNR and SSIM than the state-of-the-art approach.



miu.lam@cityu.edu.hk