

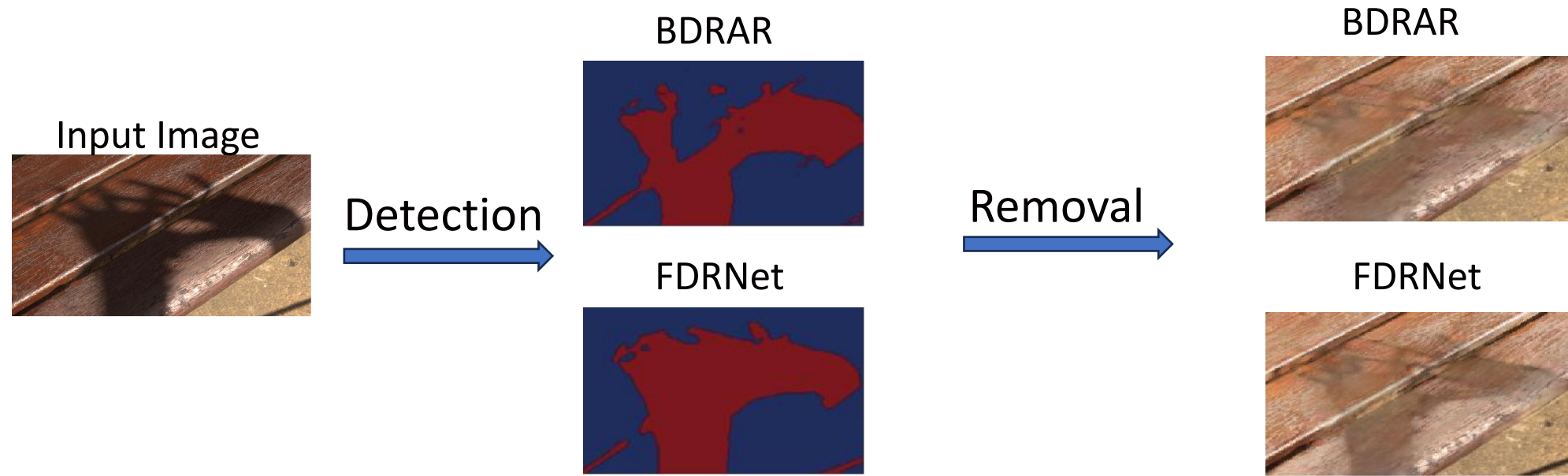
Under the Shadow: Exploiting Opacity Variation for Fine-grained Shadow Detection

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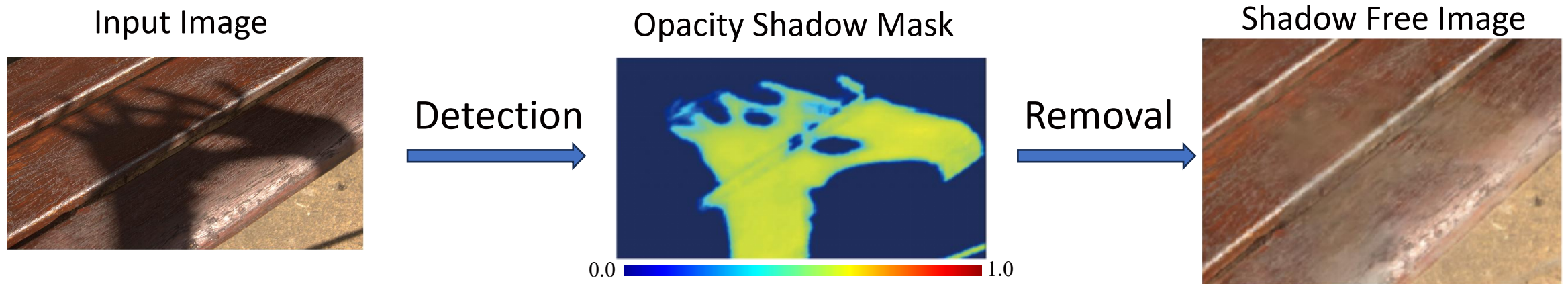
Motivation

- Existing works consider shadow regions as binary masks, often leading to imprecise detection results and suboptimal performance for scene understanding applications.



