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革新の波動
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Layered Shape Synthesis: Automatic Generation of Control Maps for Non-Stationary Textures

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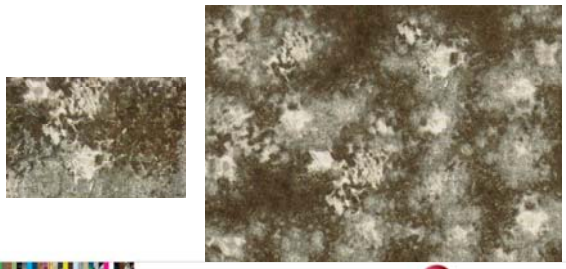
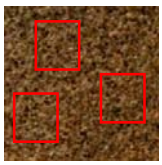
Non Stationary Textures

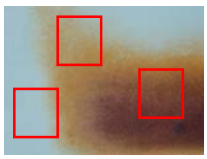


Non Stationary Textures

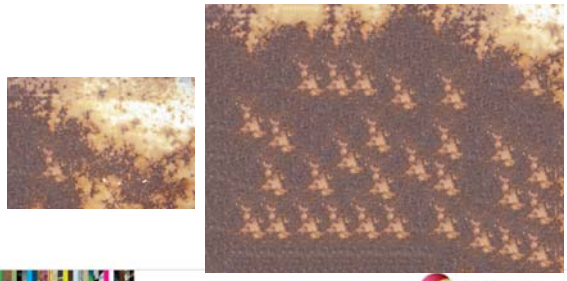
stationary textures



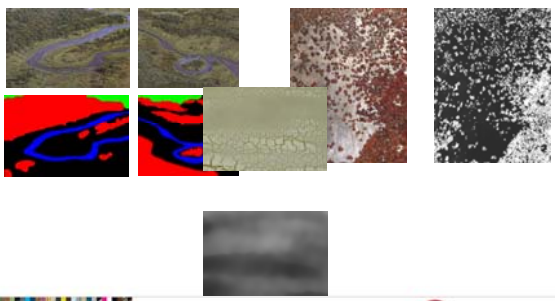
non stationary textures



Non Stationary Textures

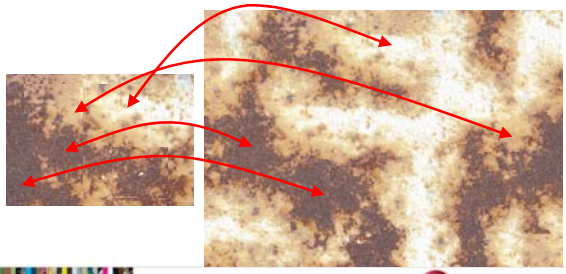


Control Maps

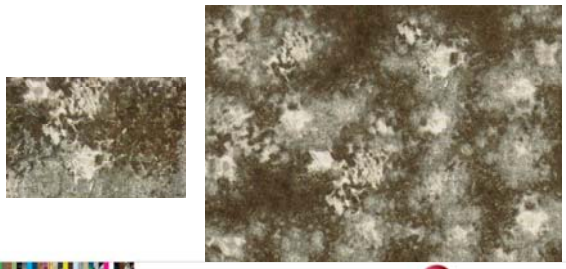


One Way Mapping for Synthesis

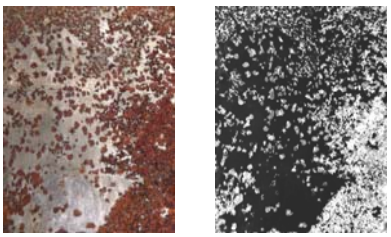
Bijective Mapping for Synthesis



Layer Map Synthesis



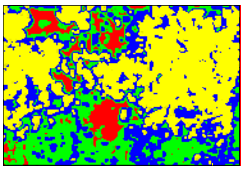
Degree Maps

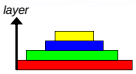


Appearance manifolds for modeling time-variant appearance of materials / Wang et al. 2006

