

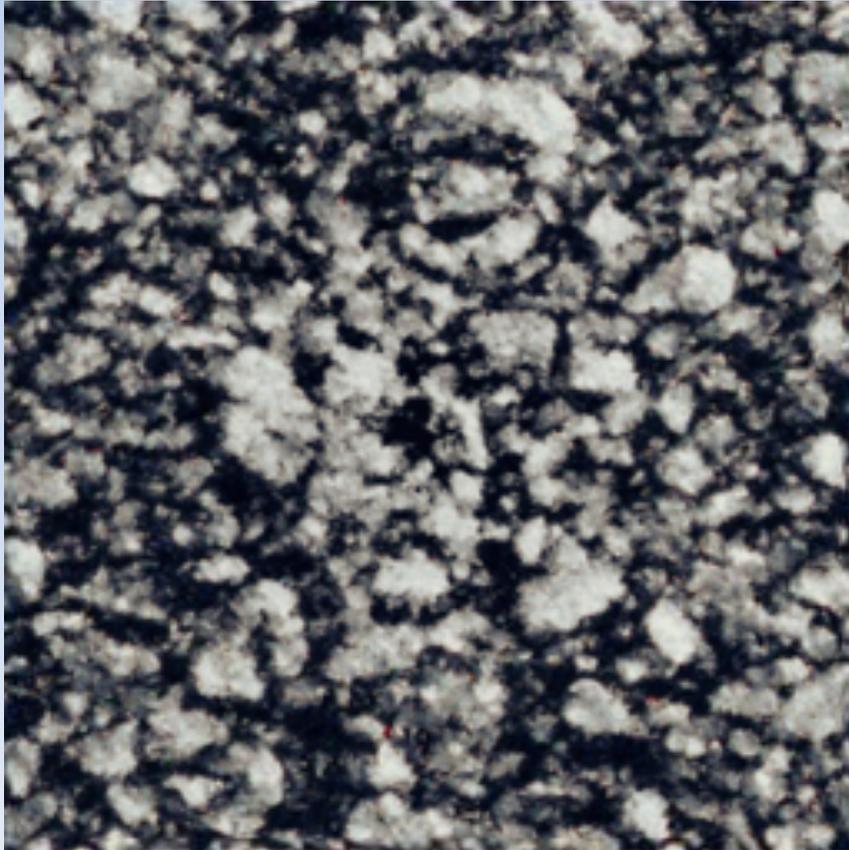


Questions?

(Sometimes people applaud now)

Results

Textures that look good at any scale



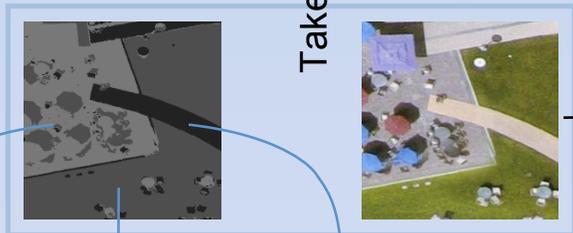
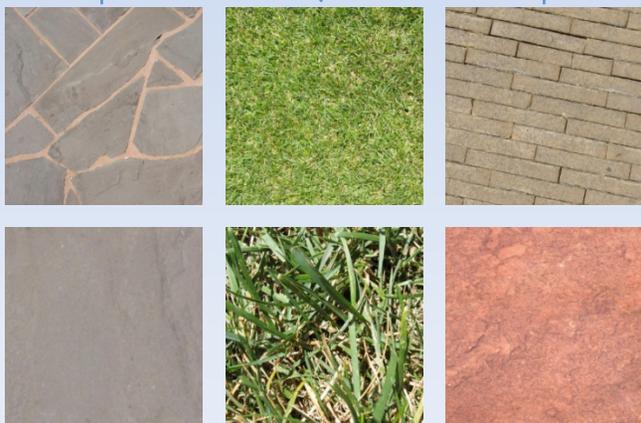
Results

