CS 663:Fundamentals of Digital Image Processing – Project

Image Quilting for Texture Synthesis and Transfer

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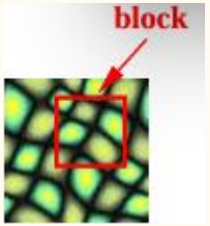
Image Quilting for Texture Synthesis and Transfer

- Image Quilting is a method of generating novel visual appearance in which a new image is synthesized by stitching together small patches of existing images.
- we extend the algorithm to perform texture transfer– rendering an object with a texture taken from a different object.
- Libraries used – numpy, PIL

- Our project is based on the paper –

  http://graphics.cs.cmu.edu/people/efros/research/quilting/quilting.pdf

Texture Synthesis Algorithm



Texture Synthesis Algorithm:

- Go through the image to be synthesized in raster scan order in steps of one block (minus the overlap).
- 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

. Steps followed during implementation

1. Created a list to store all possible blocks of size blocksize from texture image.
2. Calculated the number of blocks required in a row and column to get synthesised final image.
3. Traverse through each row and column and firstly we find the best match block among the list of blocks based on SSD error and tolerance.
4. Secondly, Based on the type of overlap, we send corresponding adjacent block along with match block to get the minimumcostpath mask using dynamic programming concept.
5. And finally, minimum cut mask is used to fix the boundary between two blocks.
6. Repeat three steps

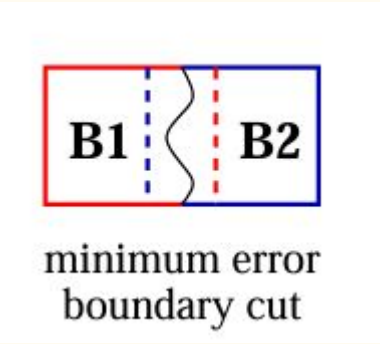
Minimum Error Boundary Cut

The minimal cost path through the error surface is computed by using Dynamic programming method. If B1 and B2 are two blocks that overlap along their vertical edge with the regions of overlap B1 and B2 , To find the minimal vertical cut through this surface we traverse e (i =2..N) and compute the cumulative minimum error E for all paths:

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

In the end, the minimum value of the last row in E will indicate the end of the minimal vertical path though the surface and one can trace back and find the path of the best cut.

Create a mask that is having zeros for before boundary values and ones for after boundary values.



minimum error boundary cut

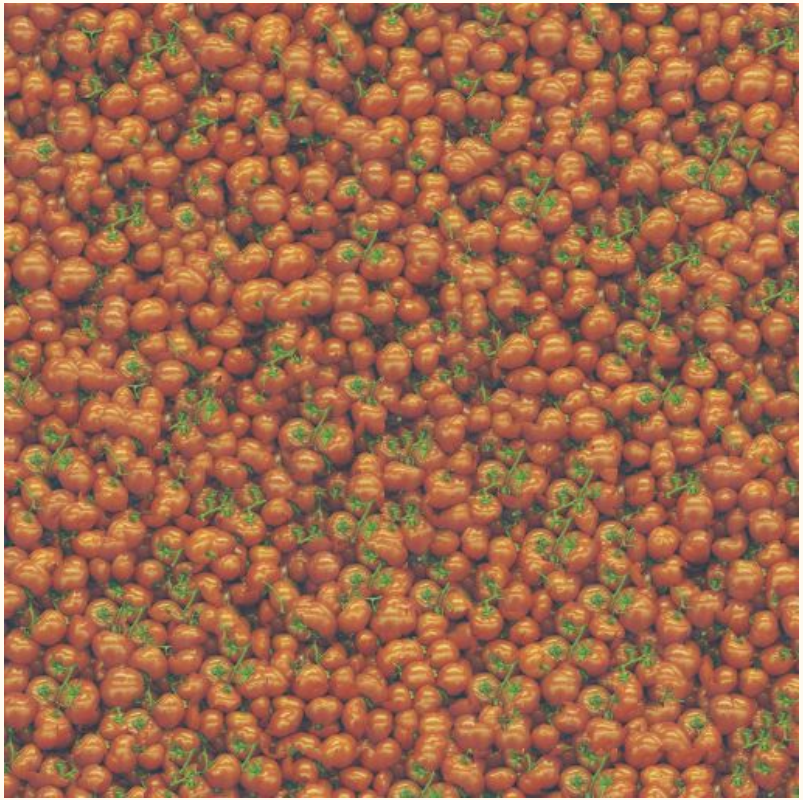
Texture Transfer

If we modify the synthesis algorithm by requiring that each patch satisfy a desired correspondence map, C , as well as satisfy the texture synthesis requirements, we can use it for texture transfer.

