

# What You Can Reconstruction from A Shadow

## Supplementary Materials

### A. Kagemusha: A Dataset of Shadows

Kagemusha<sup>1</sup> is a dataset of 3D objects and their shadows. The dataset contains four common objects of the ShapeNet dataset [1]. For each 3D object, we sample a random point light source location from the northern hemisphere with a radius of 3 and a camera location sampled from the northern hemisphere with a radius of 2, to create a scene with shadow. We then compute the segmentation mask and shadow mask of the object. The dataset uses the same train/validation/test split as the original ShapeNet dataset [1].

### B. Implementation Details.

We apologize for omitting some important details! We have updated the paper to include these and will release all code, models, and data to ensure reproducibility. To create  $G(\mathbf{z})$ , we use the unconditional 3D generative model from [24], which is trained to produce an occupancy network with a 128-dimensional latent vector. The generative model is trained separately on four categories of the ShapeNet dataset, as in [24]. To optimize the full model, we use spherical gradient descent to optimize  $\mathbf{z}$  (and optionally  $\mathbf{c}$  and  $\phi$ ) for up to 300 steps. We use a step size of 1.0 for known light and pose experiments and 0.01 for unknown light and pose experiments.

To perform the differentiable shadow rendering  $\pi$ , we evenly sample 128 points along each light ray emitted from the illumination source, then evaluate them for occupancy. To handle occlusion from other objects as well as self-occlusion, we calculate the segmentation mask of all objects in the scene and disable gradients coming from light rays intersecting with these masks.

For baselines, we trained the “single image 3D reconstruction model” in [24] on a synthetic ShapeNet dataset where the input is shadow masks instead of RGB images, following the same training procedures and hyperparameters. The synthetic shadow dataset used in the paper is gen-

erated with the Blender ray-tracing engine.

### References

- [1] Angel X Chang, Thomas Funkhouser, Leonidas Guibas, Pat Hanrahan, Qixing Huang, Zimo Li, Silvio Savarese, Manolis Savva, Shuran Song, Hao Su, et al. Shapenet: An information-rich 3d model repository. *arXiv preprint arXiv:1512.03012*, 2015. 1

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<sup>1</sup>Named after Akira Kurosawa’s movie, which translates to “shadow warrior”.