Hallucination of
detail

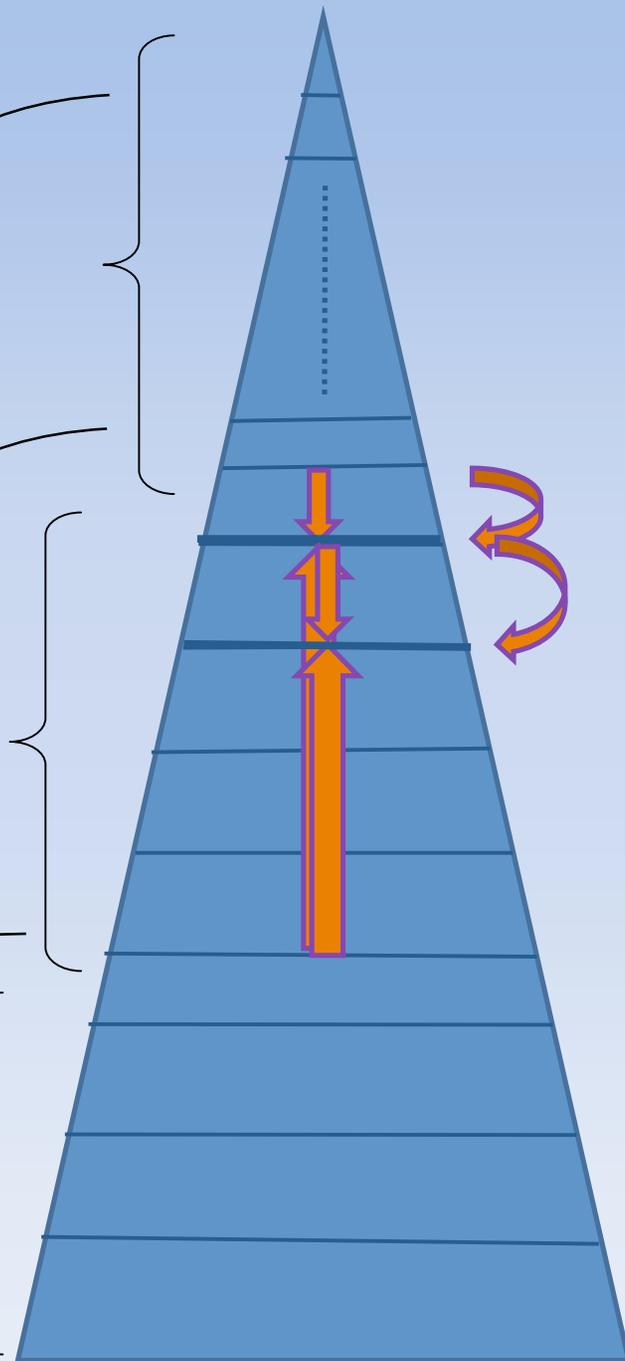


The Script of the movie you just watched...

Taken anywhere

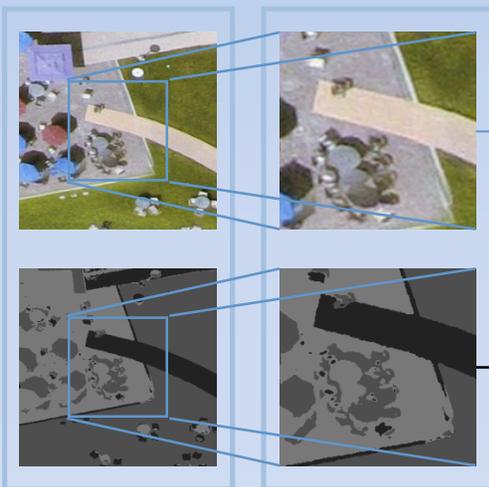


Taken "in place"

