

Manifold Path Guiding for Importance Sampling Specular Chains

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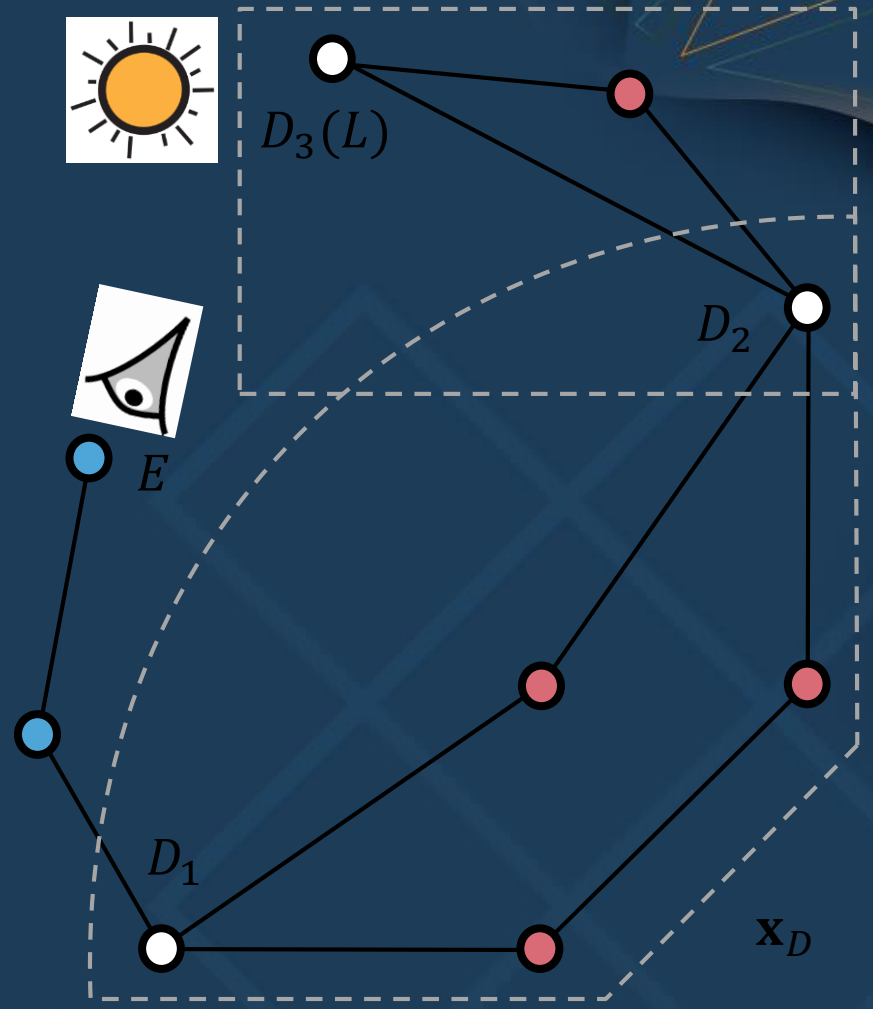
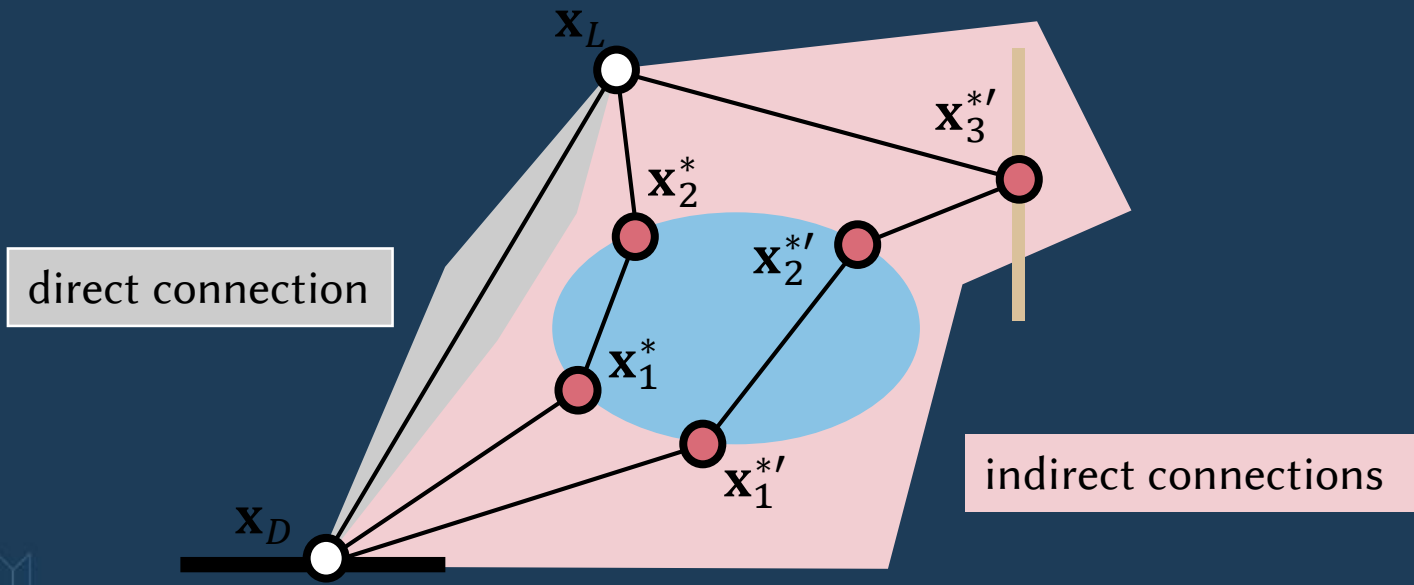
Caustics

