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Image Quilting Project Report

24th November, 2018

OVERVIEW

Implementation of the paper “Image Quilting for Texture Synthesis and Transfer" by Alexei A. Efros and William T. Freeman.

GOALS

1. Understanding the paper and distribution of work.
2. Implementation of the algorithm as specified in the paper.
3. Testing on various images and textures. Examples include test images from MATLAB, textures can be found on the website for the project : http://graphics.cs.cmu.edu/people/efros/research/quilting.html
4. No exact parameter for evaluation as such, but can be done by comparing our results with the one reported in the paper. For unknown images, eyes are the best evaluators.

SPECIFICATIONS

The project performs two main functions, extending existing texture from given patch of texture and mapping the given texture to a target image. Specifically, the fast and simple quilting algorithm can be extended to perform texture transfer. The algorithm does not require any 3D data, i.e depth data and works directly on images.

IMPLEMENTATION

The algorithm is classified as a dynamic programming algorithm to find the boundary between two blocks by calculating the minimum error in the overlapping blocks. To extend texture from the given image, we find patches in the given image that can be placed together to give a larger piece of texture. To find two patches, we calculate overlap error between patches and choose one among the lowest errors, within some tolerance. To find the boundary between these two patches that will have minimum error when transitioning from one block to other, we calculate the minimum error for all paths and then choose the path with the minimum error. Thus, we get the output patch to be stitched together to get the final image.

For texture transfer, the only change is determined by the error that is used to determine the next block that is to be patched. We weigh two errors, the overlap error between the patches from the texture, and other being the error between the current patch in the target image and all the possible patches. We choose the patch within the tolerance value from the possible patches and then use the minimum-cut algorithm to determine the boundary.

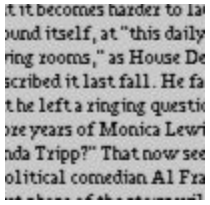
OBSERVATIONS

Texture synthesis requires the given image to be significantly similar or symmetric to give satisfying results. The patch size also needs to be determined depending upon the unit of the texture in the image. Overlap between two patches gives a trade-off as larger overlap means there are less patches to choose from but smaller overlap does not stitch the texture well enough. The error tends to be within 10^1 and 10^2, thus error tolerance between min-error and 2*min-error gives the best results.

Texture transfer on the other hand, requires the patch size and the overlap to be significantly lower than what is used in synthesis. This is because it needs to accommodate for the finer details in the target image, which may be missed because no patch of a bigger size from the texture could represent the patch correctly. Tolerance also needs to be reduced to get results corresponding more to the target image. The weight alpha tends to weigh more towards the error in the target image, as we want the result to be similar to the target, and not an extended texture.

RESULTS

Texture Synthesis-



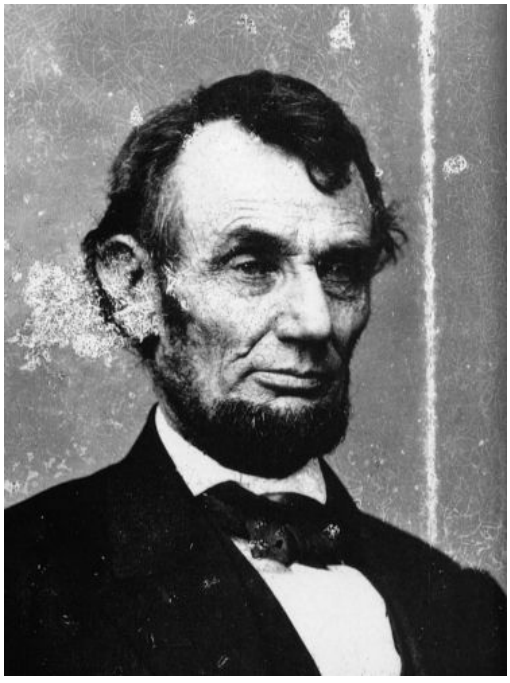
Synthesized Texture with Cut

Synthesized Texture with Cut

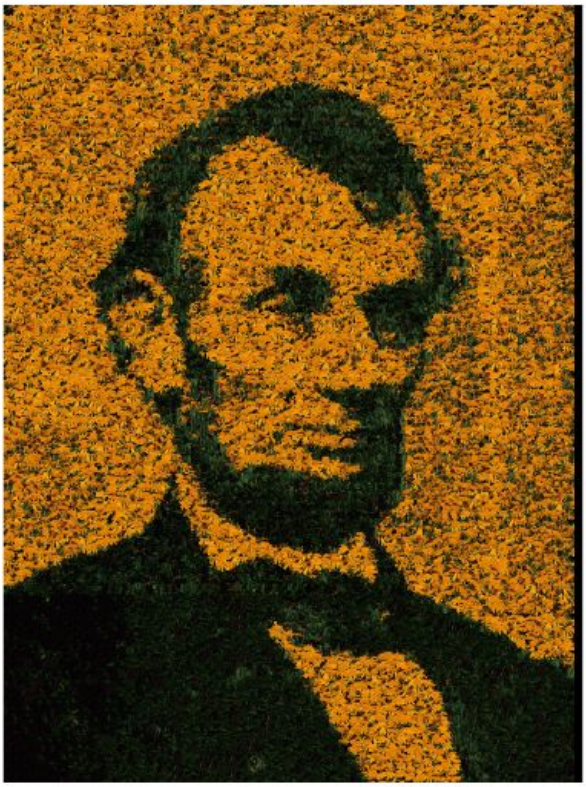
Synthesized Texture with Cut

Synthesized Texture with Cut

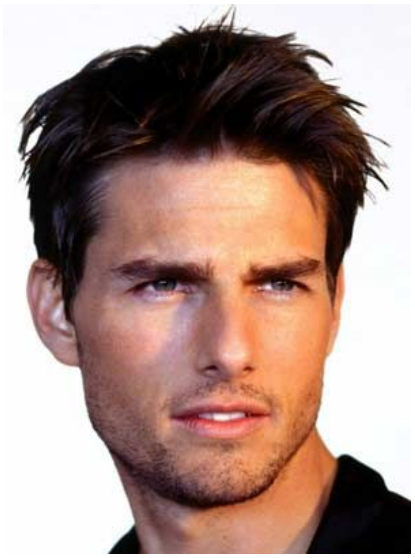
Texture Transfer -



Texture Transfer



Texture Transfer



Texture Transfer