

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

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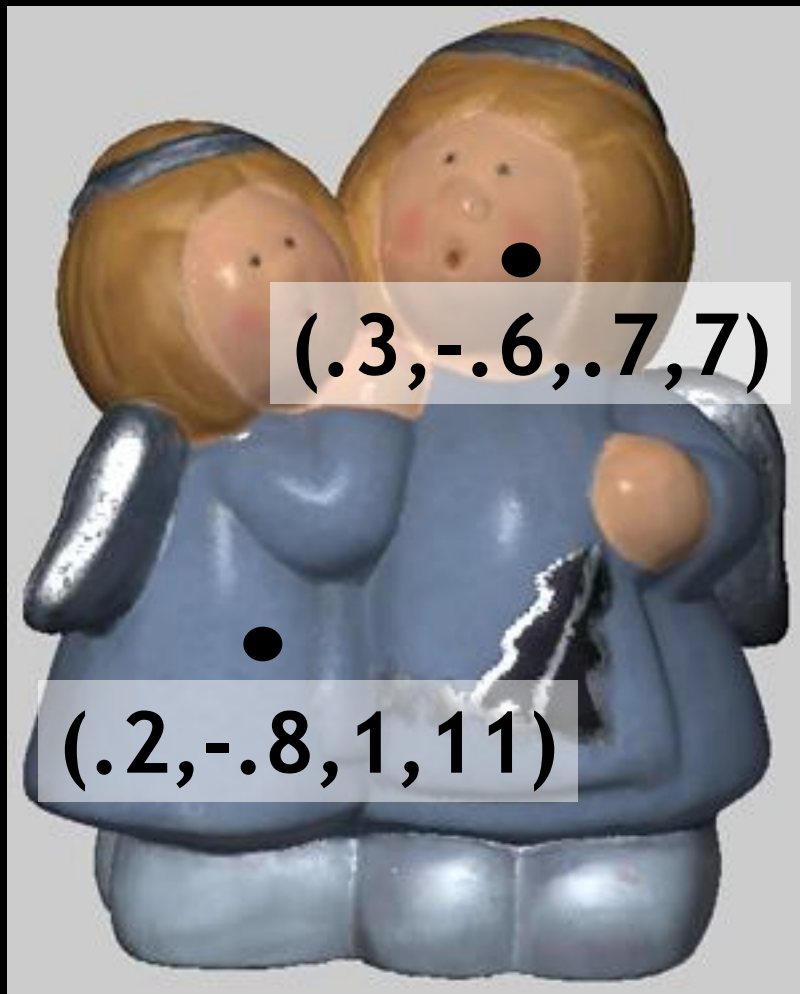


