

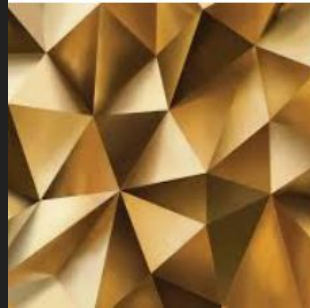
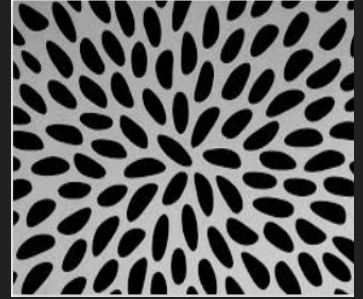
# Image Quilting for Texture Synthesis and Transfer

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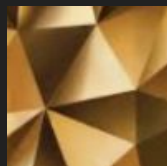
# What is texture?

- ❑ Surface characteristics and perceived appearance of an object.
- ❑ Texture can be defined as a 2D visual pattern which, at some scale, has a stationary distribution.



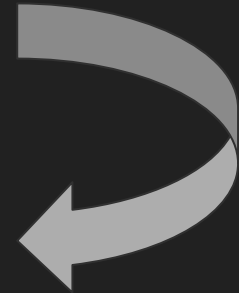
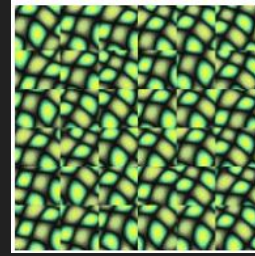
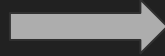
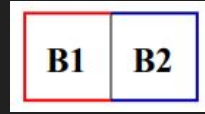
# What is texture synthesis?

- ❑ Texture synthesis is constructing a bigger image from small image by taking advantage of its structural content.
- ❑ There are many ways to do texture synthesis. In this project we have chosen to use image quilting to do this.

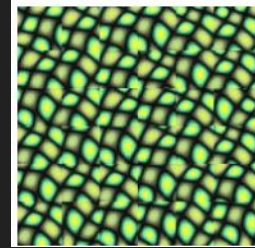
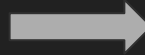


# Comparison

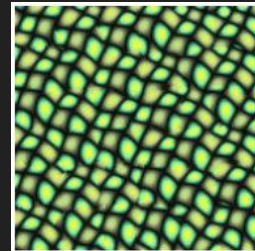
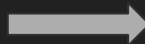
- No overlap of blocks



- Neighbouring blocks constrained by overlap



- Minimum error boundary cut



# What is Image quilting?



- ❑ Image quilting is a patch based algorithm where new image is synthesized by stitching together small patches of existing images.
- ❑ Selection of new/output patch is based on local image information, so can be extended to texture transfer application

## Texture transfer

- Rendering an object with texture taken from different object.

# Algorithm

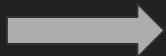
- ❑ Go through the image to be synthesized in raster scan order in steps of one block.
- ❑ For every location, search the input texture for a set of blocks that satisfy the overlap constraints (above and left) within some error tolerance. Randomly pick one such block.
- ❑ Compute the error surface between the newly chosen block and the old blocks at the overlap region. Find the minimum cost path along this surface and make that the boundary of the new block. Paste the block onto the texture. Repeat

# Minimum error boundary cut

$$E_{i,j} = e_{i,j} + \min (E_{i-1,j-1}, E_{i-1,j}, E_{i-1,j+1})$$

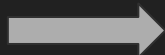
- We use above formula in array formation using dynamic programming.
- After this we take the least value in the final row and fix this as one end of boundary and based on the resultant array we traverse above in the overlap region to complete boundary with minimum cost(for horizontal overlap/transpose for vertical).
- For mixed overlap we use same strategy but the start point would be the the element with the least value in diagonal.