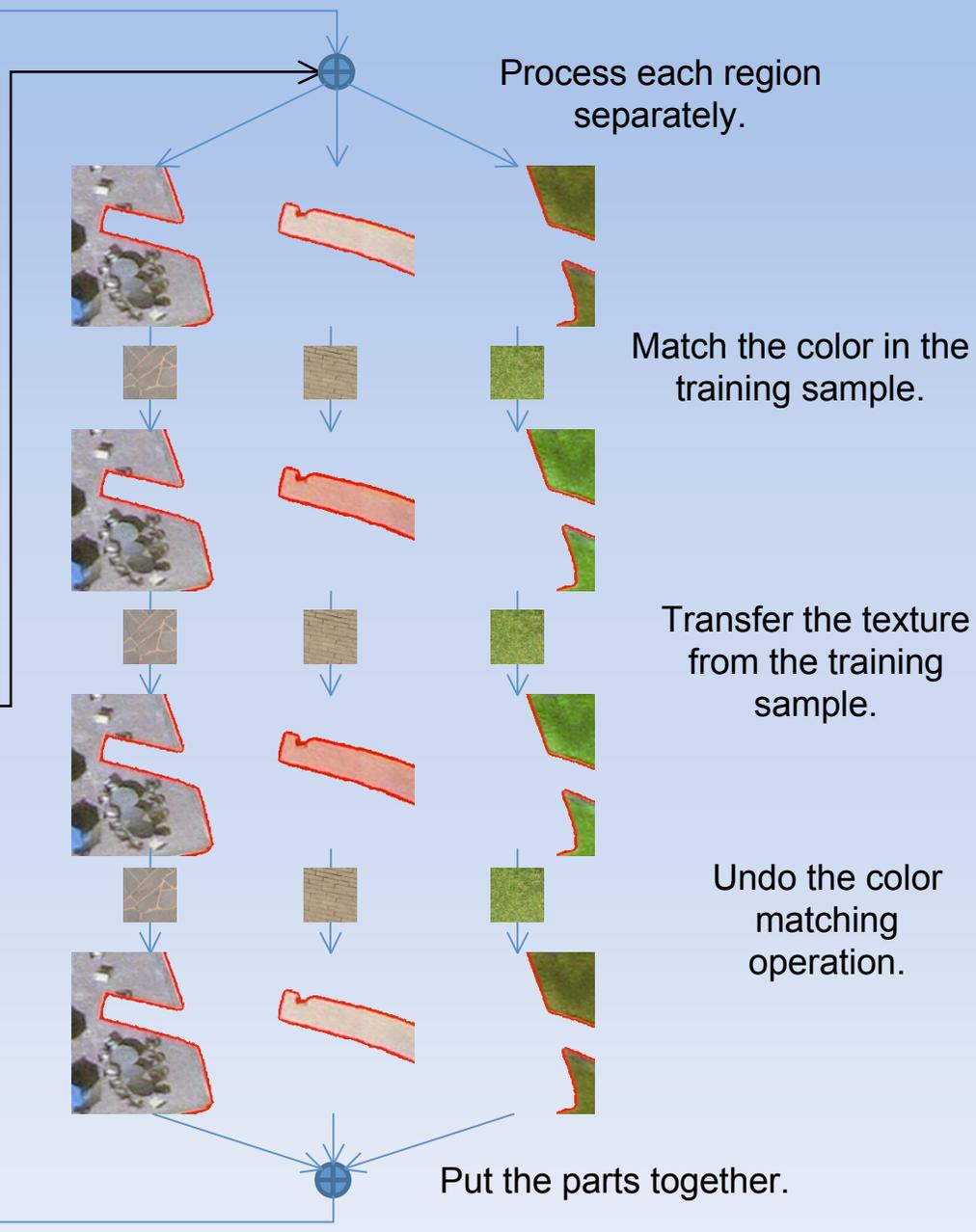


“Shooting” one frame... (overview)

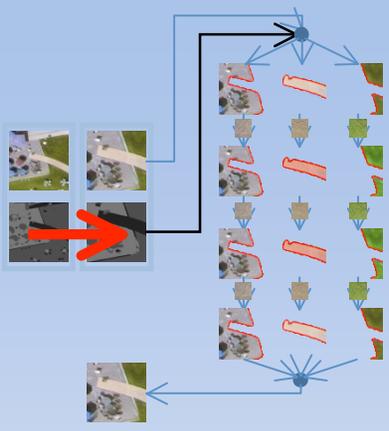
Double the resolution
of the central part.



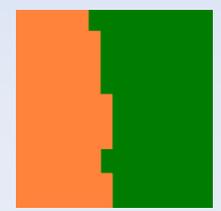
The finished frame.



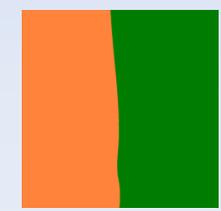
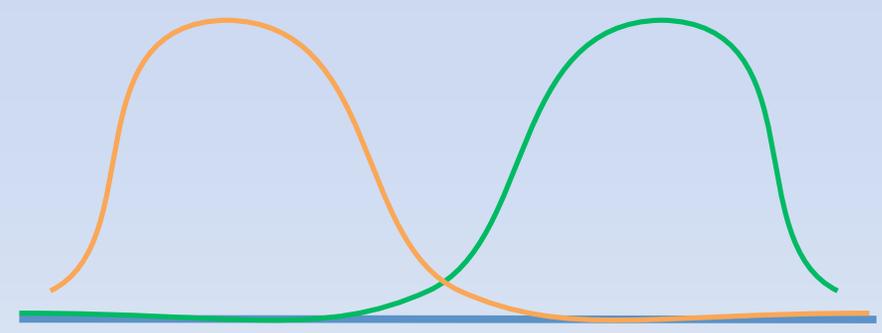
Doubling the Resolution of the Labels...