- Complex visual effects with high-frequency details
- Produced by paths containing multiple consecutive specular vertices
- A long-standing challenge to unbiased Monte Carlo rendering

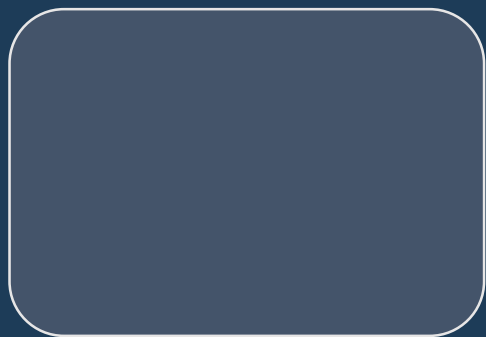


- separator
- specular vertex
- eye vertex

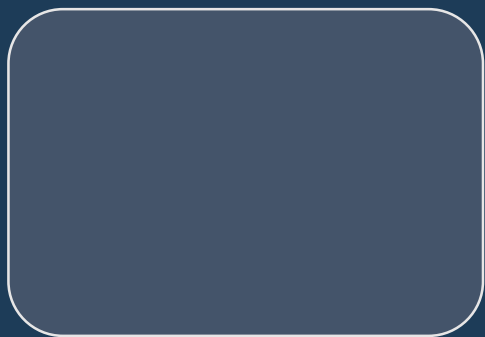
Path with specular chains



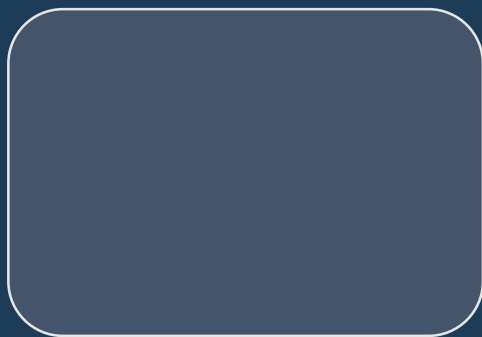
Prior works



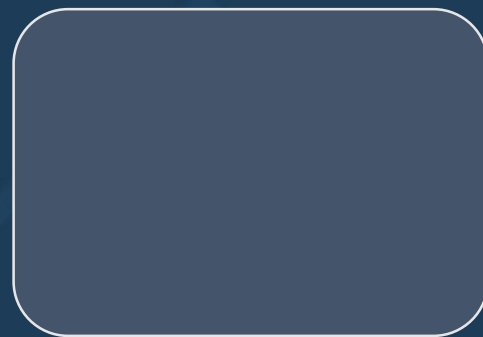
SPPM



MEMLT



MNEE

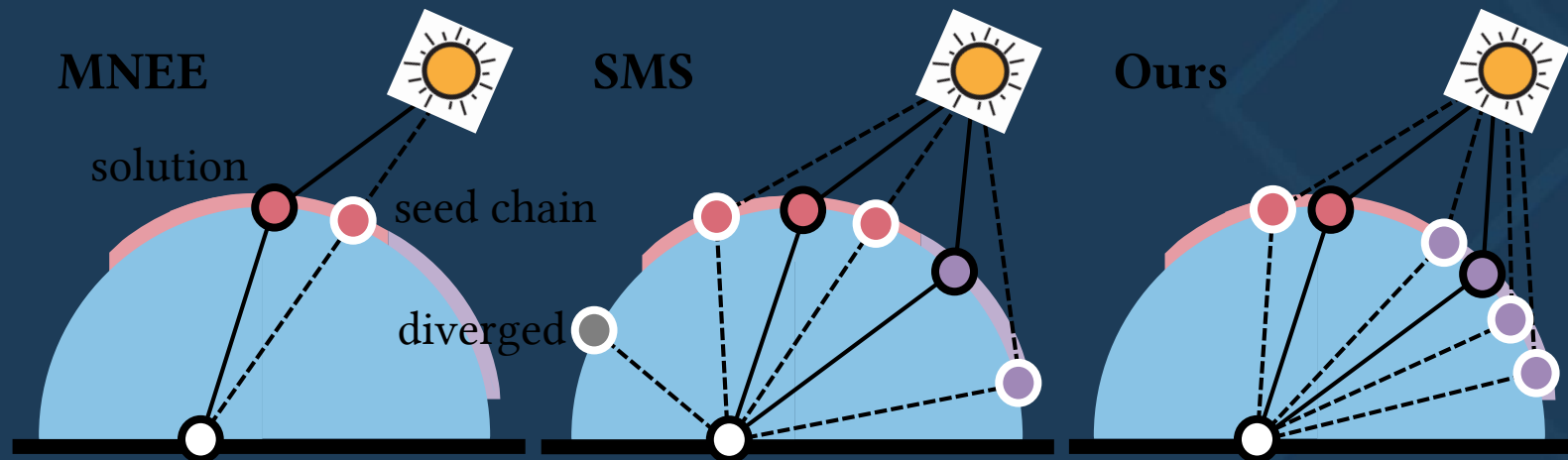


SMS

Overview

1. Motivation
2. Importance sampling specular chains
3. Manifold path guiding
4. Results
5. Discussion and conclusion

Motivation





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Importance Sampling Specular Chains