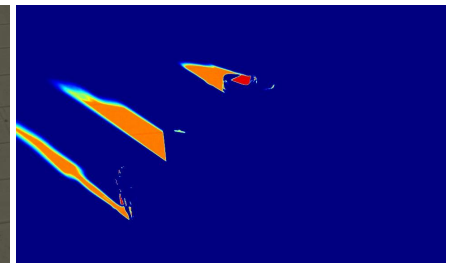
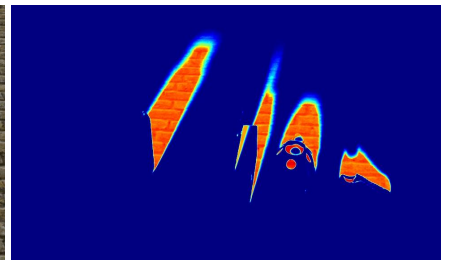
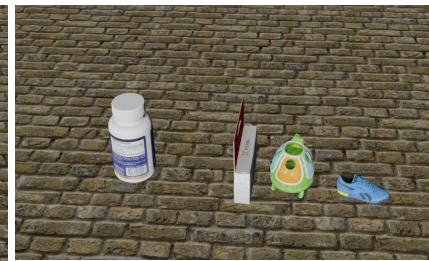
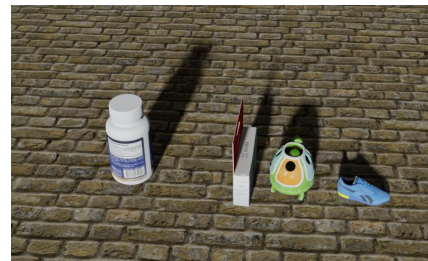
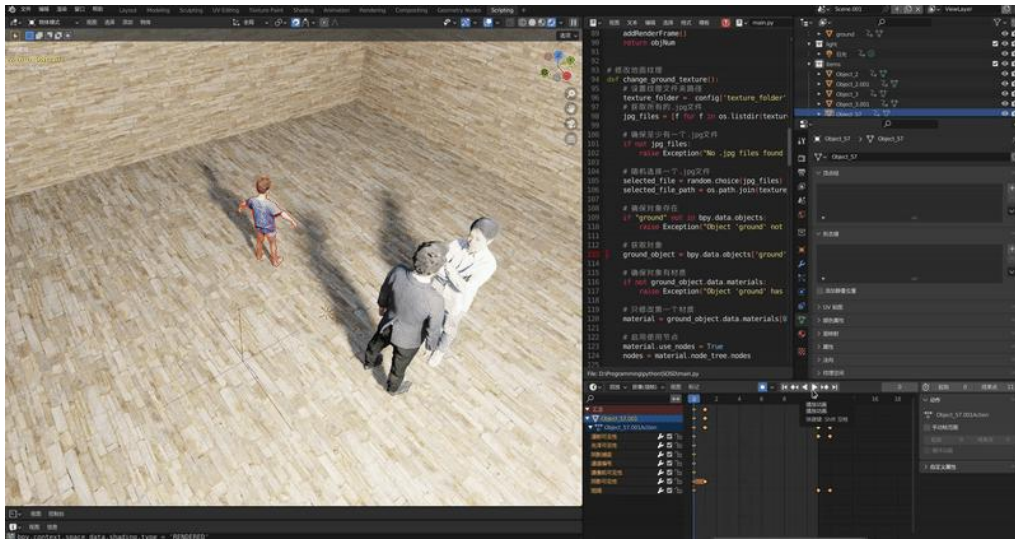
Fine-grained Shadow Detection Problem

- Given an input image, our goal is to predict a continuous opacity mask representing the shadow region.
- The continuous shadow opacity mask is useful in various downstream scene understanding applications.