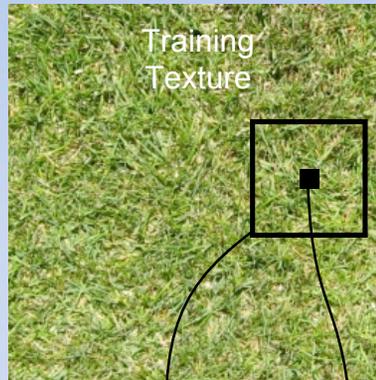
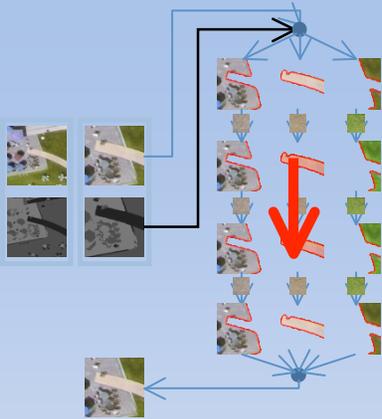
Interpolation + Thresholding



Gaussian Smoothing + Thresholding

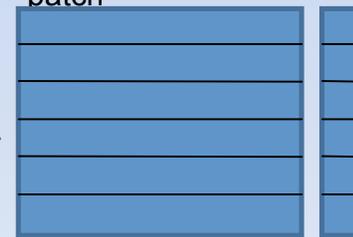


Transferring the Texture... (Texture Synthesis Basics)

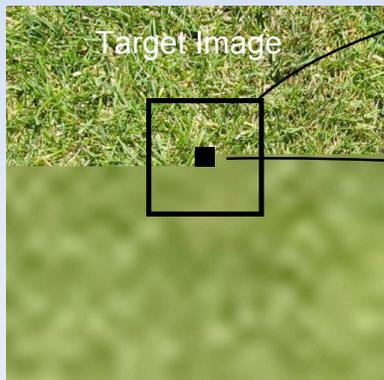


Function
of the
patch

Center
Color



Dictionary



Synthesis by
Non-Parametric
sampling.



Eros & Leung ('99)

Eros & Leung:

- Function is simply a concatenation of the values in the causal part of the patch.
- Did not support “user input”.
- Relatively Slow.
- Tends to blur details.

Transferring the Texture...

Natural
Textures

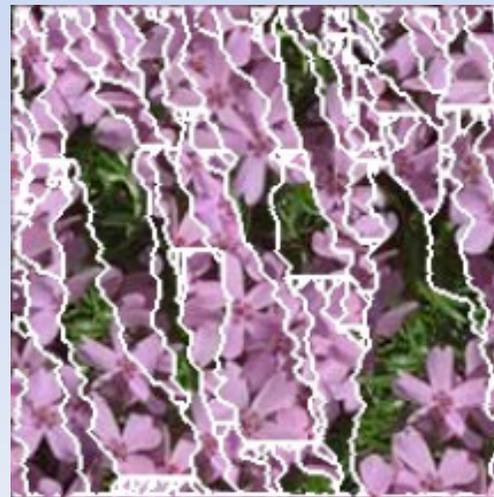
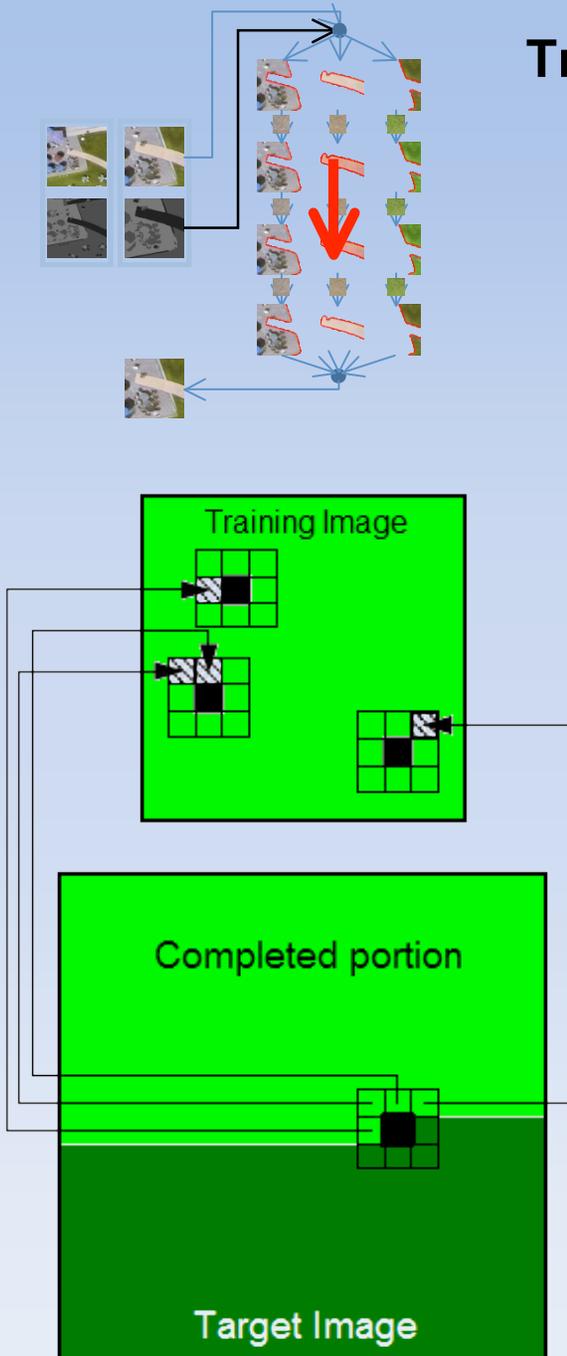