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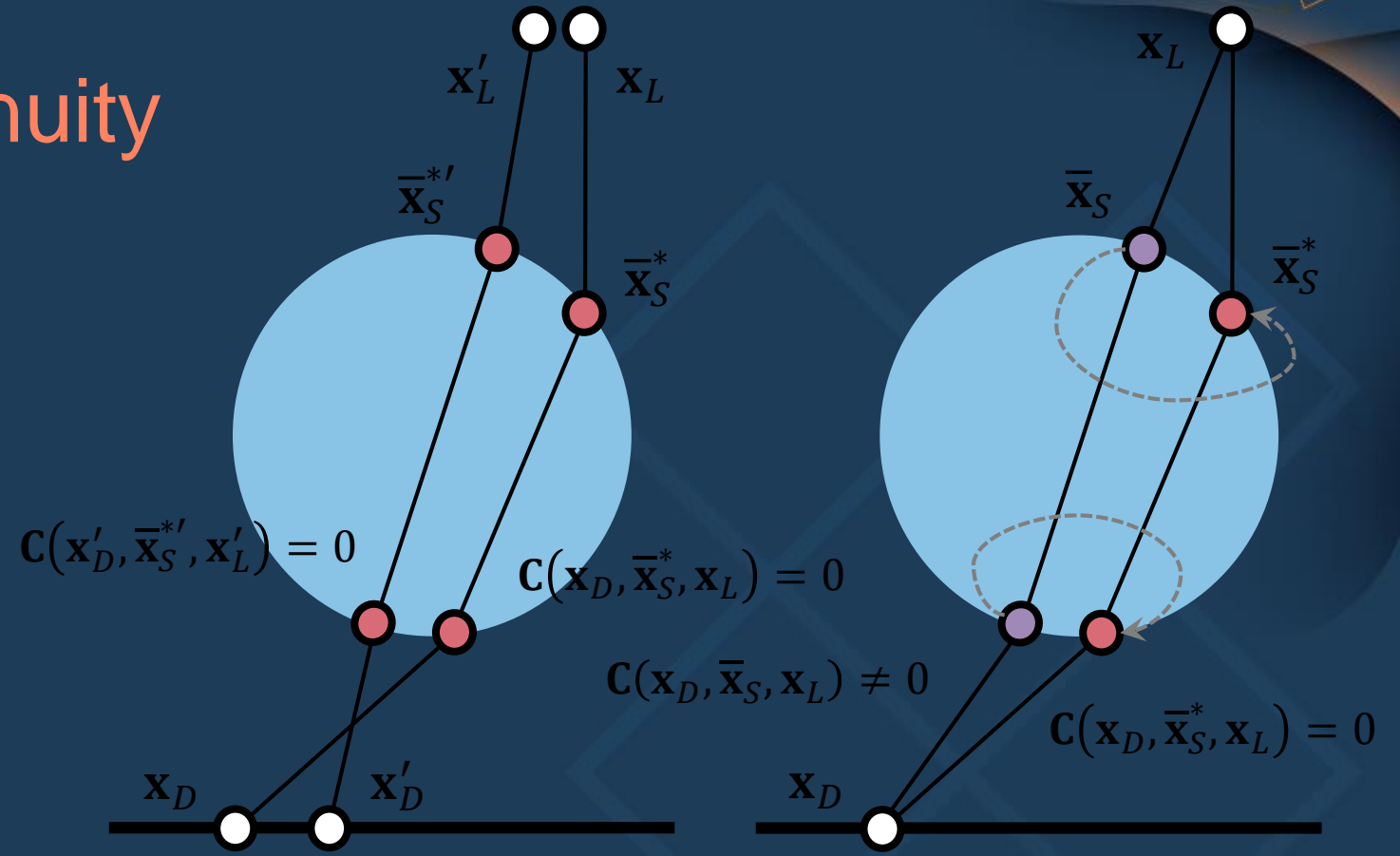


