MaterialGAN: Reflectance Capture using a Generative SVBRDF Model

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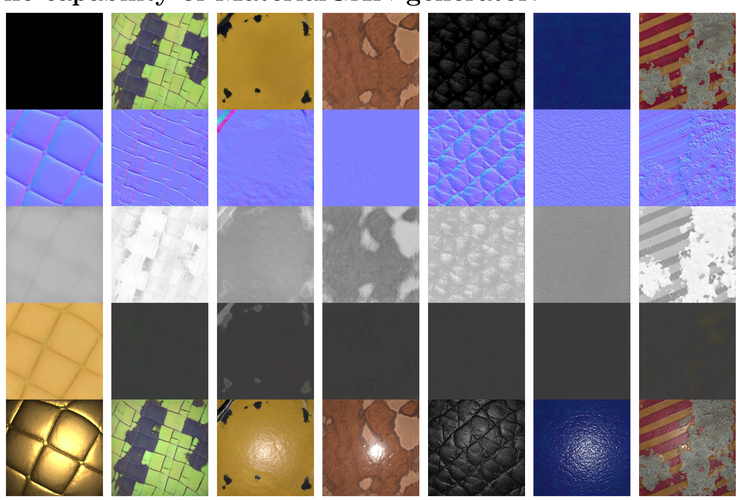
Introduction

We introduce a method to capture SVBRDF material maps from a small number of mobile flash photographs, achieving high quality results both on original and novel views. Our key innovation is optimization in the latent space of MaterialGAN, a generative model trained to produce plausible material maps; MaterialGAN thus serves as a powerful implicit prior for result realism. Here we show re-rendered views for several different materials under environment illumination. We use 7 inputs for these results (with 2 of them shown). (Please use Adobe Acrobat and click the renderings to see them animated.)

MaterialGAN

A GAN that is trained to generate plausible materials, thus implicitly learning an SVBRDF manifold. MaterialGAN is based on the architecture of StyleGAN2 [1].

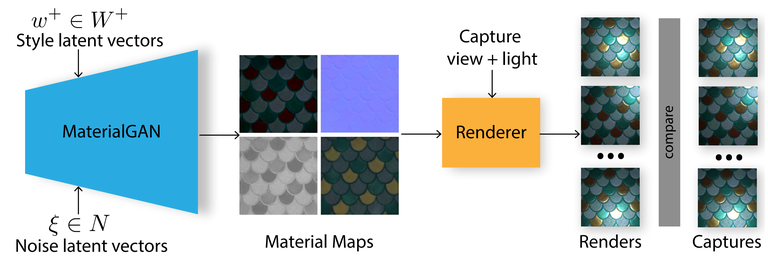
The capability of MaterialGAN generator:



The material maps generated by randomly sampling MaterialGAN are high-quality with meaningful correlations both spatially and across materials parameters, and visually look like plausible real-world materials.

Inverse rendering

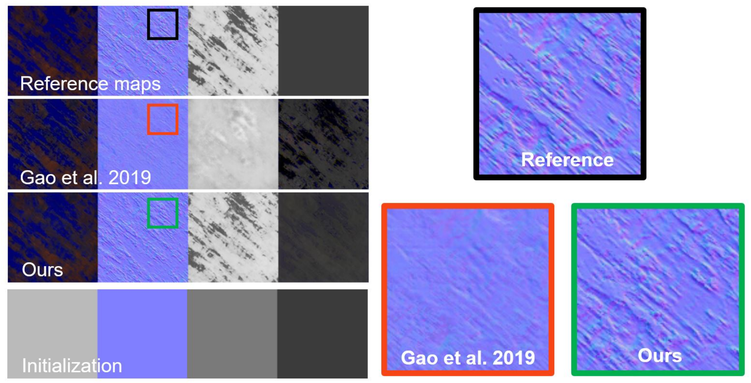
Pipeline:



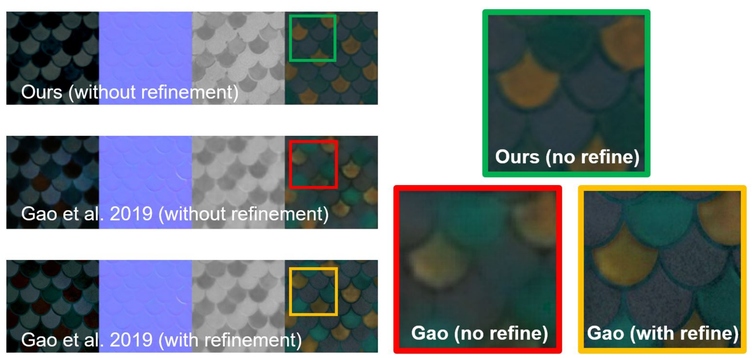
We optimize for latent vectors $\boldsymbol{w}^+$ and $\boldsymbol{\xi}$, that feed into the layers of the StyleGAN2-based MaterialGAN model. The MaterialGAN generator produces material maps (diffuse albedo, normal, roughness and specular albedo), that are rendered under the captured view/light settings. Finally, the renderings and measurements are compared using a combination of L2 and perceptual losses.

Comparison

Ours is less sensitive to initialization:

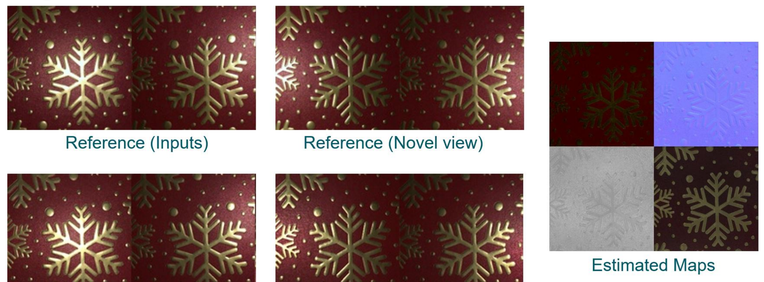


Post-refinement is less important in ours method:



Results

Large features:



Small features:

High specularity:

(Please see more results from our paper and supplemental materials.)

References

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[2] Duan Gao, Xiao Li, Yue Dong, Pieter Peers, Kun Xu, and Xin Tong.
Deep inverse rendering for high-resolution svbrdf estimation from an arbitrary number of images.
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