Layer Maps

stacked layers





Related Work

A control map is either provided by the user, or derived from a specific model of texture formation across a 3D surface:

- Image Analogies / Hertzmann et al. (2001)
- Synthesis of progressively-variant textures on arbitrary surfaces / Zhang et al. (2003)
- Appearance Manifolds for Modeling Time Variant Appearance of Materials / Wang et al. (2006)
- Time-varying surface appearance: acquisition, modeling and rendering / Gu et al. (2006)
- Context-aware textures / Lu et al. (2007)
- Inverse texture synthesis / Wei et al. (2008)

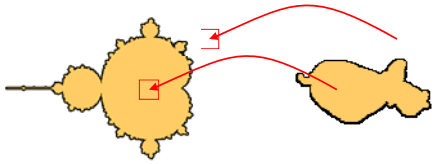
Shape Synthesis

- Synthesizing layers = synthesizing shapes
- Similar to Texture Optimization (Kwatra et al. 2005)

Exemplar Estimation

Shape Synthesis

Synthesize only boundaries



Exemplar Estimation

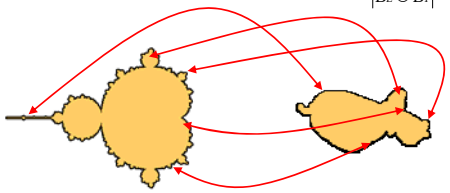
Shape Synthesis

Easier to maintain local coherence

Shape Synthesis

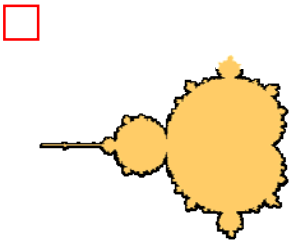
Minimize a bi–similarity measure

$$D(E,T)=\frac{\sum_{x_E\in B_E} D(x_E,S_T)+\sum_{x_T\in B_T} D(x_T,S_E)}{|B_E\cup B_T|}$$



Exemplar Estimation

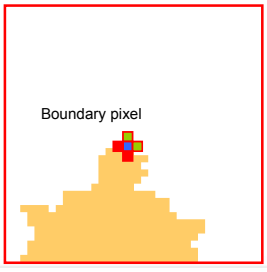
Boundary Patches



Boundary Patches

Boundary patch

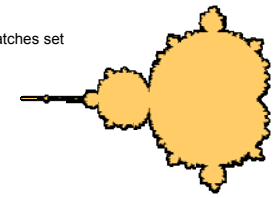
Boundary pixel



Boundary Patches

Boundary Patches

Boundary patches set

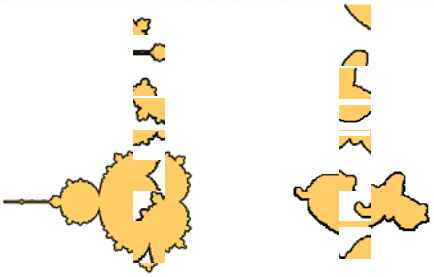


Optimization

Optimization Stage

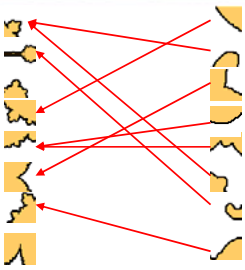
1. Matching - solve the assignment problem on the exemplar and estimated shape patches sets
2. Adjustment – modify the estimated shape to be more similar to the exemplar

Assignment Problem



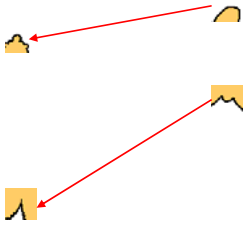
Exemplar Estimation

Assignment Problem



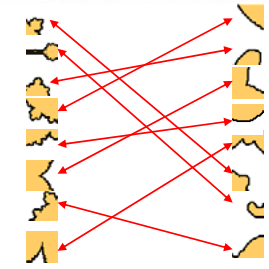
Exemplar Estimation

Assignment Problem



Exemplar Estimation

Assignment Problem



Exemplar Estimation

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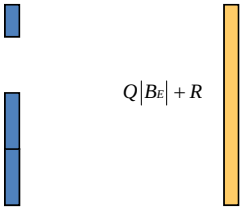
Assignment Problem