Dataset

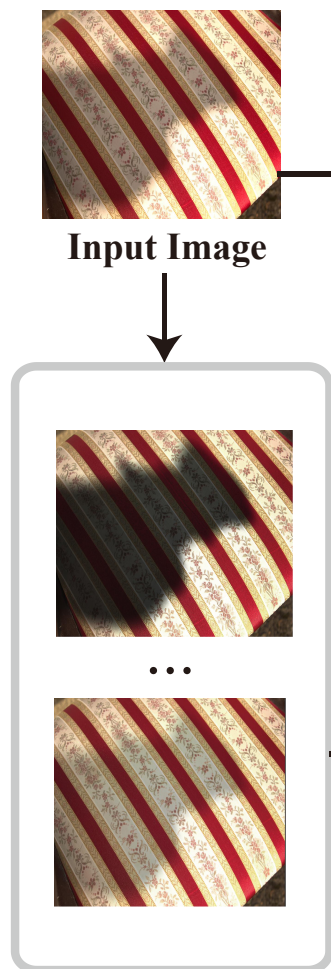
- FSD comprises 2,653 scenes with various objects, scene types, and light source properties. contains varied camera positions, light intensities, object numbers, and categories.



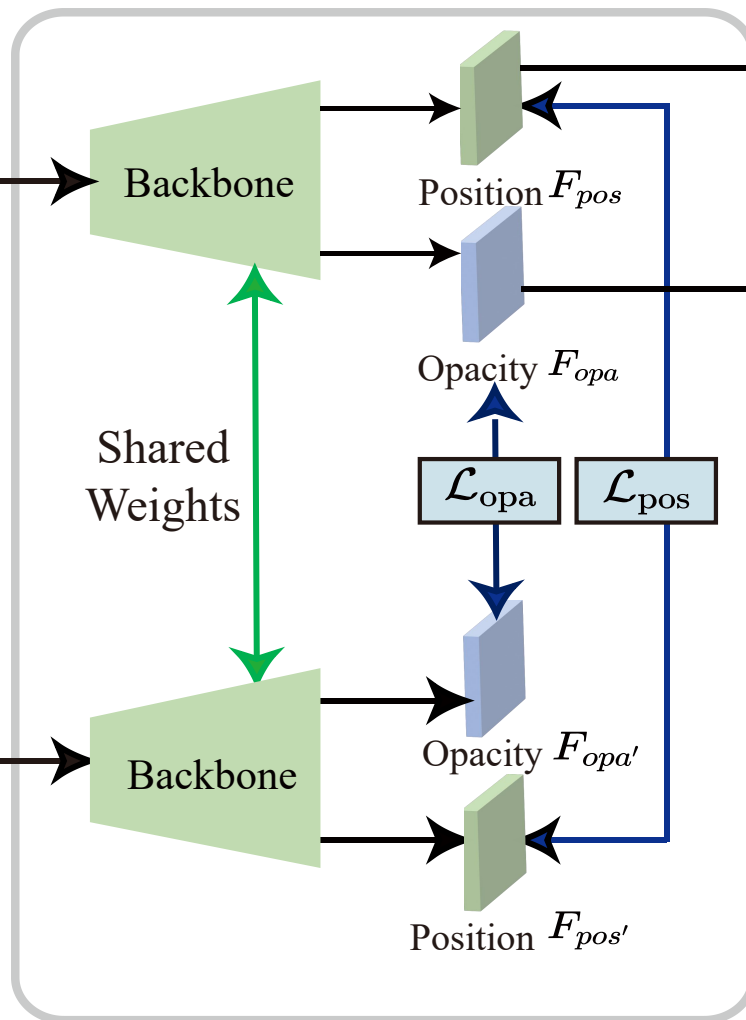
