Sampling and Reconstruction of Visual Appearance

CSE 274 [Fall 2018], Lecture 9

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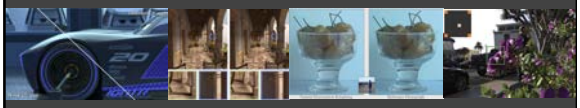

Feature-Space Methods

Monte Carlo Rendering (biggest application)

- General practical denoising (no frequency) [2012-]
- General effects (Sec 2.3 of EG STAR Report)
- General image-space denoising framework
- *But use auxiliary features (depth, normals, etc.)*
- Basis for methods deployed in industry today
- Students present 3 key papers today
- Also one slide on real-time rendering (students present 3 key papers next class)

Random Parameter Filtering

- Sen Darabi 12, importance of each feature
  - Addresses noisy features (e.g. depth of field)
  - Notion of mutual information
- Weighted bilateral filter, very good at low samples
  - Parameters determined by feature importance
  - Auxiliary features are key to beat image denoising
  - Has led to newer methods, commercialization

Subsequent Work

- SURE (Stein's unbiased risk estimator: general kernels, adaptive sampling, general effects)

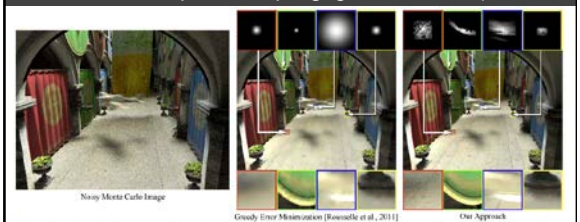

Figure 1: *Comparisons between greedy error minimization (GEM) [Rousselle et al. 2011] and our SURE-based filtering. With SURE, we are able to use kernels (cross bilateral filters in this case) that are more effective than GEM's isotropic Gaussians. Thus, our approach better adapts to anisotropic features (such as the motion blur pattern due to the motion of the airplane) and preserves scene details (such as the textures on the floor and curtains). The kernels of both methods are visualized for comparison.*

Subsequent Work

- Moon et al. local linear or polynomial models, treat as regression. Many other methods
- APR: Polynomial order chosen to minimize error
- Newest methods use learning instead (later in course)

Real-Time Rendering

- Previous reconstruction methods high overhead
- What about real-time for games, interactive?
- Ray/Path-Tracing interactive at low sample counts (e.g., NVIDIA Optix), used in games
- Need real-time reconstruction (simpler filters)
  - Area my group started last 6 years (papers next time)
- Axis-Aligned Filtering (Mehta et al. 12, 13, 14)
  - Faster than sheared filters, can run in real-time
- Fast Sheared Filtering (Yan et al. 15)
- Multiple Axis Aligned Filtering (Wu et al. 17)