Usually sets don't have the same size…



Exemplar Estimation

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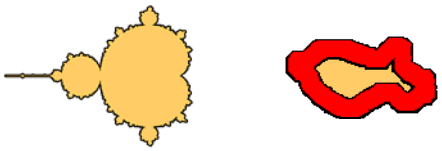
Adjustment



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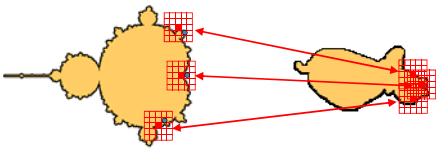
Adjustment



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Adjustment

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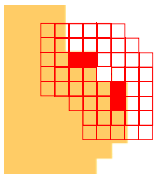
Adjustment

A target pixel is determined using a voting mechanism



Estimation

Vote weights:

1. *Quality of match:*

$$\frac{1}{1+D(x_S, x_E)}$$

2. *Gaussian kernel*

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Style Transfer

Layered Shape Synthesis

1. First layer shape is initialized randomly
2. After first layer is complete we synthesize next layer in an enclosed area by using a mask.
3. More details in the paper…

Texture By Numbers

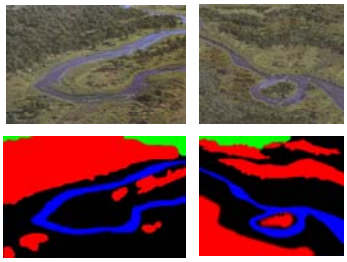
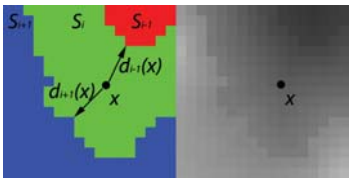
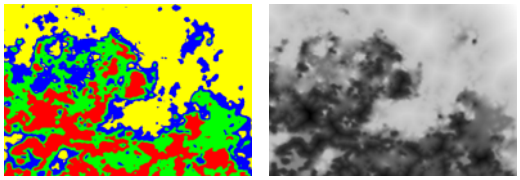


Image Analogies / Hertzmann et al. (2001)