Problem formulation

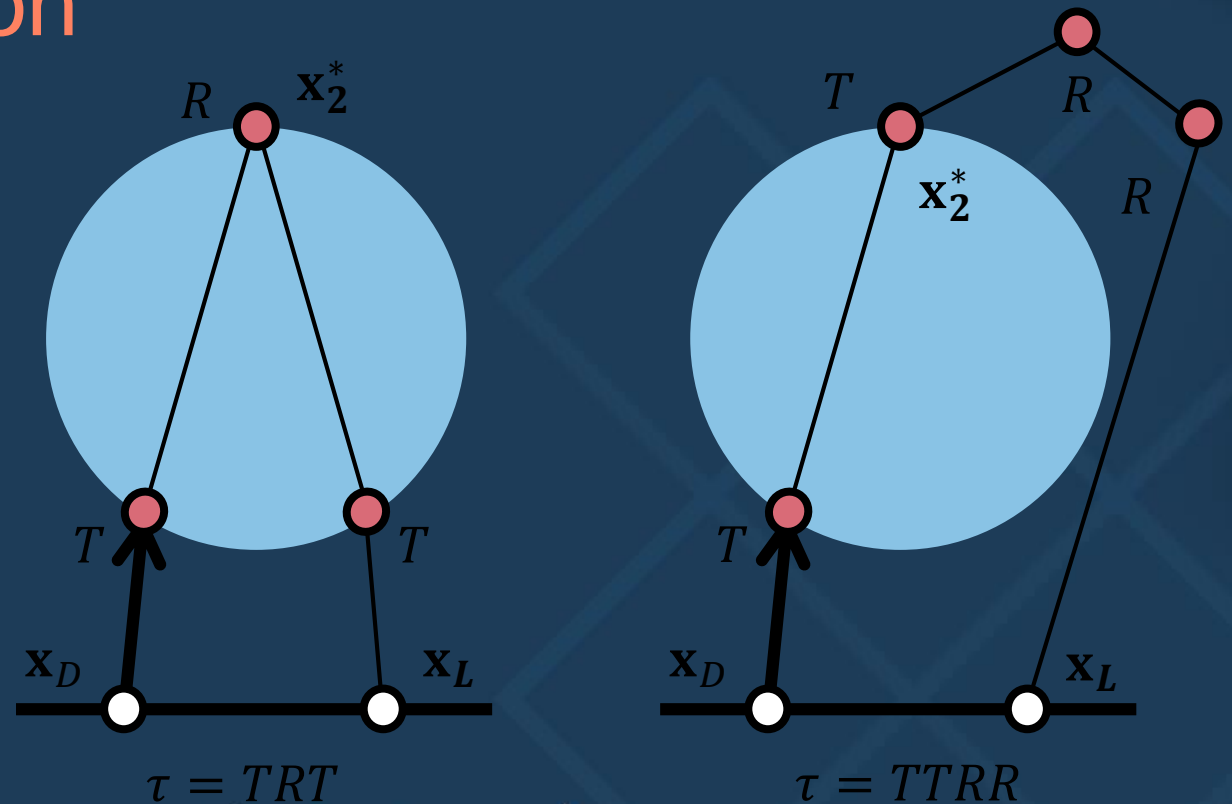
$$\left\langle \sum_{\bar{\mathbf{x}}_S^* \in \mathcal{P}_S^*} T(\mathbf{x}_D, \bar{\mathbf{x}}_S^*, \mathbf{x}_L) \right\rangle = \frac{1}{N} \sum_{i=1}^N \frac{T(\mathbf{x}_D, \bar{\mathbf{x}}_S^{*(i)}, \mathbf{x}_L)}{P(\bar{\mathbf{x}}_S^{*(i)} | \mathbf{x}_D, \mathbf{x}_L)}$$