- The correspondence map is a spatial map of some corresponding quantity over both the texture source image and a controlling target image.
- For texture transfer, image being synthesized must respect two independent constraints:
    - (a) the output are legitimate, synthesized examples of the source texture
    - (b) that the correspondence image mapping is respected.
- Hence, we modify the error term by the use of an ‘alpha’ parameter.

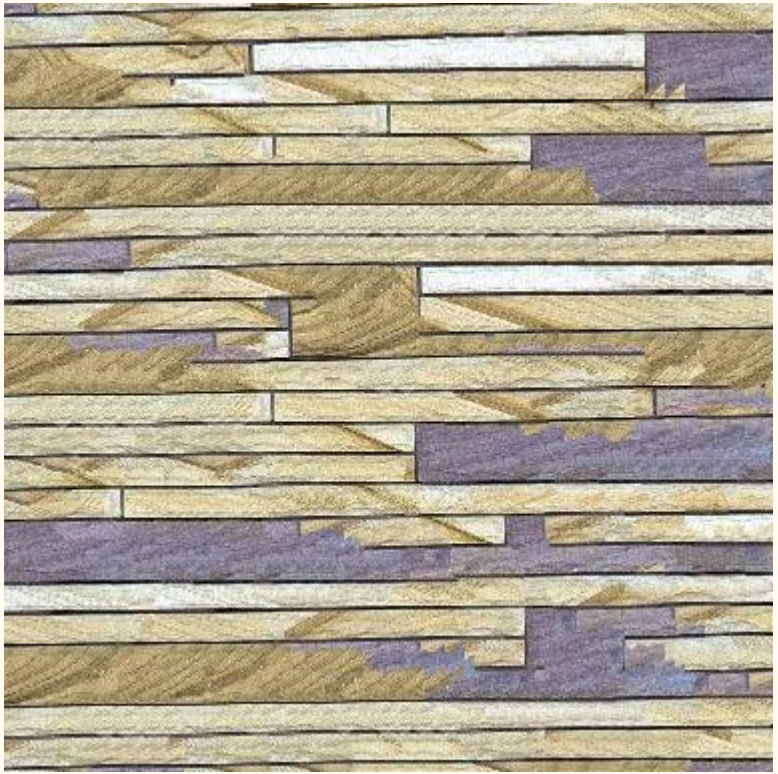
RESULTS Of Texture Synthesis

Source Image

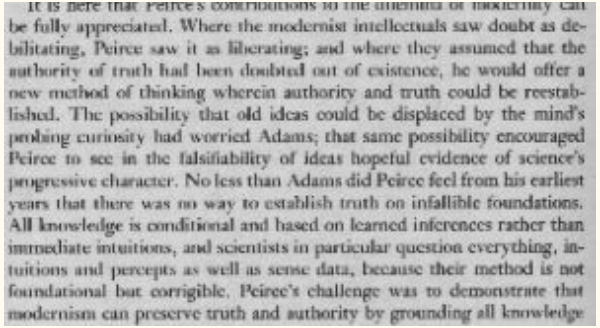


Synthesized Image

Source Image

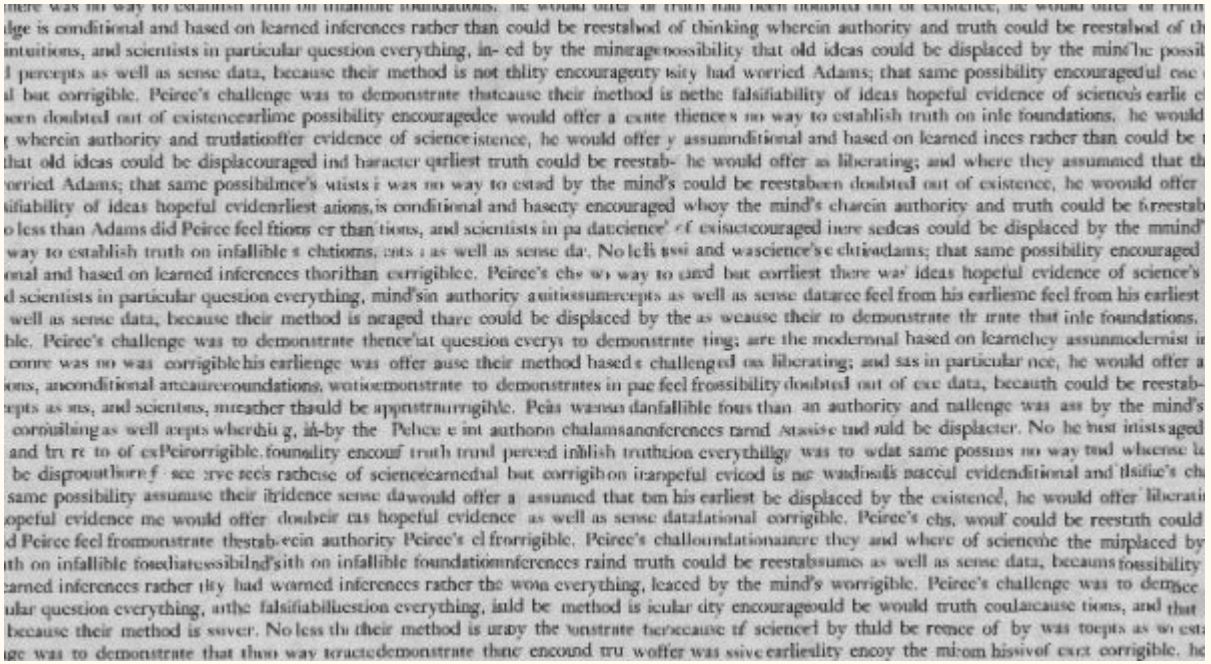


Synthesized Image



It is here that Peirce's contributions to the theme of modernity can be fully appreciated. Where the modernist intellectuals saw doubt as debilitating, Peirce saw it as liberating; and where they assumed that the authority of truth had been doubted out of existence, he would offer a new method of thinking wherein authority and truth could be reestablished. The