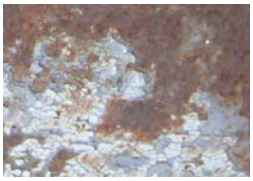
Continuous Map

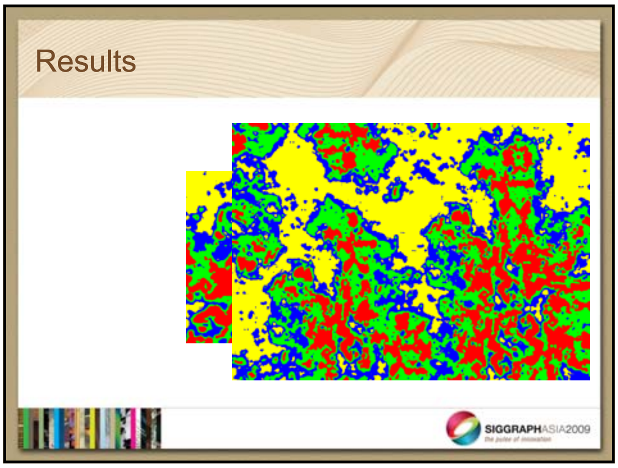


Continuous Map



Results




Results
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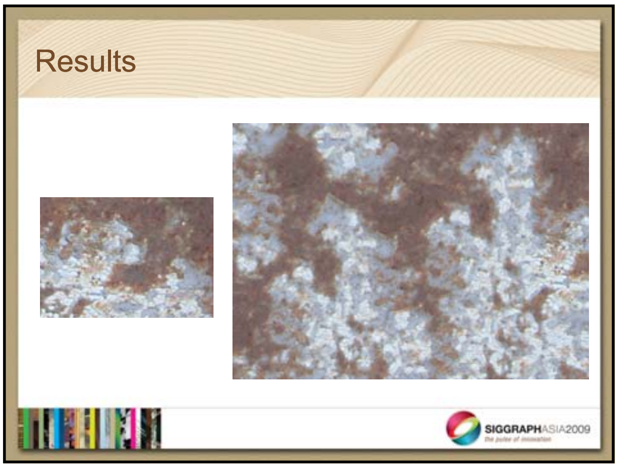
Results
SIGGRAPHASIA2009


Results
SIGGRAPHASIA2009


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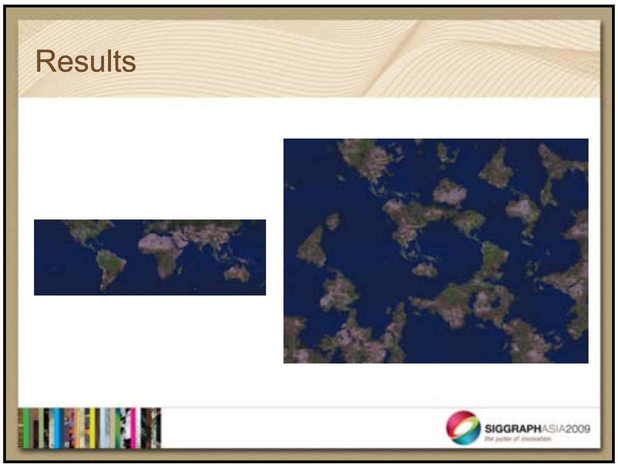
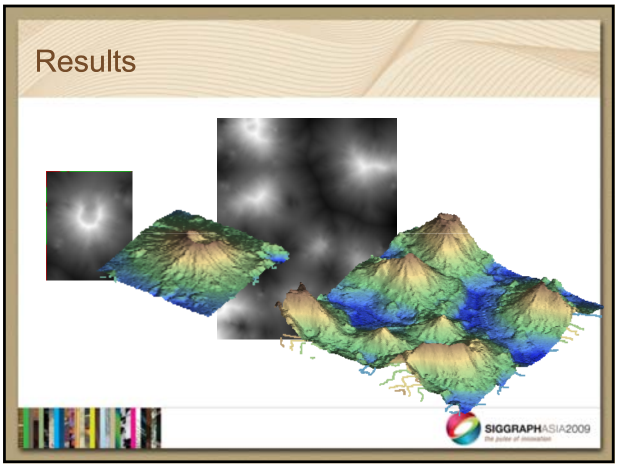
SIGGRAPHASIA2009


Results
SIGGRAPHASIA2009


Results
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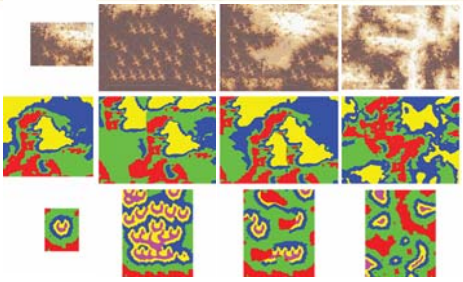
Results

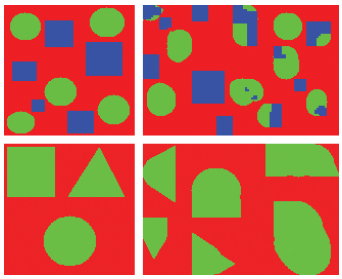
User control

Comparisons



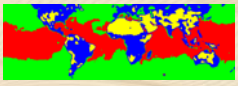
Kwatra et al. (2005) Kopf et al. (2007) Our

Limitations



Summary

1. Synthesizing *layer maps*
2. *Shape Synthesis* – synthesis of shapes
3. *Assignment problem* –
   - Bijective mapping
   - Maintaining global patch statistics



Thank you