

MatSynth: A Modern PBR Materials Dataset

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Large Scale Materials Dataset



Why materials matter?

- Determine how light interacts with surfaces, affecting realism in computer-generated imagery.
- Find applications in architecture, simulation, design, gaming and more...

Challenges

- High expertise and complex tools required for material crafting.
- Learning-based approaches lack the degree of control needed by artists.

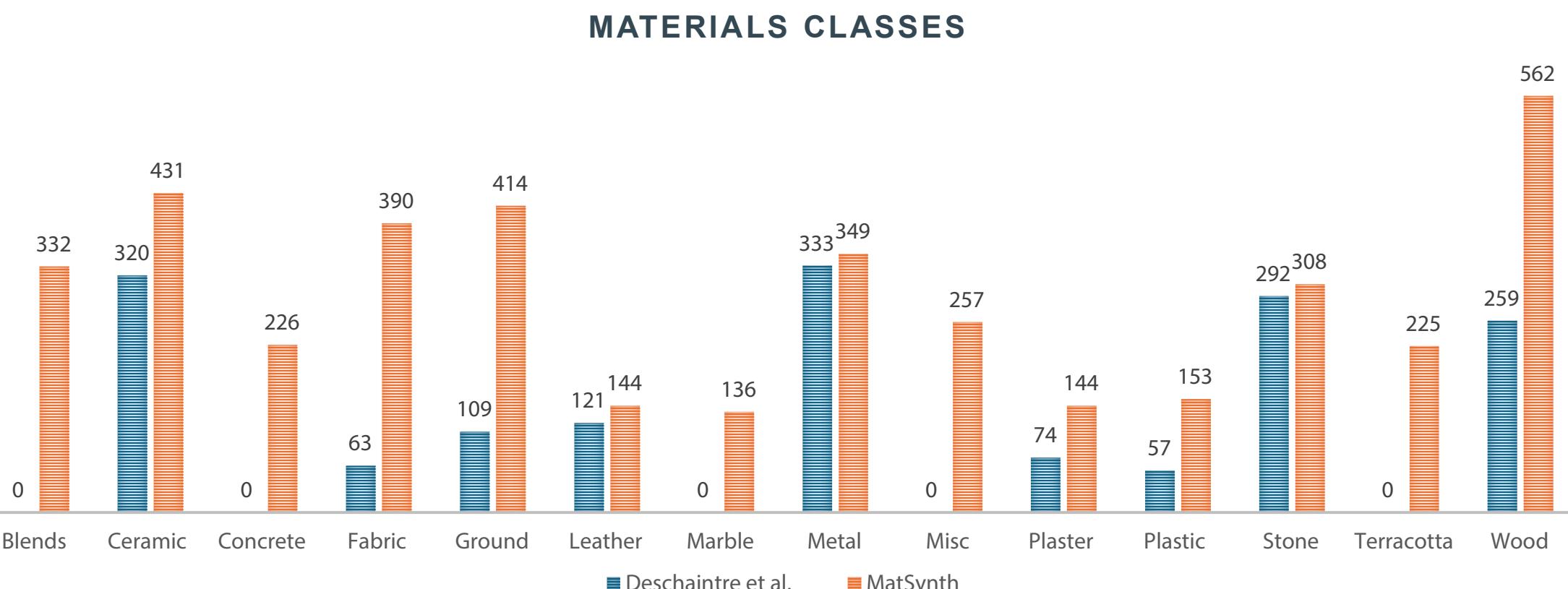
The Dataset

Data sources

- Over 4000 materials with permissive licensing.
- CC0 and CC-BY licenses.
- 3736 unique 4K resolution pre-augmentation samples.
- 332 blends of compatible classes.

Data processing and annotation

- Common set of PBR maps.
- Extensive metadata.
- 13 classes + blends.
- 3061 stationary and 1008 non-stationary.

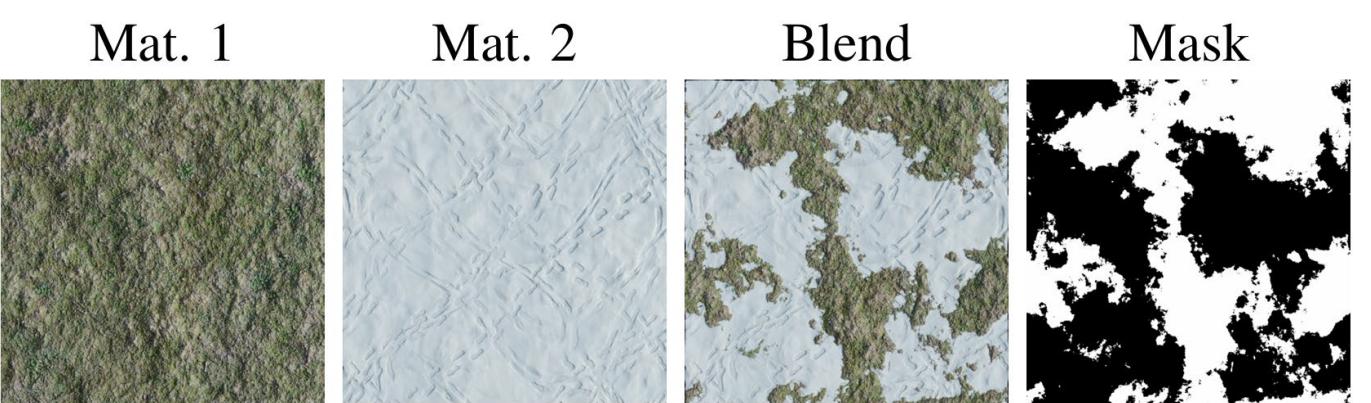


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Data Augmentation



We extract 168 multiscale crops for each material.