Approach



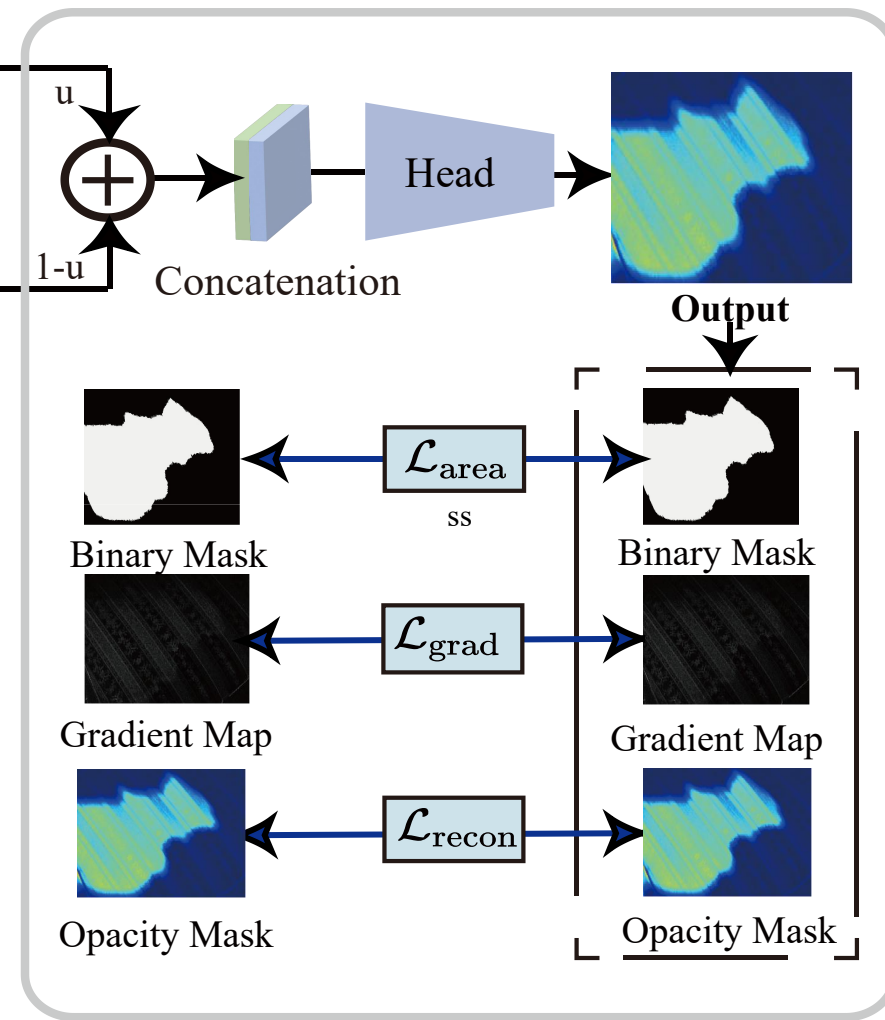
Shadow Opacity Augmentation



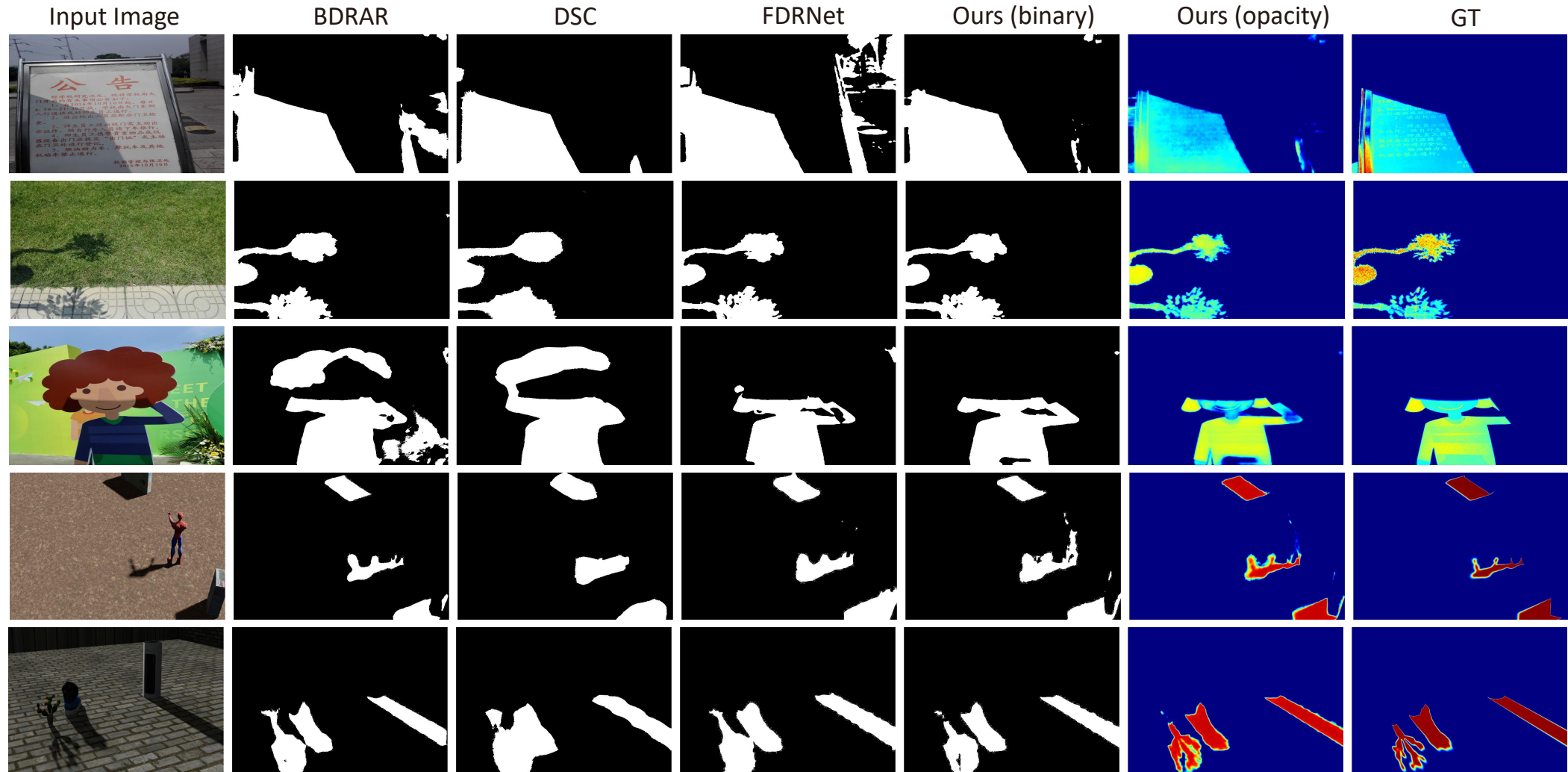
Shadow Feature Separation



Opacity Mask Prediction



Qualitative Evaluation





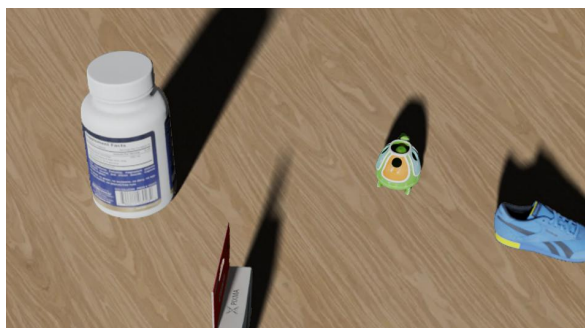
Quantitative Evaluation

Method	BER ↓	Shadow ↓	Non Shadow ↓
stacked-CNN	8.60	7.69	9.23
scGAN	4.70	3.22	6.18
ST-CGAN	3.85	2.14	5.55
BDRAR	2.69	0.50	4.87
DSC	3.42	3.85	3.00
DSD	2.17	1.36	2.08
MTMT	1.72	1.36	2.08
FDRNet	1.55	1.22	1.88
Ours	1.32	0.96	1.67