**measured
reflectance**



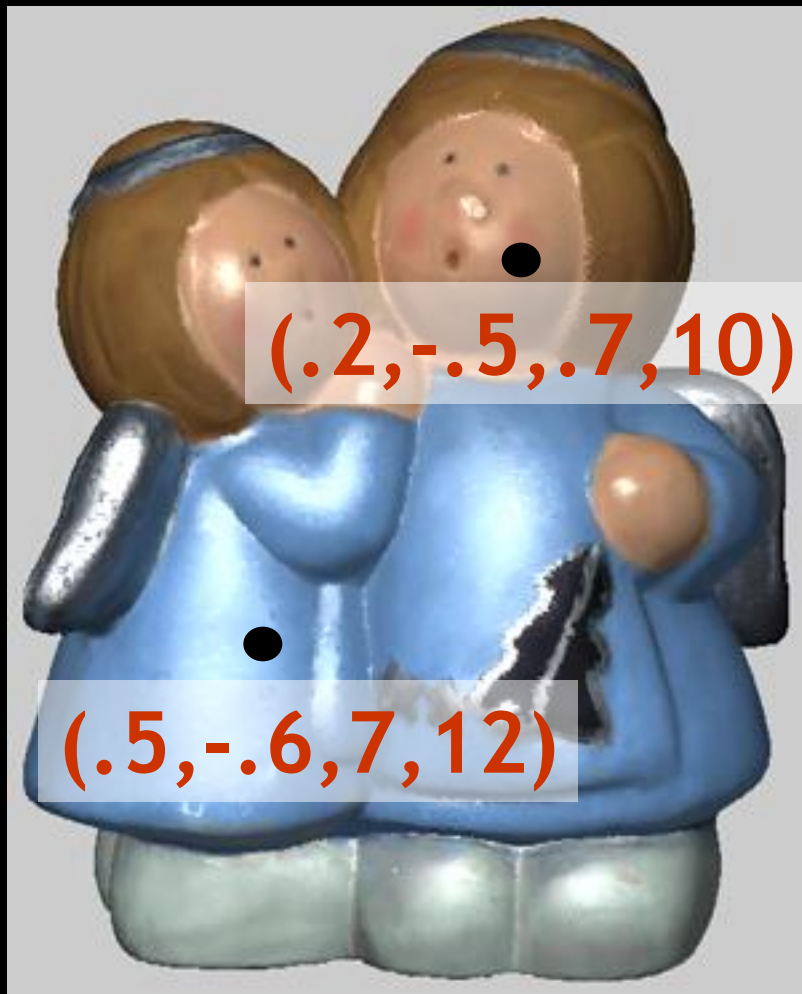
**measured
reflectance**

**full BRDF
at each
surface point**



**measured
reflectance**

**full BRDF
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surface point**



editing:
modify all BRDFs
consistently



editing:
modify all BRDFs
consistently

goal:
interactively
with minimal input

our approach

results
related work
conclusion



input



input



input



input

output



**policy: similar edits
for similar appearance**



AppWand:

algorithm for
efficiently propagating
sparse constraints that
enforces this editing policy