# Results for synthesis

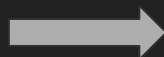




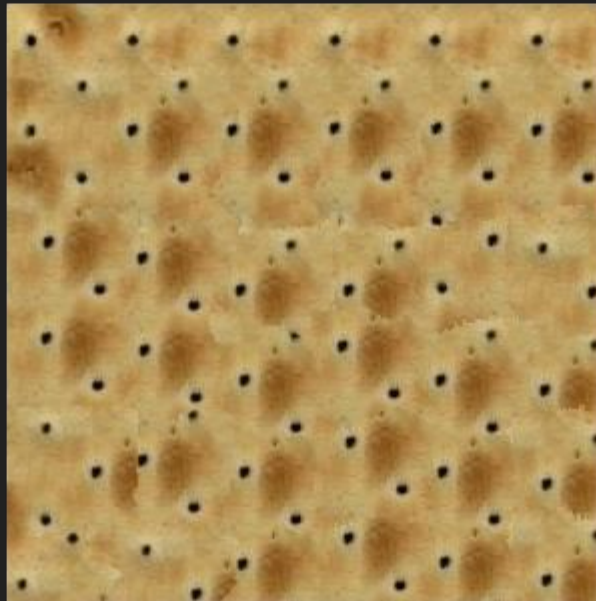
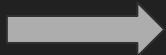
# Results for synthesis



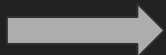
# Results for synthesis



# Results for synthesis



# Results for synthesis

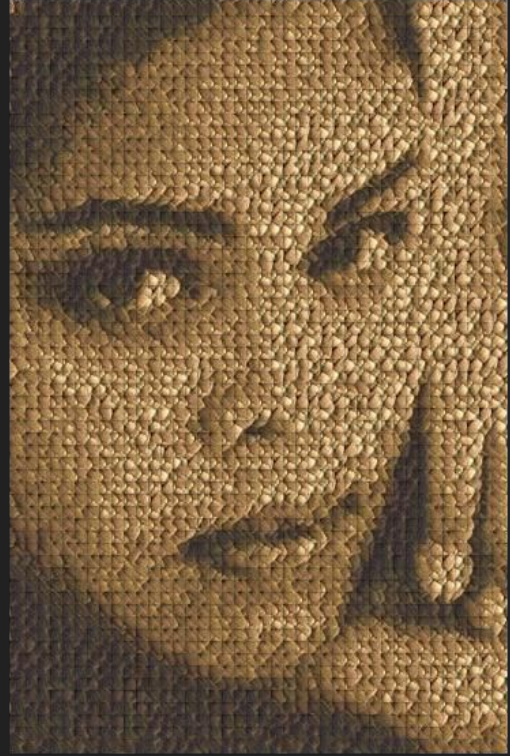
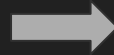


# Texture Transfer

- ❑ For texture transfer, image being synthesized must respect two independent constraints:
  - ❑ the output are legitimate, synthesized examples of the source texture
  - ❑ that the correspondence image mapping is respected.
- ❑ We modify the error term of the image quilting algorithm to be the weighted sum, ( $\alpha$ ) times the block overlap matching error + ( $1 - \alpha$ ) times the squared error between the correspondence map pixels within the source texture block and those at the current target image position.



# Results for transfer



# Variation with parameters



Increasing block size



Increasing overlap

# Applications

- ❑ Using image segmentation to find boundaries of regions and storing a small patch from each region, we can use texture synthesis to recreate entire image. This can be used as a lossy compression technique.
- ❑ Texture synthesis can be used in computer vision/graphics and texture analysis
- ❑ Image to painting: generating painting texture from images.





# Limitations

- Excessive repetition and mismatched/distorted boundaries.

# References

- ❑ [Researcher Website \(berkeley.edu\)](#)
- ❑ [Image Quilting paper \(berkeley.edu\)](#)

# Authors

- Alexei A. Efros
- William T. Freeman<sup>2</sup>

THANK YOU