Ashikhmin

Ashikhmin's tricks:

- Good for natural textures.
- Initialized with random locations.
- Use the candidates suggested by the neighbors (not self).

- Does not blur the result and maintains structure (e.g. flowers).
- Several passes (using non-causal patches).
- Allows "user input".
- Much faster than E&L.



Transferring the Texture...

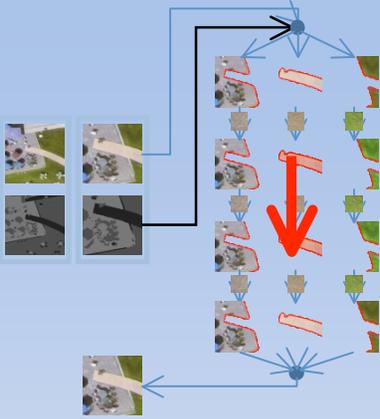


Image Analogies



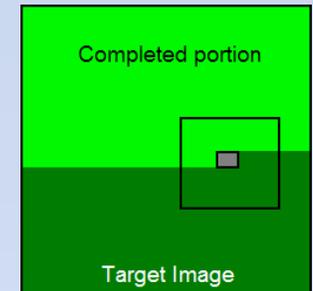
Hertzmann *et. al.*

Image Analogies:

- Combination of Efros-Leung & Ashikhmin (sum of their computation times).
- Observed that many image operations (image denoising, texture synthesis and transfer, super-resolution) can be implemented as special cases of (almost) this framework.
- The difference lies in the function that encodes the patch characteristics.

Functions:

- Must encode what can be perceived (color, edges, ...) and filter the rest.
- Useful for predicting the center color without overfitting.
- Causal vs. Non-causal (avoid low frequency bias).
- Reduce dimensionality using PCA.

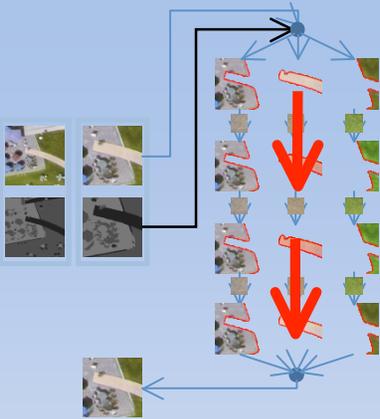


Final algorithm for Texture Transfer:

Pass	Type	Function
1 st	E & L	mean color + luminance gradient
2 nd	Ash.	whole downsampled + causal luminance
3 rd	Ash.	downsampled IQ + whole luminance

