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**CS 445 - Project 2: Image Quilting**

Complete the claimed points and sections below.

**Total Points Claimed** [135] / 175

**Core**

- |                                |           |
|--------------------------------|-----------|
| 1. Randomly Sampled Texture    | [10] / 10 |
| 2. Overlapping Patches         | [20] / 20 |
| 3. Seam Finding                | [20] / 20 |
| 4. Additional Quilting Results | [10] / 10 |
| 5. Texture Transfer            | [30] / 30 |
| 6. Quality of results / report | [10] / 10 |

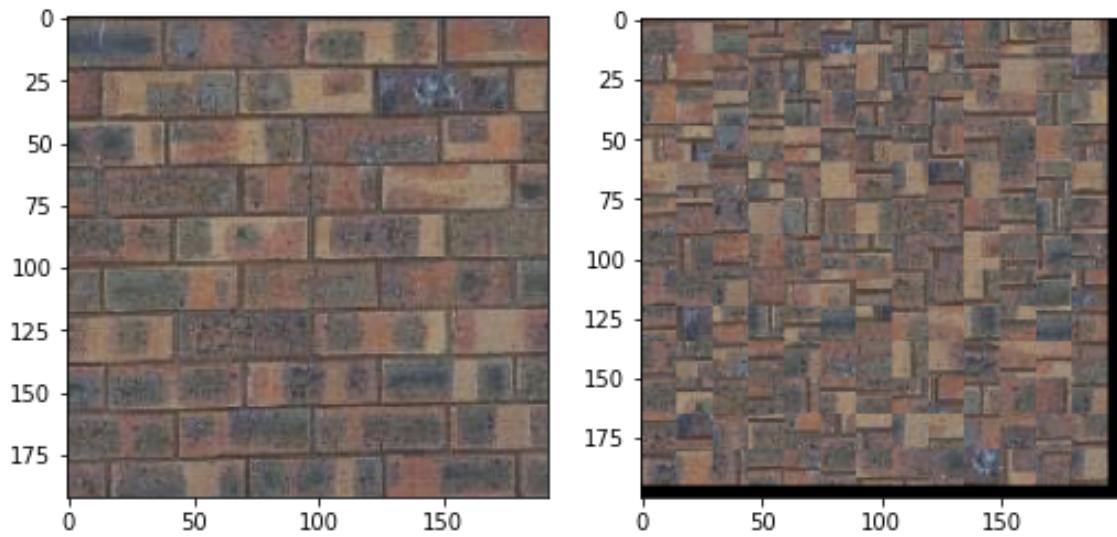
**B&W**

- |                                      |           |
|--------------------------------------|-----------|
| 7. Iterative Texture Transfer        | [15] / 15 |
| 8. Face-in-Toast Image               | [20] / 20 |
| 9. Hole filling w/ priority function | [0] / 40  |

**1. Randomly Sampled Texture**

Sample and output images, Parameters: patch size, output size

**Parameters: (Patch Size = 15, Output Size = 200)**

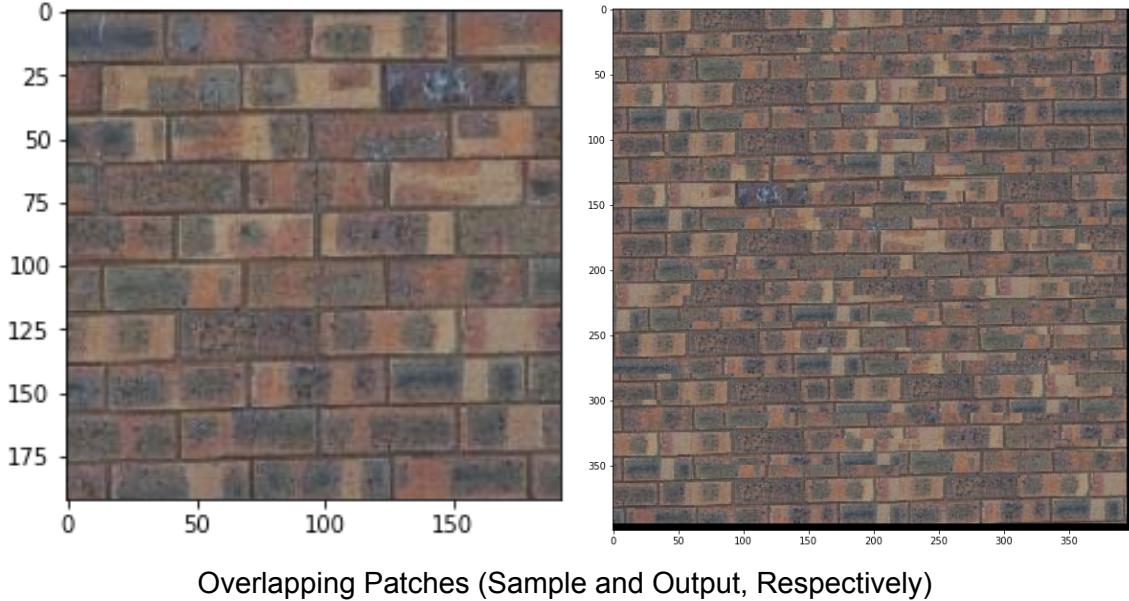


Randomly Sampled Texture (Sample and Output, Respectively)

## 2. Overlapping Patches

Output image for same sample as part 1, Parameters: patch size, overlap size, tolerance