Seed chain sampling

Exploitation of continuity



Dimensionality reduction



Sampling the type of chains



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Manifold Path Guiding

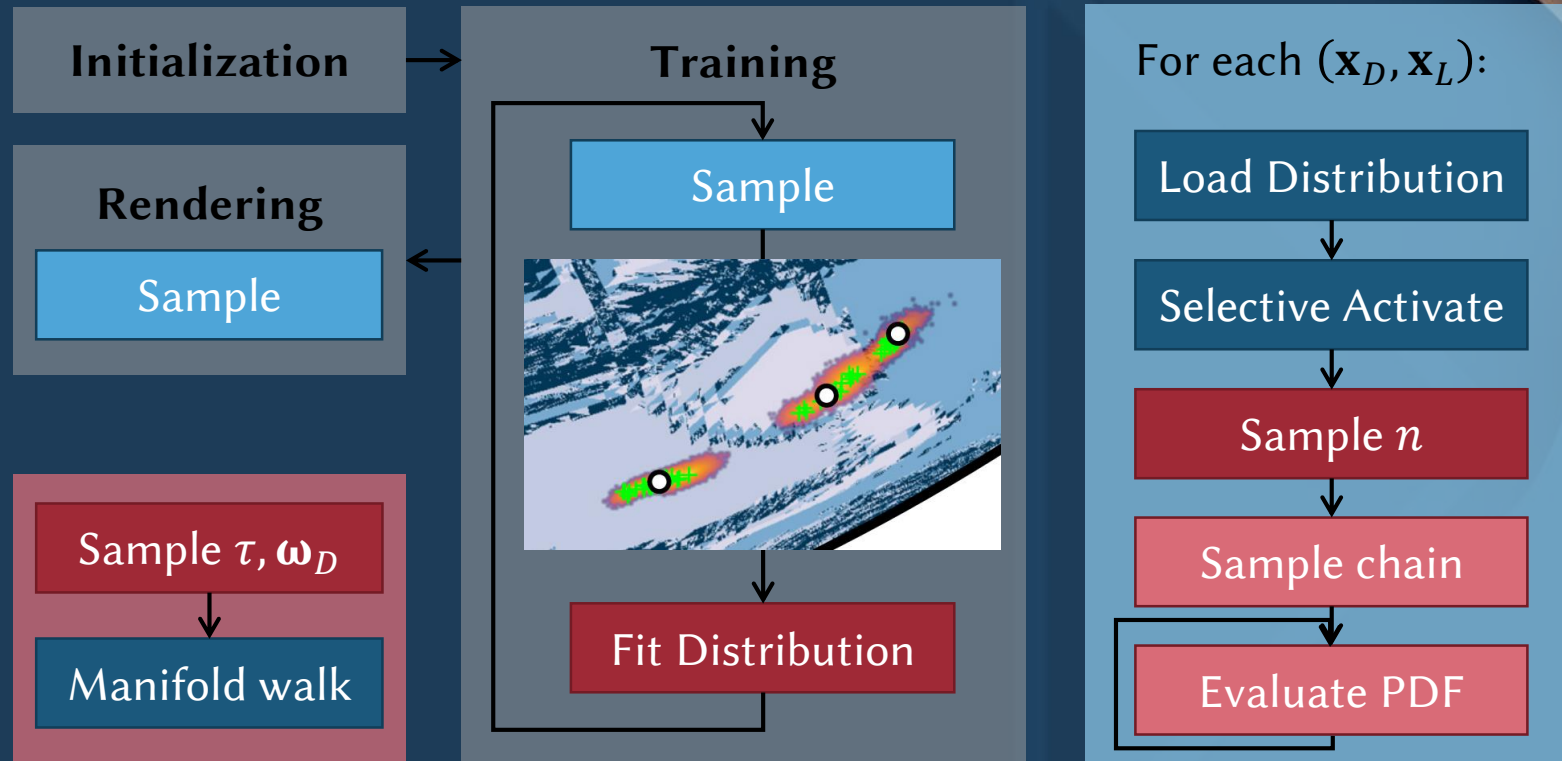


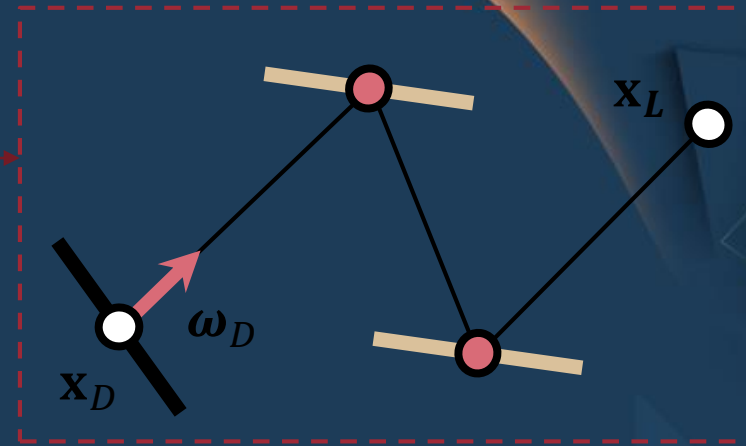
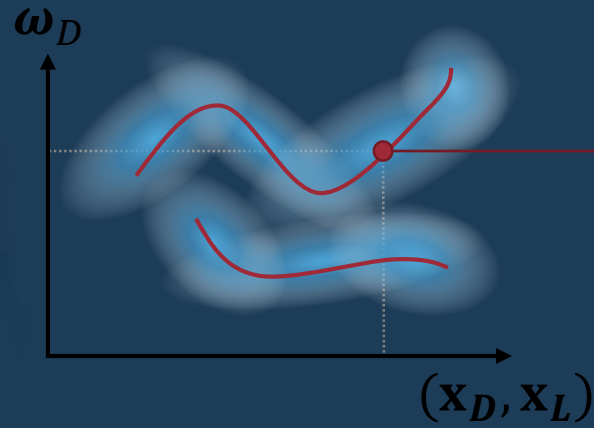
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Pipeline overview





Spatio-directional structures

Glossy separators and chains

More details



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Results

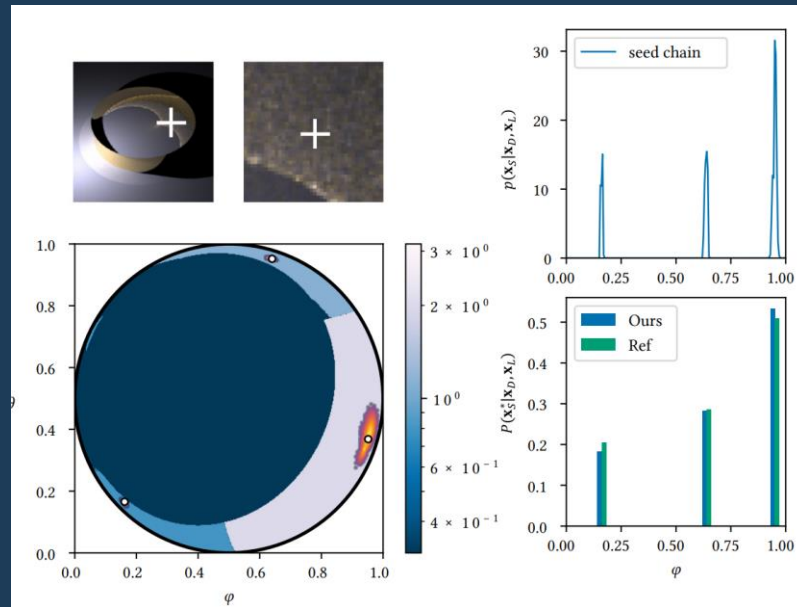
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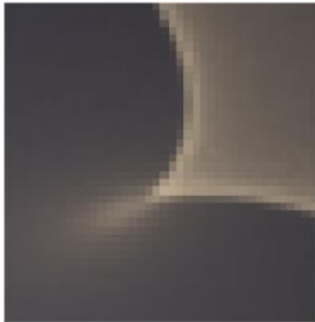
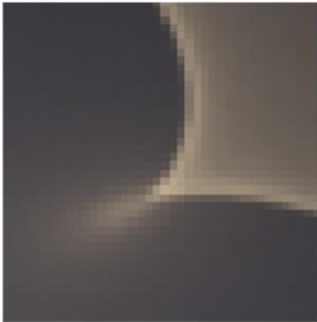
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Validation of importance sampling



Unbiasedness

PLANE		RING	
			
SMS*	Ours	SMS*	Ours
16384 spp	2048 spp	16384 spp	2048 spp
MSE=0.00032	MSE=0.00027	MSE=0.00005	MSE=0.00004

Equal-time comparisons

- ?

Temporal coherency

- video

Impact of scene complexity

Validation of building blocks

More experiments



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Discussion

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Overhead and variance of reciprocal estimation

Online learning pitfalls



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Conclusion



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Conclusion



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