Sampling and Reconstruction of Visual Appearance

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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)
- 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)