**Parameters: (Patch Size = 25, Output Size = 400, Overlap = 15, Tolerance = 1)**



## 3. Seam Finding

Output image for same sample as part 1

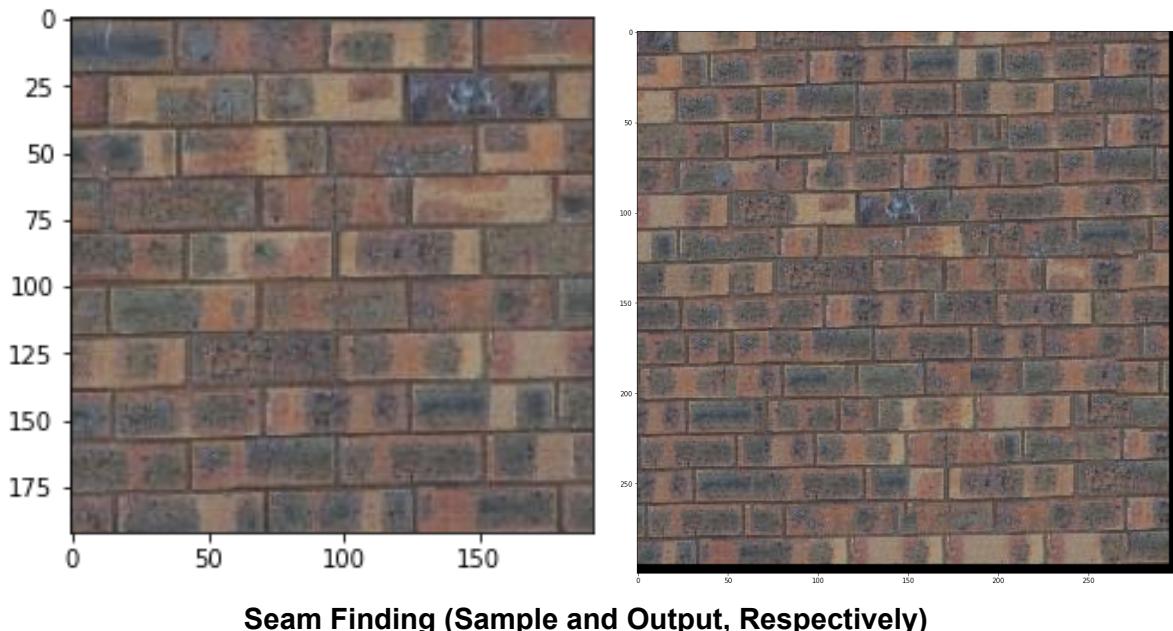
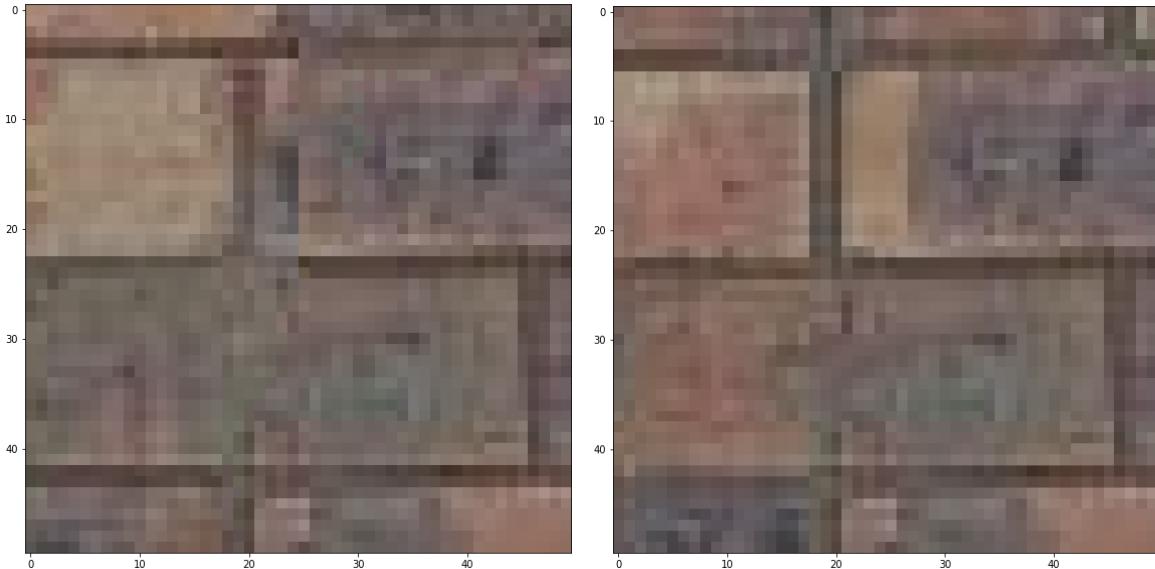
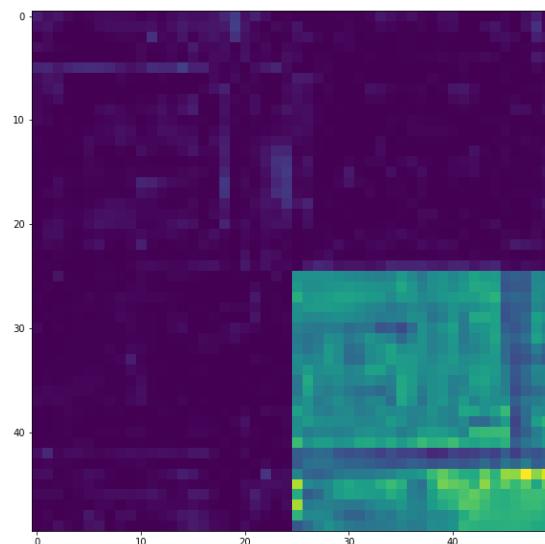


Illustration: for a selected patch, display (a) the two overlapping portions; (b) pixelwise SSD cost; (c) horizontal mask; (d) vertical mask; (e) combination mask. The mask is binary and tells which pixels come from which patch.