appearance graph



by *N*-nearest
neighbors

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

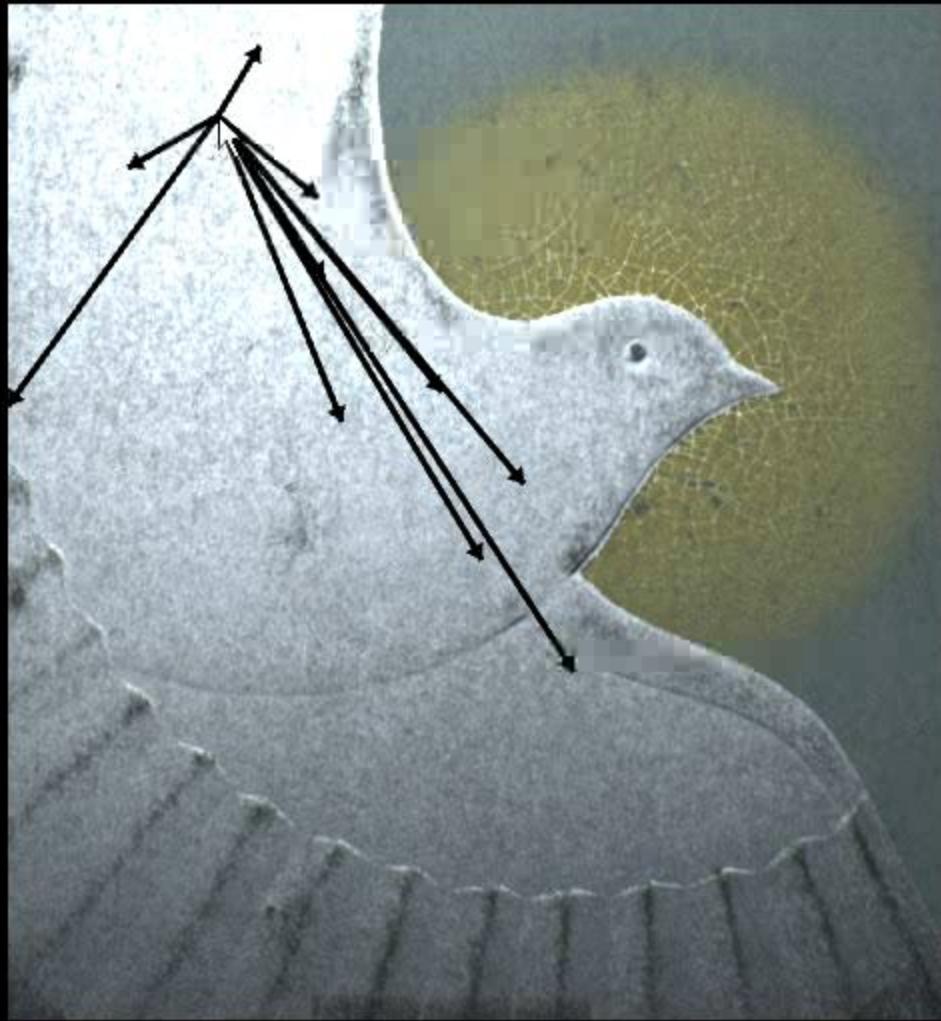
appearance graph



by *N*-nearest
neighbors

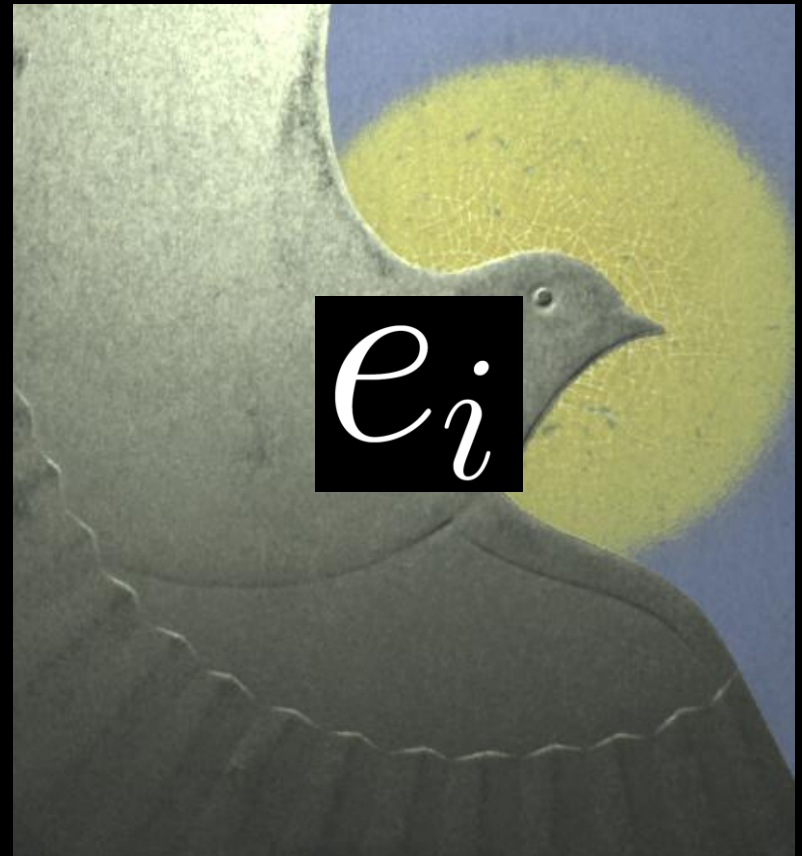
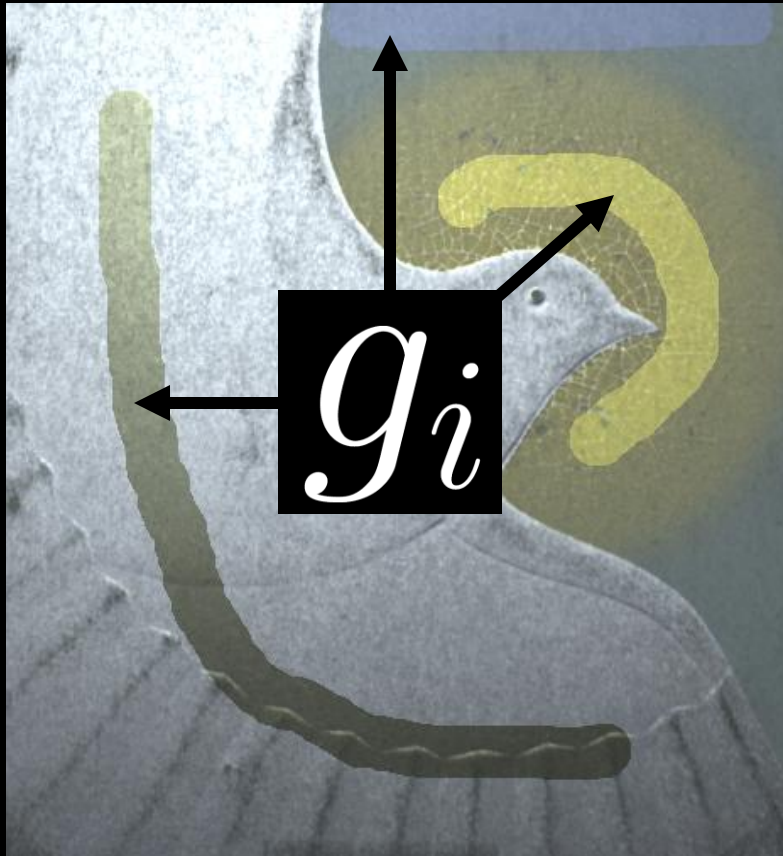
$$\int_{\Omega_i} \int_{\Omega_o} (\rho - \rho')^2 d\omega_i^\perp d\omega_o$$

