Supplementary Materials: Hierarchical Adaptive Filtering Network for Text Image Specular Highlight Removal

Details of Our Dataset Construction

To illustrate the details of our dataset construction, we present a case study focusing on the simulation of realistic specular highlights on bank card materials.

In this example, we employ a directional light source to simulate sunlight. The color of the directional light is set to a warm sunlight hue, which approximates the environmental lighting effects observed in real-world scenarios. The intensity of the light can be adjusted as needed to achieve the desired brightness.

Shadow Type and Intensity: Soft shadows with moderate intensity are utilized to ensure that shadow edges are smooth, thereby enhancing the realism of the scene.

Indirect Lighting Intensity: Set between 1.0 and 2.0, this setting ensures that reflections and bounce lighting contribute to the realism of the object's surface highlights and overall illumination.

Rendering Mode and Culling Mask: The rendering mode is configured to a high priority, and the culling mask is adjusted so that the lighting affects only the layer containing the bank card. This configuration reduces unnecessary performance overhead while ensuring the precision of the specular highlights.

Shader Configuration: The bank card shader is designed with the following parameters:

- **MainTex** ("Main Texture", 2D) = "white" .
- **Smoothness** ("Smoothness", Range(0, 1)) = 0.6.
- **Metallic** ("Metallic", Range(0, 1)) = 0.8.
- **OcclusionStrength** ("Strength", Range(0, 1)) = 1.
- **Emissive** ("Emissive Color", Color) = (1,1,1,1).
- **ReflectionTex** ("Probe", Cubemap) = "Skybox".
- **Anisotropy** ("Anisotropy", Range(0, 1)) = 0.5.

MainTex: This parameter represents the primary texture of the bank card body. It provides the base appearance and visual details of the card's surface.

Smoothness: Set to 0.6, this parameter defines the smoothness of the bank card's surface. It affects how glossy or matte the surface appears.

Metallic: This value is set to 0.8, indicating a high degree of metallic reflection for specific parts of the card, particularly the metallic printing sections.

OcclusionStrength: This parameter, set to 1, adjusts the strength of ambient occlusion. It contributes to the depth and realism of the material by simulating the shading that occurs in crevices and detailed areas.

Emissive: This setting defines the color of self-illumination. It allows parts of the bank card, such as security marks or decorative elements, to appear glowing even in low-light conditions.

ReflectionTex: This Cubemap texture is used for reflection probes. It enhances the specular reflection on the card's surface, contributing to a more realistic highlight effect.

Anisotropy: Set to 0.5, this parameter simulates anisotropic reflection, which mimics directional reflective effects such as stripes or brush strokes on the card's surface.

1. Discussion And Experiments

Figure 1 presents the experimental results of our method compared to other approaches on our dataset. We can observe that traditional methods Shen [5] and Yang [7], as described in the main text, produce unrealistic results with severe visual artifacts.

Figure 2 and Figure 3 provide visual comparison results on the RD [3] dataset. We can observe that our method recovers finer details in regions where the information under highlights is not completely lost.

Figure 4 and Figure 5 provide the visual comparison results on the SD1 [3] dataset. As described in our paper, our method effectively removes highlights while restoring the information obscured by the highlights and avoiding visual artifacts.

Figure 6 illustrates the limitations of our method, as described in the main paper

Additional results on other types of text images are provided in Figure 7

Comparison method: Shen [5], Yang [7], TASHR [3], JSHDR [1], Wu [6], THSHR [2], IDRHR [4].

References

[1] Gang Fu, Qing Zhang, Lei Zhu, Ping Li, and Chunxia Xiao. A multi-task network for joint specular highlight detection and removal. In *Proceedings of the IEEE/CVF Conference on Computer Vision and Pattern Recognition*, pages 7752–7761, 2021. 1