We blend materials of compatible classes (e.g.: ground and snow) using the height map for a realistic transitioning.



We render each material with 5 different environment lights.

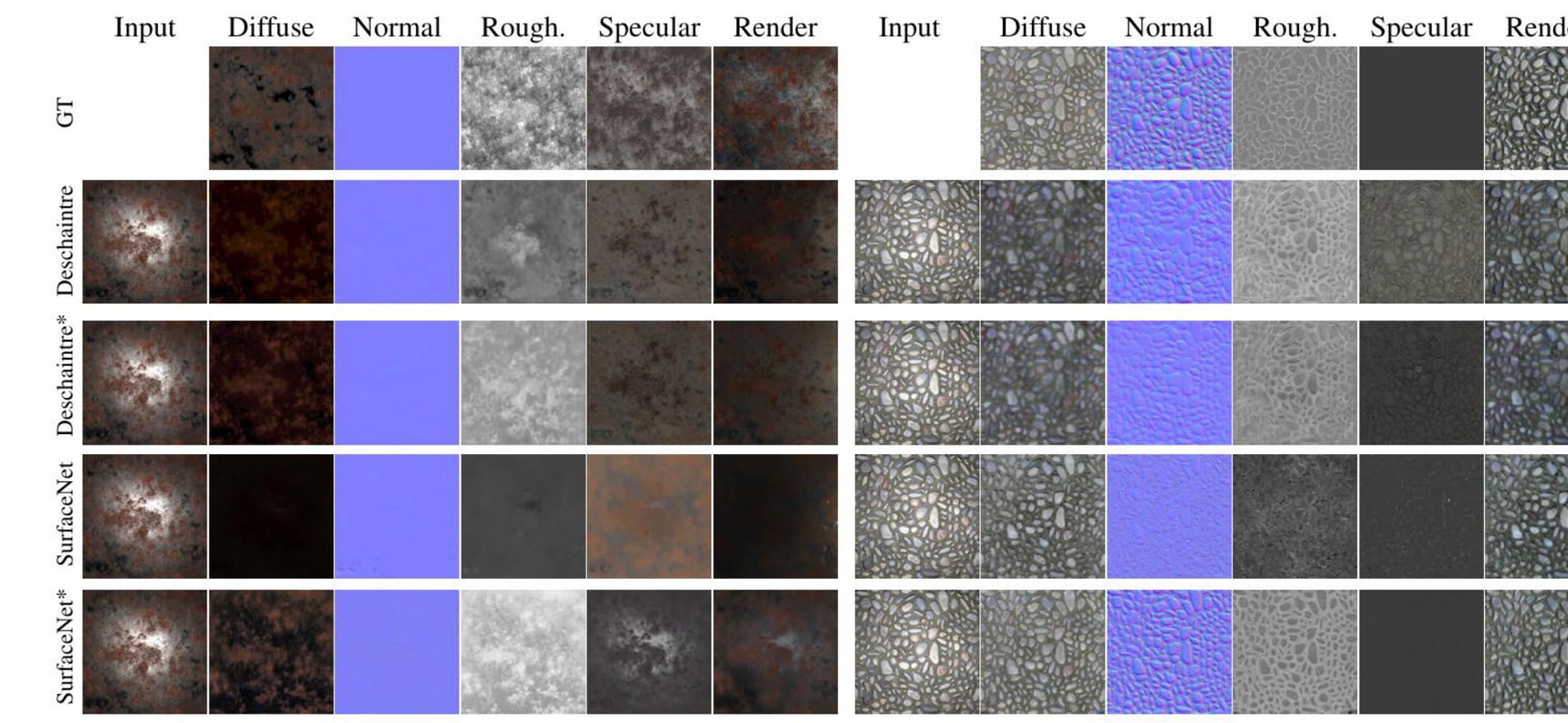
SVBRDF Estimation Results

Image Type	Deschaintre ^[1]	Deschaintre (MatSynth)	SurfaceNet ^[2]	SurfaceNet (MatSynth)
Renderings	0.172	0.160	0.161	0.135
Diffuse	0.100	0.093	0.119	0.094
Normal (Cos dist)	0.576	0.573	0.600	0.544
Roughness	0.322	0.215	0.221	0.162
Specular	0.119	0.080	0.086	0.057

Estimation performances in terms of RMSE \downarrow between predicted and ground-truth maps and renderings.

Image Type	Metric	Deschaintre	Deschaintre (MatSynth)	SurfaceNet	SurfaceNet (MatSynth)
Renderings	SSIM	0.532	0.560	0.494	0.613
	LPIPS	0.560	0.294	0.395	0.281

Perceptual metrics for the Renderings, under 5 environment lightings SSIM \uparrow and LPIPS \downarrow .



Acquisition comparison on synthetic data.

Generation Results


Comparison on unconditional materials generation for MatFuse^[3] trained on Deschaintre et al. 2018 and on MatSynth.

References

- Valentin Deschaintre, Miika Aittala, Frédéric Durand, George Drettakis, and Adrien Bousseau. Single-image svbrdf capture with a rendering-aware deep network. ACM Transactions on Graphics (SIGGRAPH Conference Proceedings), 37(128):15, 2018.
Giuseppe Vecchio, Simone Palazzo, and Concetto Spampinato. SurfaceNet: Adversarial svbrdf estimation from a single image. In Proceedings of the IEEE/CVF International Conference on Computer Vision, pages 12840–12848, 2021.
Giuseppe Vecchio, Renato Sortino, Simone Palazzo, and Concetto Spampinato. MatFuse: Controllable Material Generation with Diffusion Models. In Proceedings of the IEEE/CVF Conference on Computer Vision and Pattern Recognition, 2024.