sparse
embedding



propagate
user goals

to edits of
all points



$$\operatorname{argmin}_{e_i} \sum_{i \in S} (e_i - g_i)^2 + \sum_i \sum_{j \in N_i} (e_i - e_j)^2$$



$$\operatorname{argmin}_{e_i} \sum_{i \in S} (e_i - g_i)^2 + \sum_i \sum_{j \in N_i} (e_i - e_j)^2$$



$$\operatorname{argmin}_{e_i} \sum_{i \in S} (e_i - g_i)^2 + \sum_i \sum_{j \in N_i} (e_i - e_j)^2$$



$$\operatorname{argmin}_{e_i} \sum_{i \in S} (e_i - g_i)^2 + \sum_i \sum_{j \in N_i} (e_i - e_j)^2$$



original

edited



our approach

results

related work
conclusion

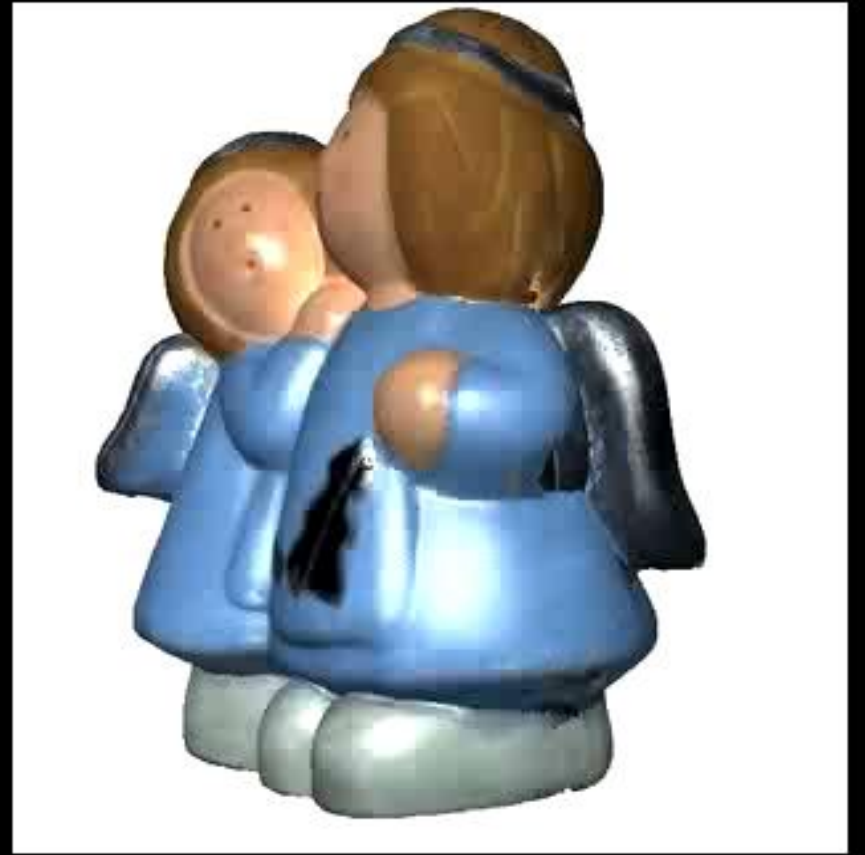