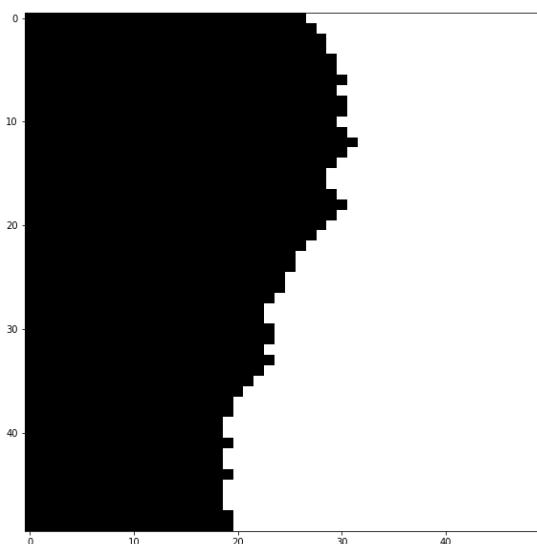
a) The two overlapping portions (Template and Selected Patch)



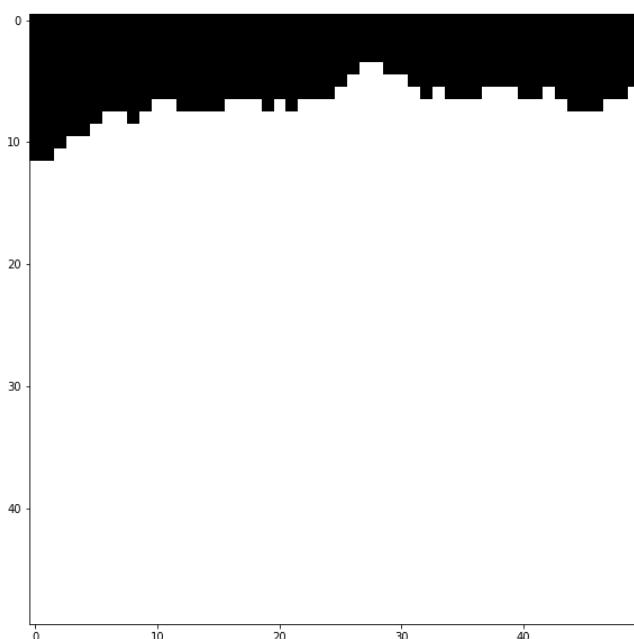
b) Pixelwise SSD Cost



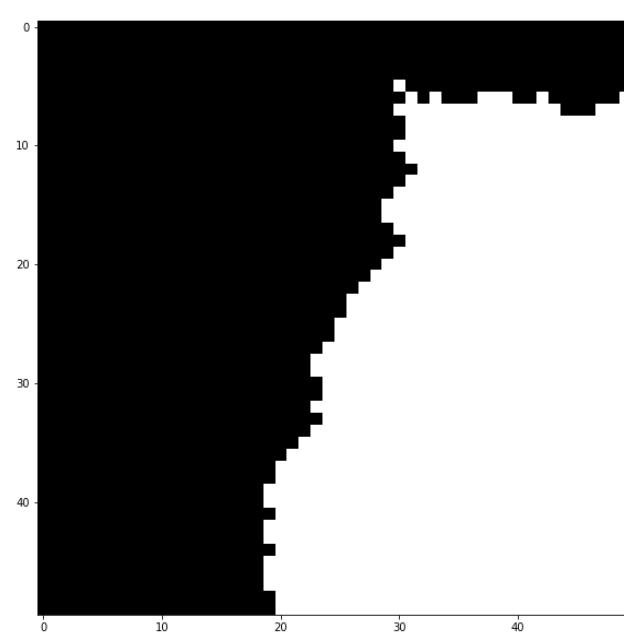
c) Horizontal Mask



d) Vertical Mask



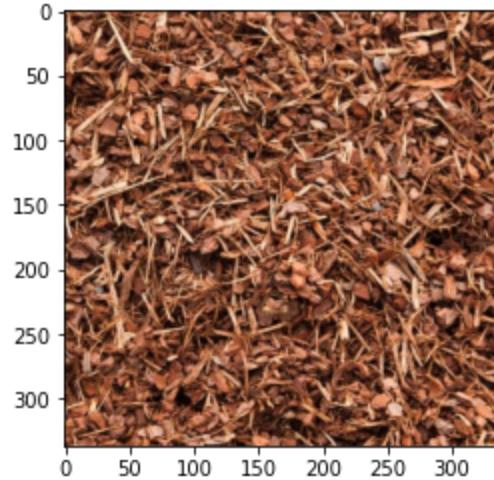
e) Combination Mask



#### 4. Additional Quilting Results

At least two quilting results on your own images (excluding provided samples). Each result should show input texture image and output, and output should be more pixels than input.