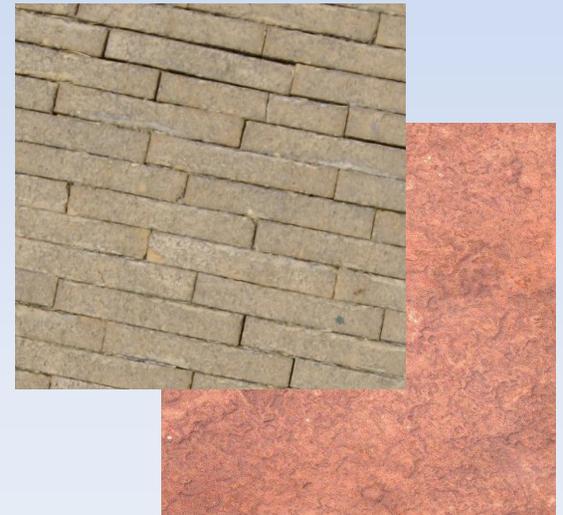


- Requires coherence (that Ashikhmin doesn't).
- Produces better results than either E&L or Ash.
- Runs faster than E&L or IA.



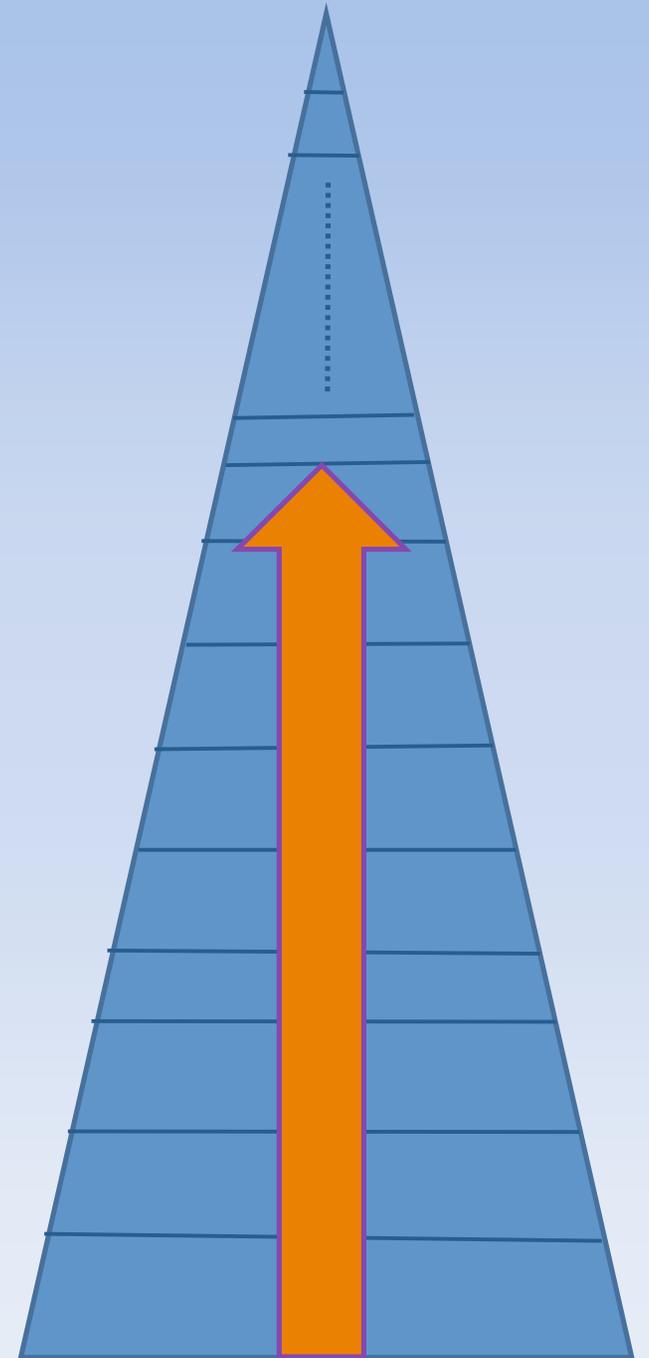
Color Matching (and Unmatching)...

- To find good matches in the dictionary the colors should be equalized.
- Otherwise, only particular regions of the dictionary are used.
- Done by simply matching the means.



Last step: Enforce Layer Coherence...

- Each layer is not EXACTLY a downsampled version of the layer below. That can sometimes be noticed.
- We enforce this coherence by substituting the center of each frame with the information from the frame below.
- The modification is so small that the edges of the square can not be noticed!



Motivation

What to do beyond the available resolution?



According to NASS: 10% of the US total area is covered by the top 4 crops (predictable textures).

Synthetic Superresolution (or Texture Keyframing)

**Diego Rother & Lance Williams
Google Summer 2007**

Feel free to ask questions at any time...