(a) Input (b) Shen (c) Yang (d) TASHR (e) JSHDR

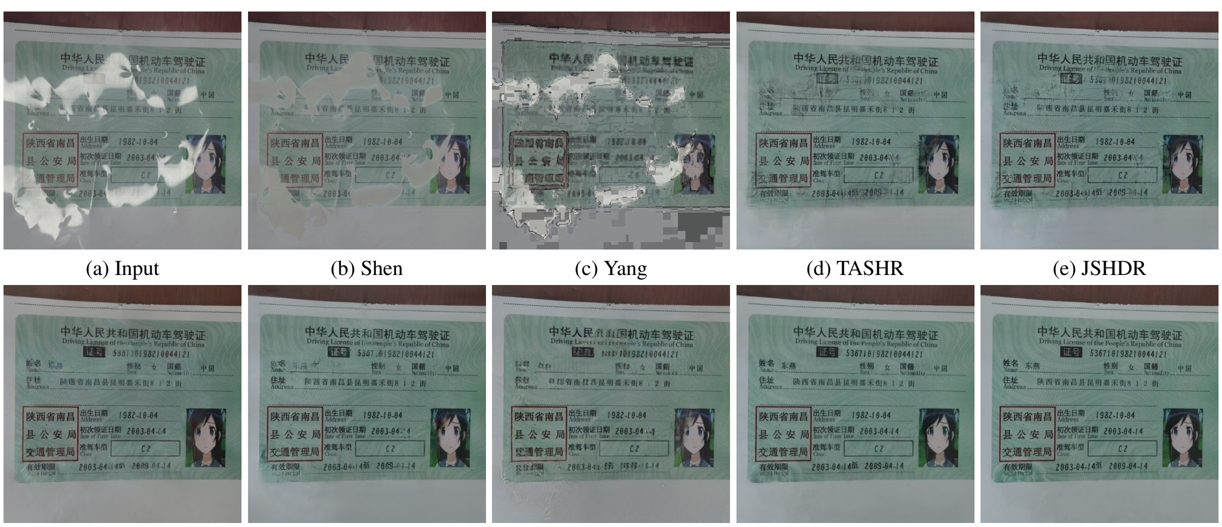
(f) Wu (g) THSHR (h) IDRHR (i) Ours (j) GT

Figure 1. Additional visual comparison results on our LSH dataset.

(a) Input (b) Shen (c) Yang (d) TASHR (e) JSHDR

(f) Wu (g) THSHR (h) IDRHR (i) Ours (j) GT

Figure 2. Additional visual comparison results on RD dataset.



(a) Input (b) Shen (c) Yang (d) TASHR (e) JSHDR

(f) Wu (g) THSHR (h) IDRHR (i) Ours (j) GT

Figure 3. Additional visual comparison results on RD dataset.

(a) Input (b) Shen (c) Yang (d) TASHR (e) JSHDR
(f) Wu (g) THSHR (h) IDRHR (i) Ours (j) GT

Figure 4. Visual comparison results on SD1 dataset.

(a) Input (b) Shen (c) Yang (d) TASHR (e) JSHDR
(f) Wu (g) THSHR (h) IDRHR (i) Ours (j) GT

Figure 5. Visual comparison results on SD1 dataset.

(a) Input (b) Our result (c) Input (d) Our result

Figure 6. Two failure cases of our method.

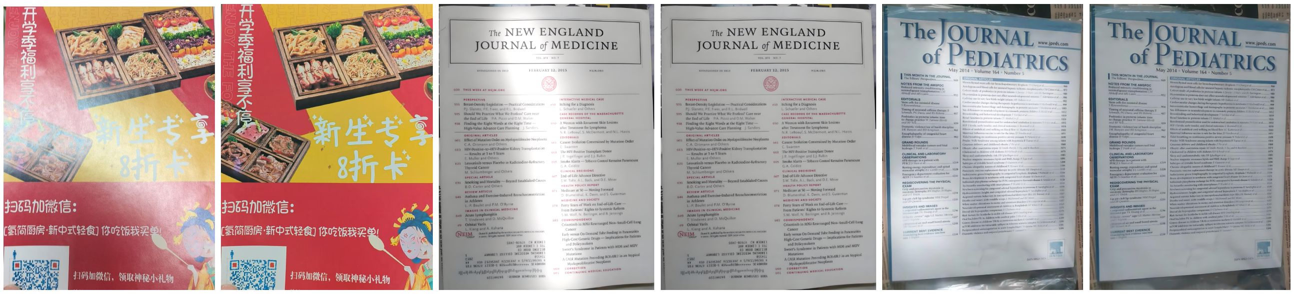


Figure 7. Additional text image results.

[2] Gang Fu, Qing Zhang, Lei Zhu, Chunxia Xiao, and Ping Li. Towards high-quality specular highlight removal by leveraging large-scale synthetic data. In *Proceedings of the IEEE/CVF International Conference on Computer Vision*, pages 12857–12865, 2023. 1

[3] Shiyu Hou, Chaoqun Wang, Weize Quan, Jingen Jiang, and Dong-Ming Yan. Text-aware single image specular highlight removal. In *Pattern Recognition and Computer Vision: 4th Chinese Conference, PRCV 2021, Beijing, China, October 29–November 1, 2021, Proceedings, Part IV 4*, pages 115–127. Springer, 2021. 1

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[5] Hui-Liang Shen and Zhi-Huan Zheng. Real-time highlight removal using intensity ratio. *Applied optics*, 52(19):4483–4493, 2013. 1

[6] Zhongqi Wu, Chuanqing Zhuang, Jian Shi, Jianwei Guo, Jun Xiao, Xiaopeng Zhang, and Dong-Ming Yan. Single-image specular highlight removal via real-world dataset construction. *IEEE Transactions on Multimedia*, 24:3782–3793, 2021. 1

[7] Qingxiong Yang, Jinhui Tang, and Narendra Ahuja. Efficient and robust specular highlight removal. *IEEE transactions on pattern analysis and machine intelligence*, 37(6):1304–1311, 2014. 1