- Lensch et al. 2001
- single-lobe isotropic Lafortune BRDF



original

edited



- Lawrence et al. 2006
- curve-based BRDF model

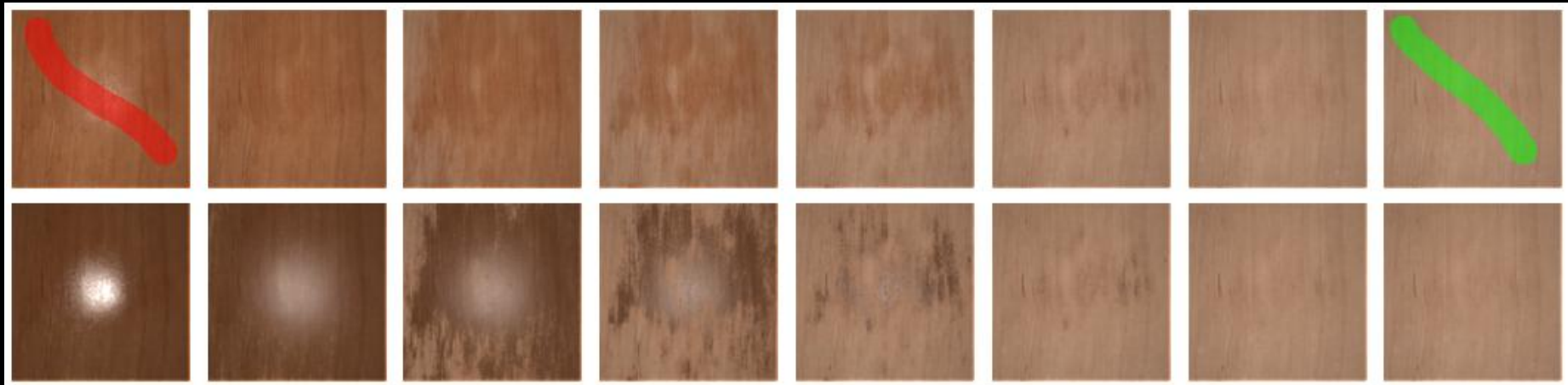


original

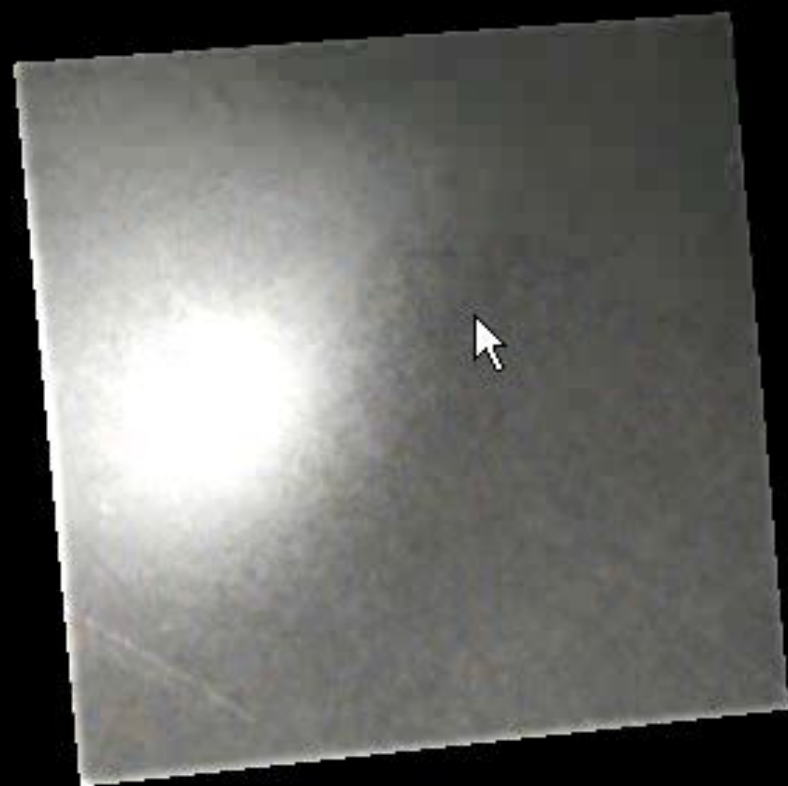
edited



- Gu et al. 2006
- **time-varying** reflectance
- modified Cook-Torrance BRDF



time →

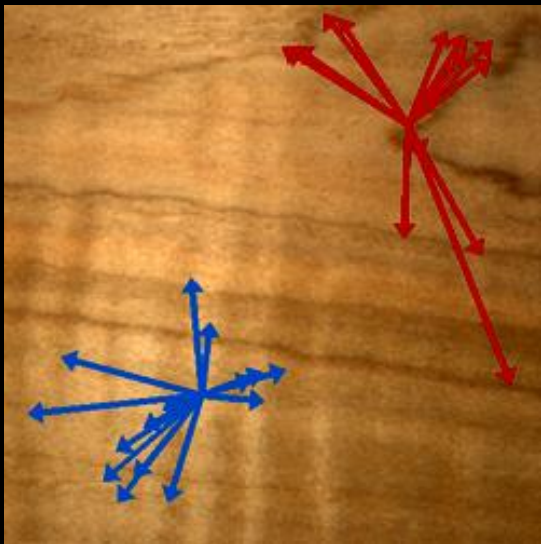


- Marschner et al. 2005
- modified Ward BRDF



extension: local edits

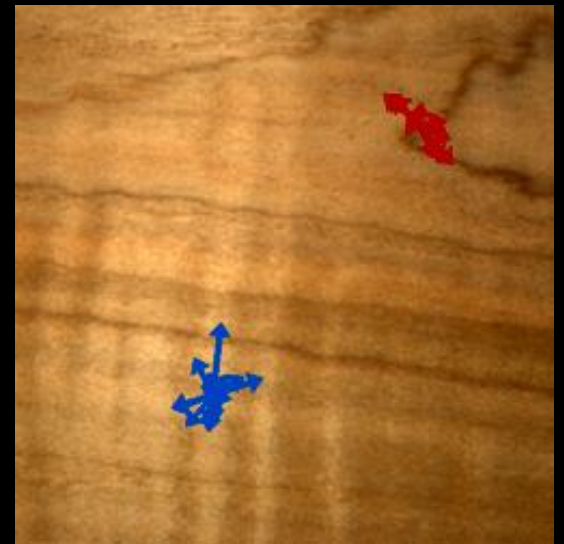
$$(1-\alpha) \left[\int_{\Omega_i} \int_{\Omega_o} (\rho - \rho')^2 d\omega_i^\perp d\omega_o \right] + \alpha [(x - x')^2]$$