**Result 1 Input:**



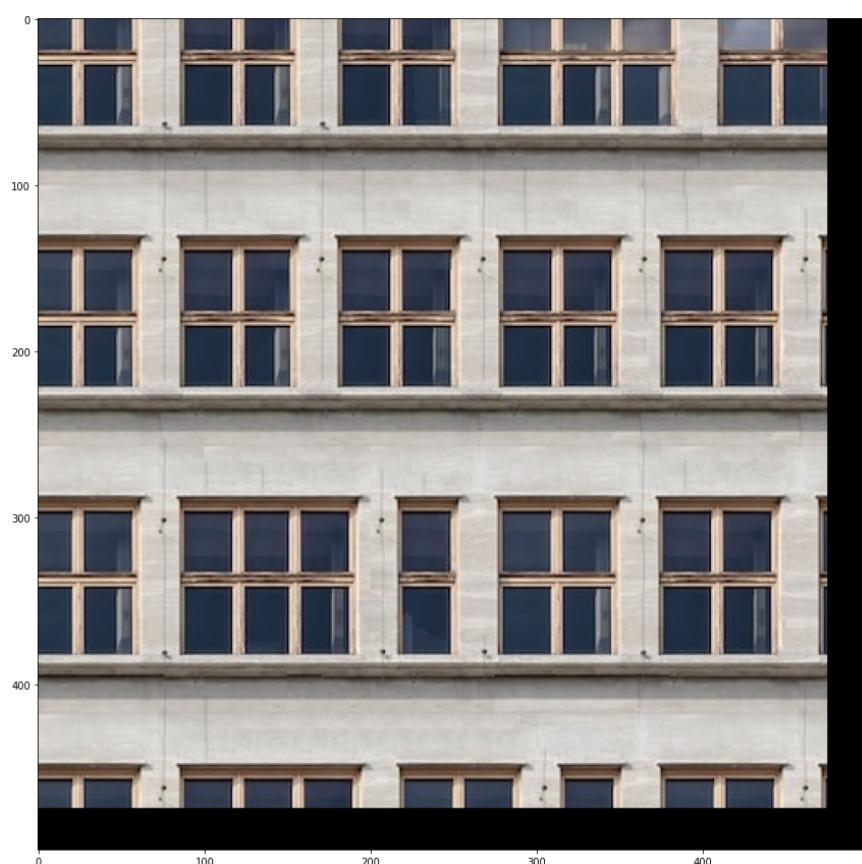
**Result 1 Output:**



**Result 2 Input:**



**Result 2 Output:**



## 5. Texture Transfer

### Brief description of texture transfer method and parameters:

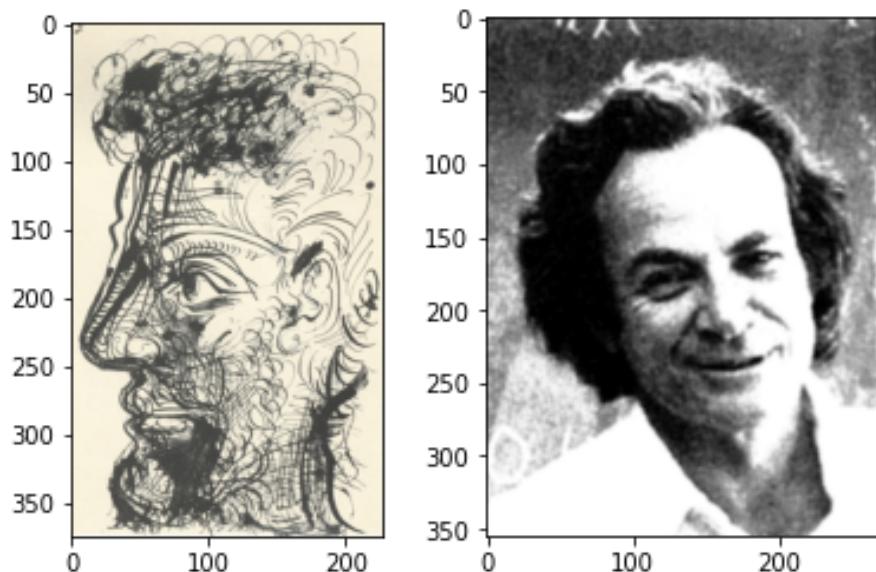
The texture transfer method is very similar to the quilt cut method, but now takes into consideration the SSD between the source texture image and the guidance image in addition to the SSD between the source image and output image. This results in an output image that aims to match the guidance image by reducing error in all three color channels.

The parameter alpha determines how much weight is given to matching the texture versus the guiding image. Higher alpha values result in a similar texture to the sample texture, whereas lower alpha values will result in an output that more closely matches the guiding image.

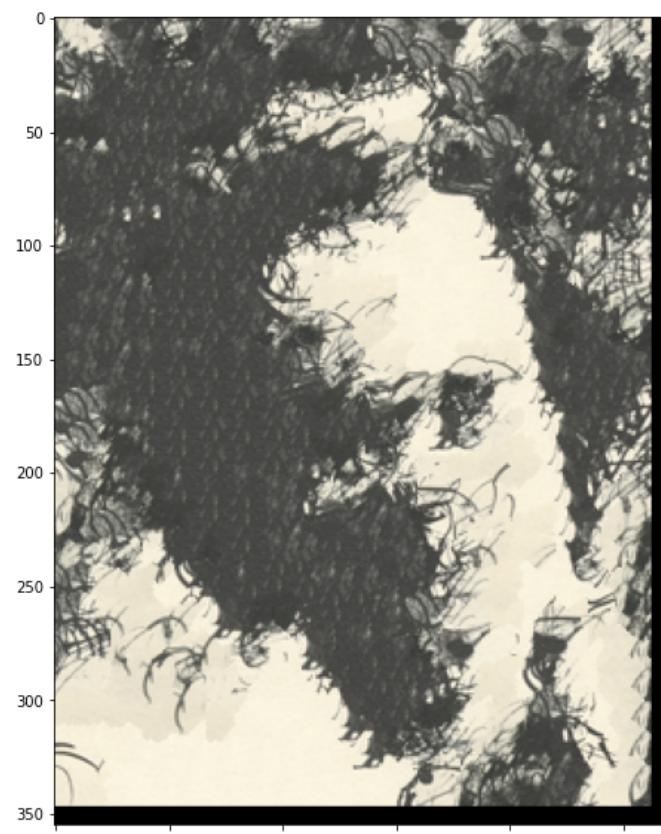
**At least two texture transfer results (one result can use provided samples). Include the input texture and target images and the output (output should be same size as target image)**