possibility that old ideas could be displaced by the mind's probing curiosity had worried Adams; that same possibility encouraged Peirce to see in the falsifiability of ideas hopeful evidence of science's progressive character. No less than Adams did Peirce feel from his earliest years that there was no way to establish truth on infallible foundations. All knowledge is conditional and based on learned inferences rather than immediate intuitions, and scientists in particular question everything, intuitions and percepts as well as sense data, because their method is not foundational but corrigible. Peirce's challenge was to demonstrate that modernism can preserve truth and authority by grounding all knowledge

Source Image



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Source Image

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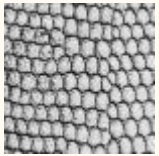

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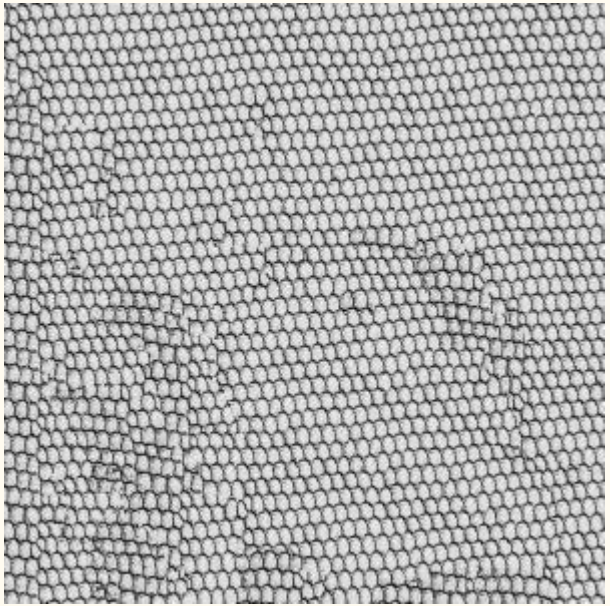
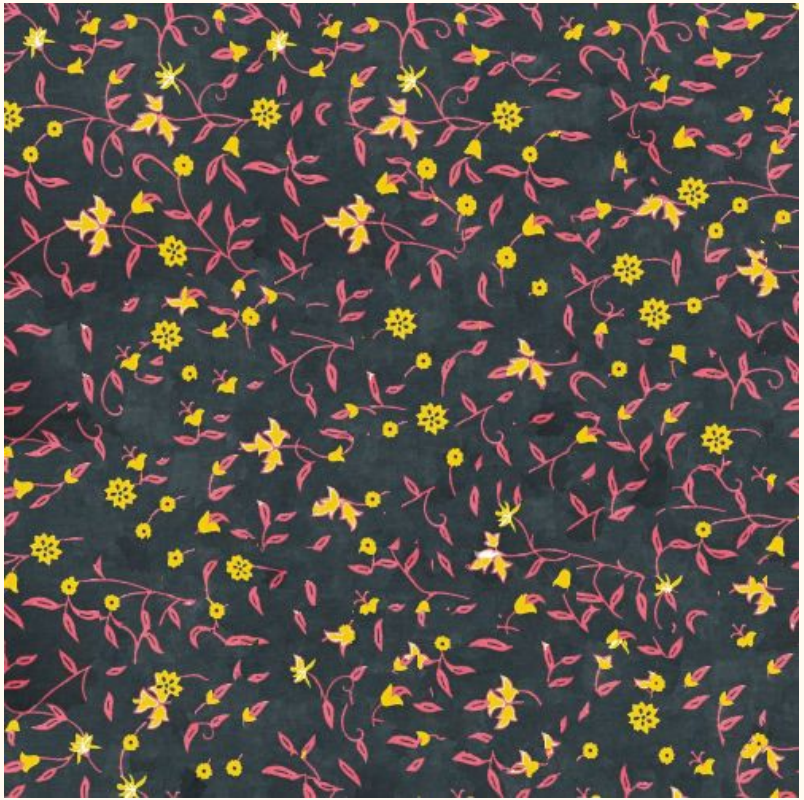