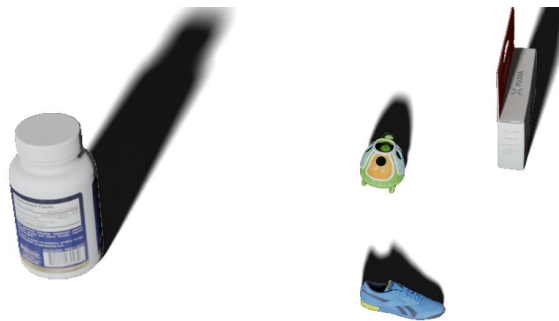
Applications

- Image Editing

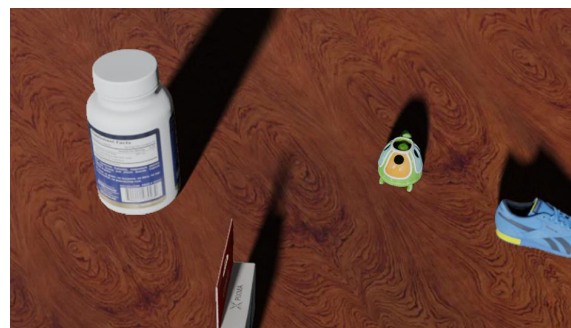
Input



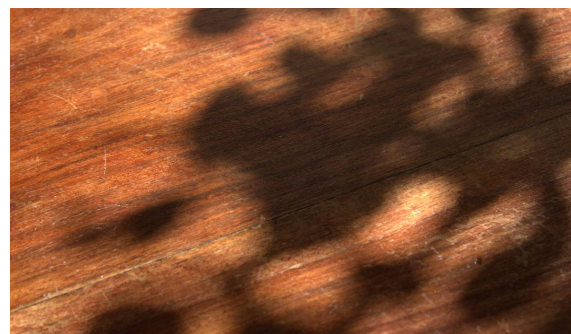
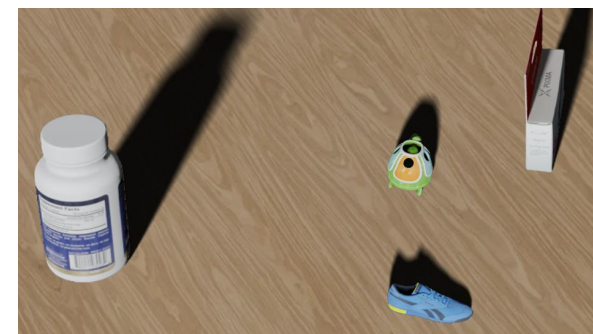
Opacity Shadow Mask



Background Editing



Foreground Editing



Applications

- Shadow Removal

Input



Binary Mask



Opacity Mask



GT





Conclusion

- We make the first attempt to investigate fine-grained shadow detection by exploiting opacity variations.
- We propose a new shadow detection method by explicitly capturing shadow position and opacity characteristics, and construct a new FSD dataset.
- Results show that our method can predict fine-grained shadow characteristics and enable various applications.



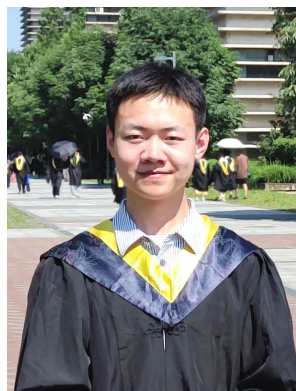
Thanks for Your Attention!



Xiaotian Qiao



Ke Xu



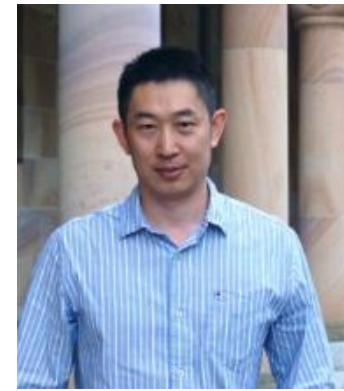
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