#### Result 1:

Parameters: (Patch Size = 25, Overlap = 11, Tolerance = 3, alpha = 0.65)

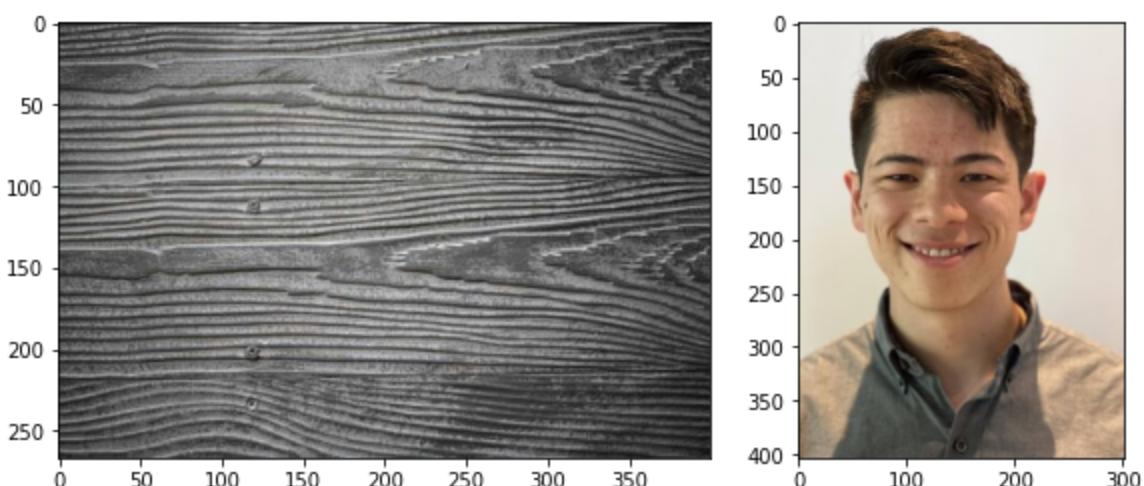


Result 1 Input Texture and Target Images, Respectively

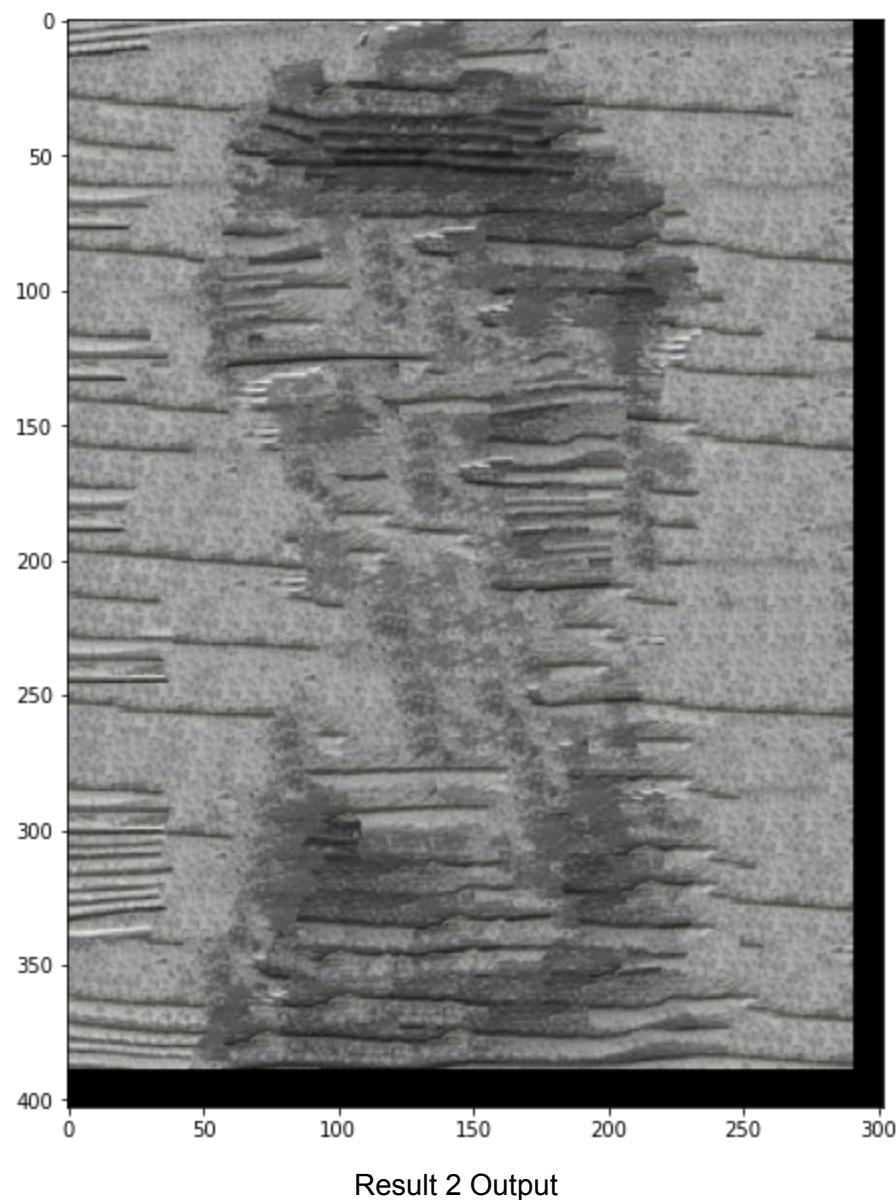


Result 1 Output

**Result 2:**



Result 2 Input Texture and Target Images, Respectively



## 6. Quality of results / report

Nothing extra to include (scoring: 0=poor 5=average 10=great).

