AppWand:
editing measured materials using appearance-driven optimization
measured reflectance
measured reflectance

full BRDF at each surface point
measured reflectance

full BRDF at each surface point

(.3, -.6, .7, 7)
(.2, -.8, 1, 11)
editing: modify all BRDFs consistently
editing: modify all BRDFs consistently

goal: interactively with minimal input
our approach

results
related work
conclusion
input
input
input
policy: similar edits for similar appearance
AppWand:

algorithm for efficiently propagating sparse constraints that enforces this editing policy
appearance graph

by $N$-nearest neighbors

$$\int_{\Omega_i} \int_{\Omega_o} (\rho - \rho')^2 d\omega_i^\perp d\omega_o$$
appearance graph

by $N$-nearest neighbors

$$\int_{\Omega_i} \int_{\Omega_o} (\rho - \rho')^2 d\omega_i^1 d\omega_o$$

sparse embedding
propagate user goals to edits of all points
argmin_{e_i} \sum_{i \in S} (e_i - g_i)^2 + \sum_i \sum_{j \in N_i} (e_i - e_j)^2
\[
\text{argmin}_{e_i} \sum_{i \in S} (e_i - g_i)^2 + \sum_i \sum_{j \in N_i} (e_i - e_j)^2
\]
$$\operatorname{argmin}_{e_i} \sum_{i \in S} (e_i - g_i)^2 + \sum_{i} \sum_{j \in N_i} (e_i - e_j)^2$$
\[ \text{argmin}_{e_i} \sum_{i \in S} (e_i - g_i)^2 + \sum_{i} \sum_{j \in N_i} (e_i - e_j)^2 \]
our approach
results
related work
conclusion
• Lensch et al. 2001
• single-lobe isotropic Lafortune BRDF
• Lawrence et al. 2006
• curve-based BRDF model
• Gu et al. 2006
• time-varying reflectance
• modified Cook-Torrance BRDF
• Marschner et al. 2005
• modified Ward BRDF
extension: local edits

\[(1-\alpha) \left[ \int_{\Omega_i} \int_{\Omega_o} (\rho - \rho')^2 d\omega_i \frac{1}{d\omega_o} \right] + \alpha \left[ (x - x')^2 \right] \]

\[\alpha = 0.1 \quad \alpha = 0.3 \quad \alpha = 0.4\]
implementation

- graph construction
  - distance in reduced basis
  - kd-tree
  - average = 1s / max 30 s

- optimization
  - conjugate gradient solver
  - display intermediate results
  - average = 0.5s / max 9 s
implementation

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related work
inverse shade trees
image-driven optimization

- Lischinski et al. 2006
- local adjustment

- Levin et al. 2004
- colorization
our approach
results
related work

conclusion
intuitive, interactive, general editing of measured materials

by enforcing similar edits for similar appearance

using optimization on a sparse appearance graph
future work

- compression + flexibility
- new user interfaces
- more general visual data
  - subsurface, light fields, BTFs
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