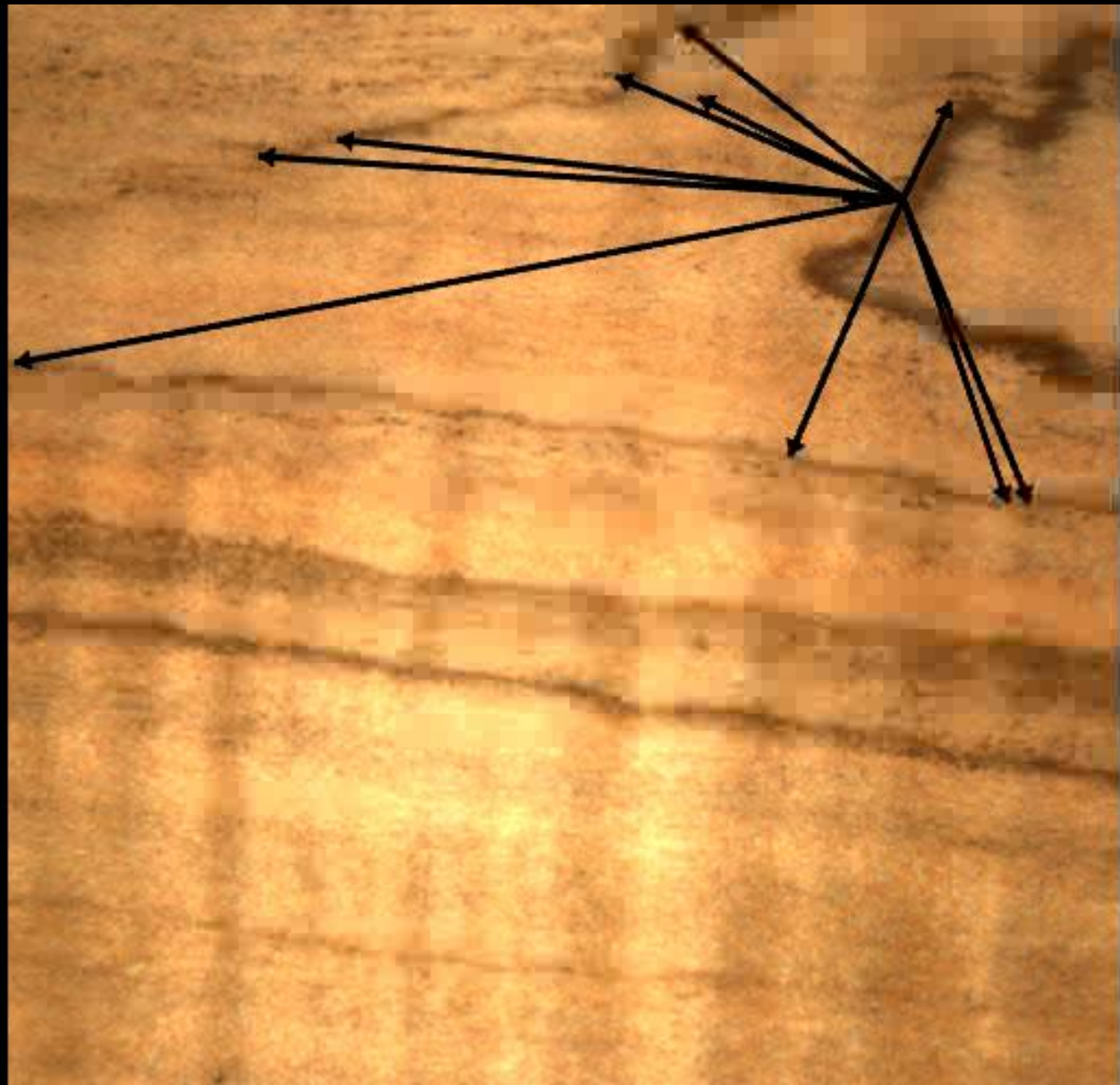
$\alpha = 0.1$



$\alpha = 0.3$



$\alpha = 0.4$



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

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our approach
results

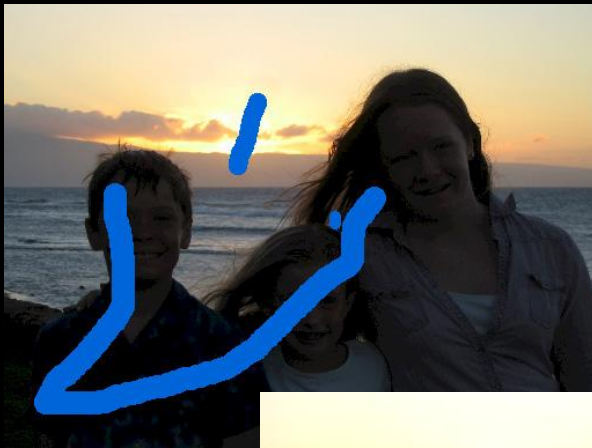
related work

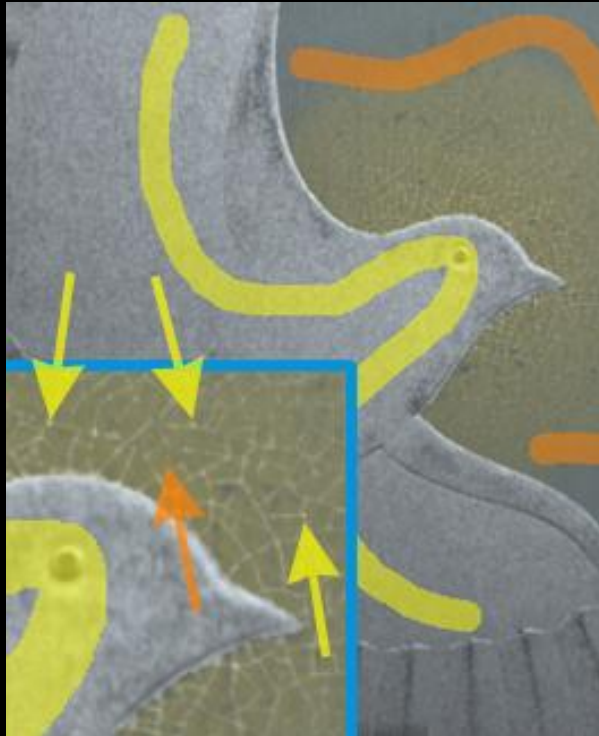
conclusion