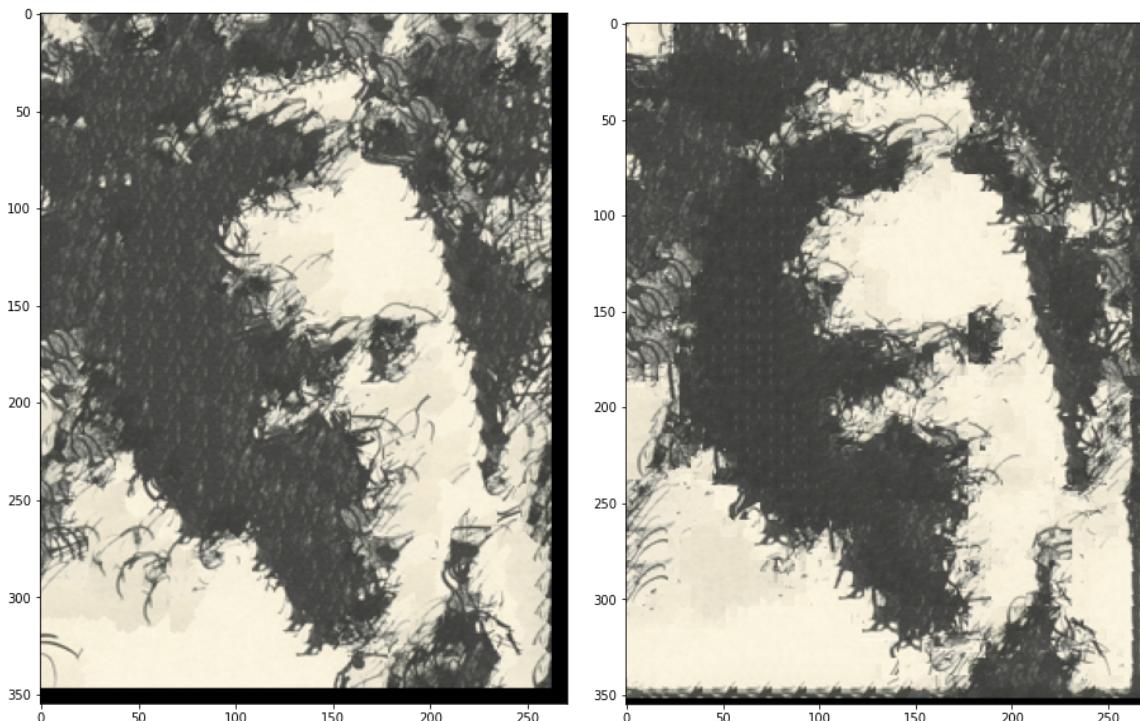
## 7. Iterative Texture Transfer (B&W)

### Describe method

This function does the same thing as the previous texture transfer function, but it repeats the process multiple times, reducing the patch size each time. In order to transition from more closely matching the guidance image on earlier passes to better matching the texture on later passes, the value of alpha increases as patch size decreases. This allows larger patches to be used to generally lay out gradients and smaller patches to be used to refine smaller texture details.

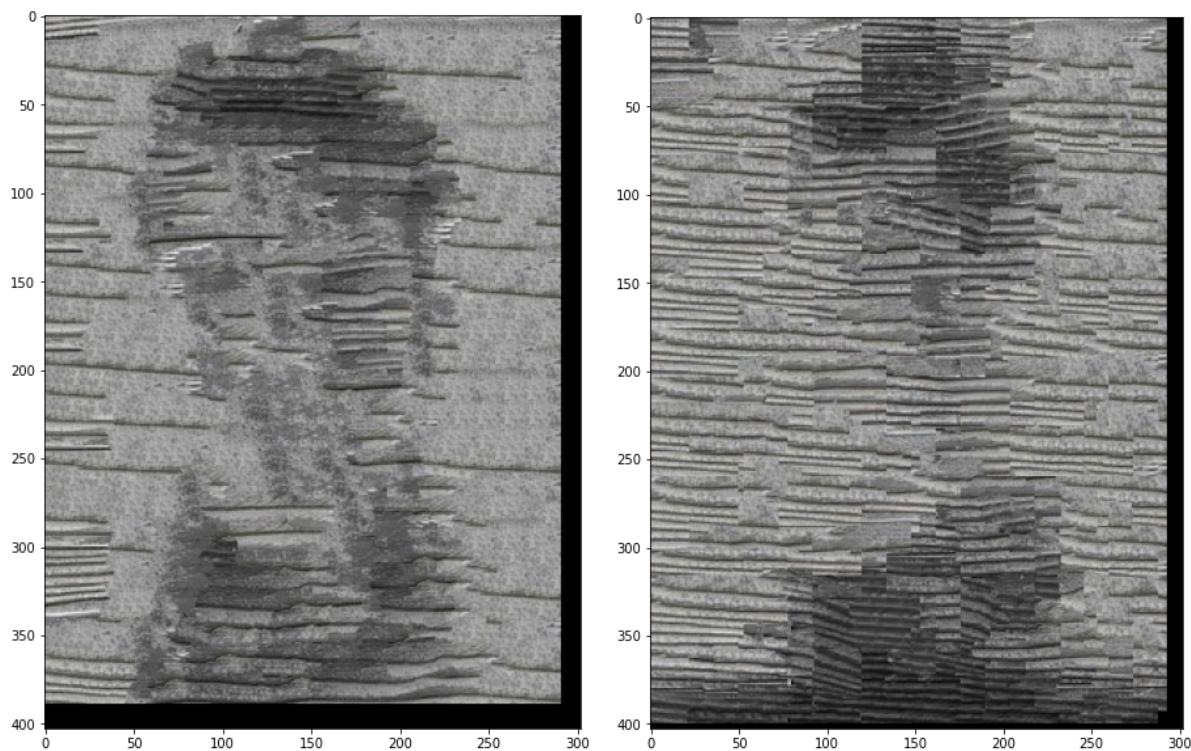
For the first result, the iterative process output image clearly has more, smaller patches, but suffers from having a more blocky appearance due to the smaller patches.

