

TexSR: Image Super-Resolution for High-Quality Texture Mapping

Jae-Ho Nah and Hyeju Kim

Sangmyung University, Seoul, South Korea

Problem

HD texture pack distribution
(+) delivers high-quality textures to end users
(-) requires designers' efforts
(-) increases storage & memory overheads

Our Method



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State-of-the-art deep-learning-based single-image super-resolution (SISR) techniques [1, 2, 3]
(+) show impressive results with noisy images in the real world
(+) can also be used for automatically increasing texture resolution [4]
(-) may not be suitable for noise-free textures

due to a detail lost and/or color distortion

Related Work

Base SISR algorithm Real-ESRGAN [1]

Texture compression format ASTC [5] with variable block sizes

1. Modification of Real-ESRGAN's training parameters

- a) Remove the additive Gaussian and Poisson noiseb) Do not consider the perceptual loss for training the network
- b) Do not consider the perceptual loss for traini

2. Post-color correction

Selectively blend four pixels in the upscaled SR image and a pixel in its original image according to the HSV difference between them

3. ASTC compression

Instead of applying the same block size to all textures, we determine the block size of each texture using a PSNR target [6]

Results

References

[1] Xintao Wang et al., Real-ESRGAN: TrainingReal-World Blind Super-Resolution With Pure Synthetic Data.*ICCVW 2021*.

[2] Kai Zhang et al., Designing a Practical Degradation Model for Deep Blind Image Super-Resolution. *ICCV 2021*.

[3] Jingyun Liang et al., SwinIR: Image Restoration Using Swin Transformer. *ICCVW 2021*.

[4] Shintaro Takemura, Optimize Deep Super-Resolution and Denoising for Compressed Textures. *SIGGRAPH Asia 2018 Posters*.

[5] Jorn Nystad et al., Adaptive scalable texture compression. *HPG 2012*.

[6] Jae-Ho Nah, ASTC Block-Size Determination Method based on PSNR Values. *Journal of KCGS* (2022)

[7] Pontus Andersson et al., FLIP: A Difference Evaluator for Alternating Images. *HPG 2020*.

[8] Jae-Ho Nah, QuickETC2: Fast ETC2 Texture Compression

TexSR successfully enhances texture details compared to Real-ESRGAN, with higher PSNR and lower mean **FLIP** [7] values



using Luma Differences. SIGGRAPH Asia 2020 (TOG).

[9] Sascha Willems, *Vulkan Sponza*. github.com/SaschaWillems/VulkanSponza

Author email: jaeho.nah@smu.ac.kr

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TexSR can reduce the size of super-resolution textures

- DXT3 textures in Vulkan Sponza [9] \rightarrow 82 MB
- ASTC textures generated from TexSR 2x (37 dB PSNR target) → 164 MB i.e., a half size compared to traditional 2x upscaling