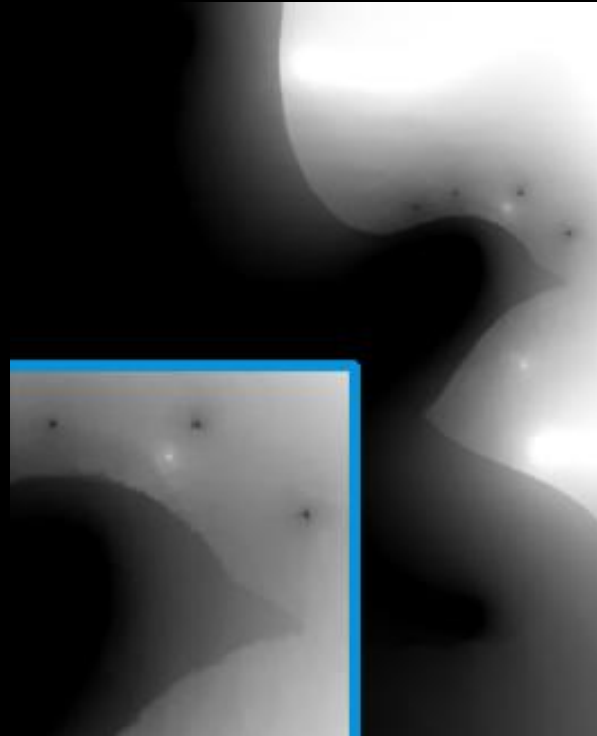
image-driven optimization

- Lischinski et al. 2006
- local adjustment
- Levin et al. 2004
- colorization

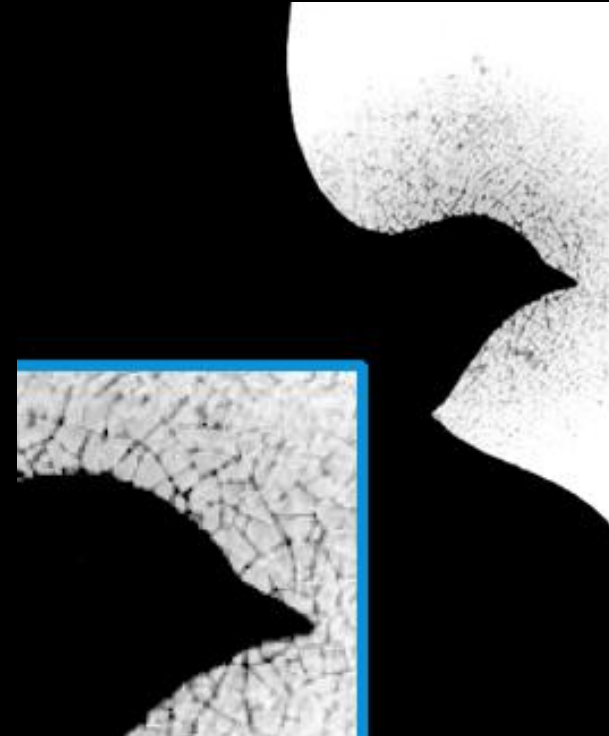




input



Lischinski 2006



our approach

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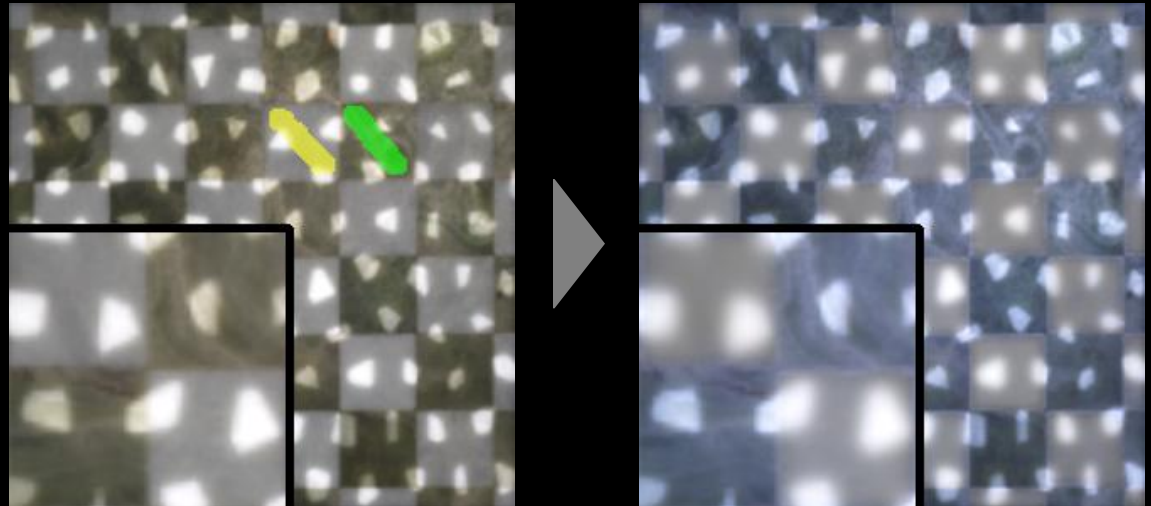
**intuitive, interactive, general
editing of measured materials**

**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



acknowledgements

- Hendrik Lensch
- Steve Marschner
- Pieter Peers
- Karl vom Berge
- Phil Dutré
- Columbia Computer Graphics Group

thank you

original

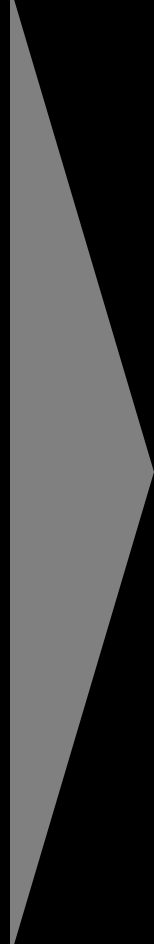


edited



influence functions





**influence
functions**