**Results on the same images as shown for texture transfer:**



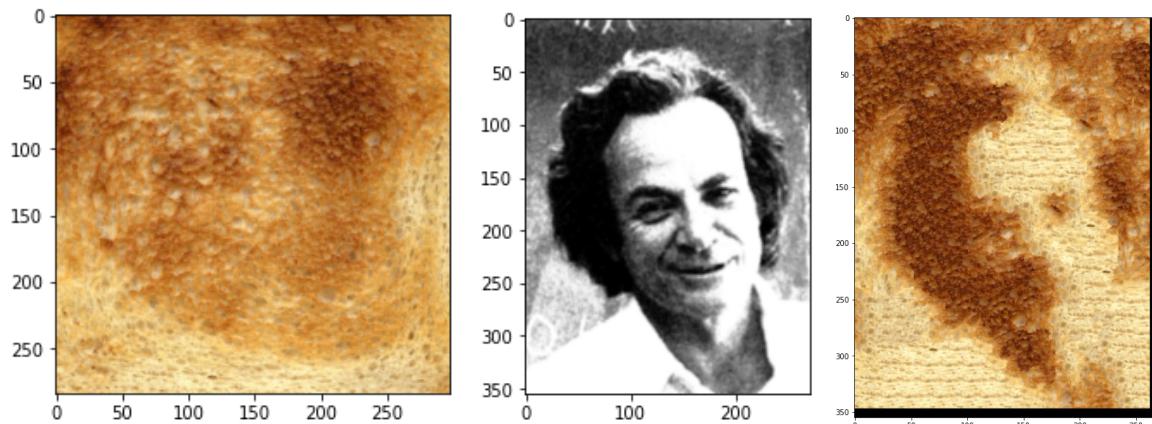
Result 1: Non-iterative result and iterative result, respectively

For the second result below, the iterative process retained significantly more texture detail and is a clear improvement in that regard. It follows the guidance image a little bit less, but the original texture image doesn't have enough variety in pixel intensity to perfectly satisfy both the guidance and texture parameters.

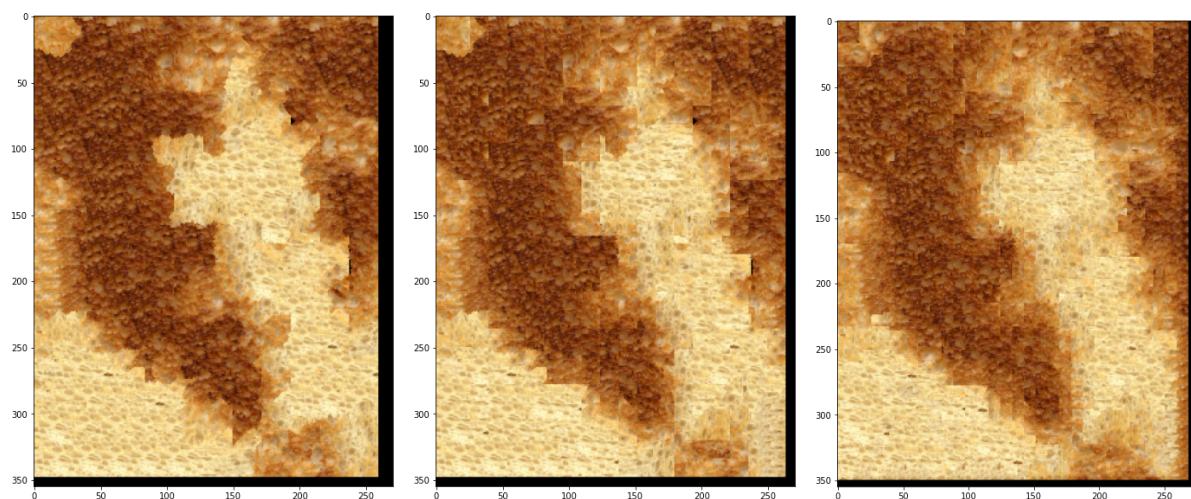


Result 2: Non-iterative result and iterative result, respectively

I've included one more example to clearly show the iterations of this process. The iterative process results in much more cohesive texture patterning.