Synthesized Image

Source Image



Synthesized Image

OUR RESULTS Of Texture Transfer

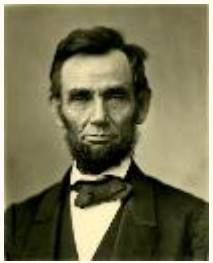
Source image

Target Image

b=30 o=5 a=0.2 t=0.1

b=10 o=5 a=0.2 t=0.1

Source image



Target Image

b=10 o=5 a=0.2_t=0.1

b=20 o=10 a=0.2 t=0.1

Source image

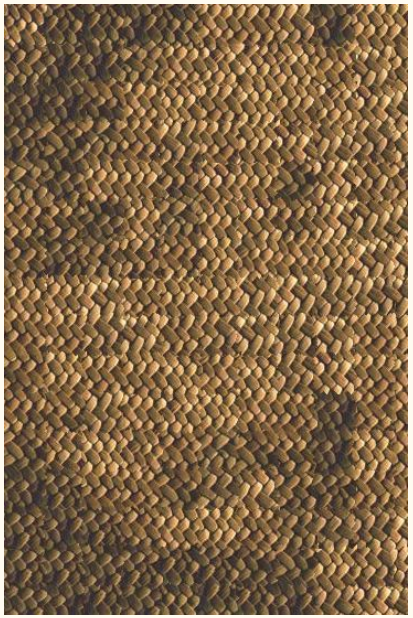
Target Image

b=30 o=10 a=0.2 t=0.1

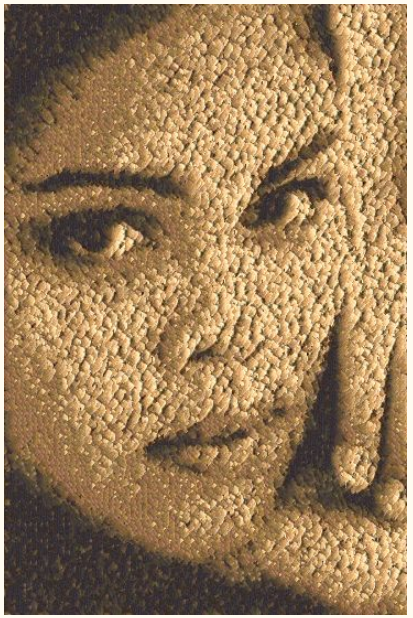
b=10 o=5 a=0.2 t=0.1

Source image

Target Image



b=10 o=5 a=0.2 t=0.1



b=40 o=5 a=0.2 t=0.1

Conclusion

1) In this ppt we implemented the image quilting matter in which there are 2 parts

   a. Texture synthesis

   b. Texture Transfer

2) Texture Synthesis reconstructs the image with as randomness and the joining parts are chose such that they are very close and have less error.

3) Texture Synthesis is a pretty fast process.

4) Texture Transfer is like we are taking the pattern of an image and mixing with another image whereas the crux of the image remains but the way of strokes changes.

5) Texture Transfer is a slow process