Result 3: Texture, Guiding Image, and Non-Iterative Result



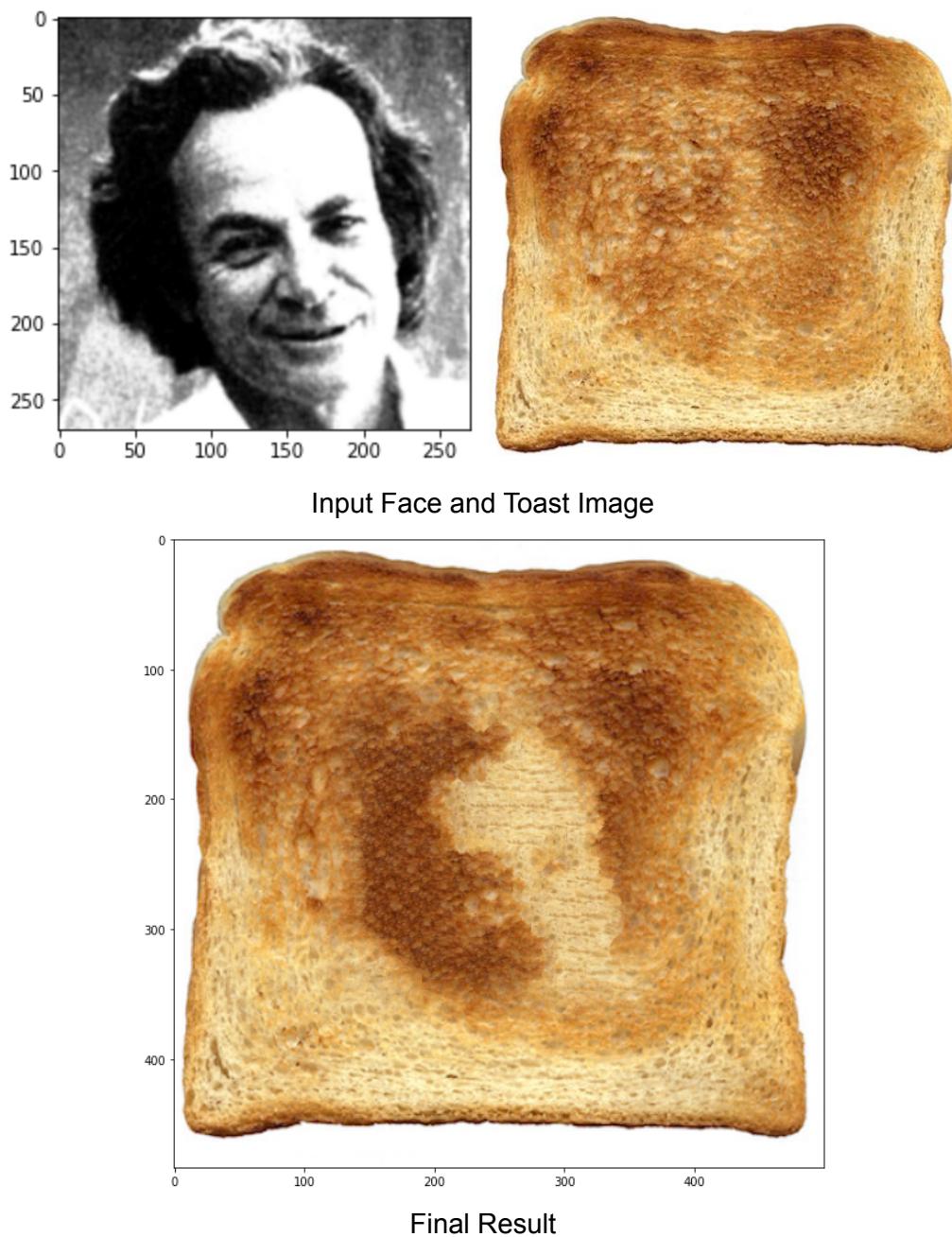
Result 3: First Iteration, Second Iteration, Third and Final Iteration

## 8. Face-in-Toast Image (B&W)

### Describe method

To put Feynman's face on the slice of toast, I started by using the texture transfer function to apply the burnt toast texture to the guiding grayscale image of Feynman. I used a smaller sample of the toast texture image to avoid confusion due to the edges of the bread and the whitespace. I then inserted this textured result into the larger toast image, using alpha blending to create a seamless transition between the face and the rest of the toast. To accomplish the blending, I defined a function that inserts the textured face into the toast one perimeter of pixels at a time, iterating from the outside of the face inwards. Each cycle, the alpha value increases based off the function:  $\alpha_i = 0.7 * \frac{i}{N-1} + 0.1$ , where  $i$  is the current iteration over the range  $[0, N]$ . A higher alpha value weighs the face more heavily, so the background toast becomes less prevalent closer to the face. After  $N$  is reached, the remaining pixels are filled in with a fixed alpha value of 0.8. This ensures that most of the image retains its detail from the texture transfer and is not blended entirely. The result below used  $N = 40$ .

### Show input face image, toast image, and final result



## 9. Hole filling w/ priority function (B&W)

Include

- Describe method
- Show result on at least two images (show input with hole and output)

### Acknowledgments / Attribution

Wood grain photo:

[https://www.google.com/url?sa=i&url=https%3A%2F%2Fwww.agedwoods.com%2Fwhy-is-the-woodgrain-important%2F&psig=AOvVaw0x6QfPwayxO9RYKGtcwSkh&ust=1664327700916000&source=images&cd=vfe&ved=0CAwQjRxqFwoTCMjstP3ls\\_oCFQAAAAAdAAAAABAD](https://www.google.com/url?sa=i&url=https%3A%2F%2Fwww.agedwoods.com%2Fwhy-is-the-woodgrain-important%2F&psig=AOvVaw0x6QfPwayxO9RYKGtcwSkh&ust=1664327700916000&source=images&cd=vfe&ved=0CAwQjRxqFwoTCMjstP3ls_oCFQAAAAAdAAAAABAD)

Building windows photo:

[https://www.google.com/url?sa=i&url=https%3A%2F%2Fwww.wallpaperflare.com%2Fnetherlands-amsterdam-sun-street-photography-streets-facades-wallpaper-ezrql&psig=AOvVaw2x\\_hgJQxJU9exEkyMoFJCd&ust=1664327884865000&source=images&cd=vfe&ved=0CAsQjRxqFwoTCojBmNTms\\_oCFQAAAAAdAAAAABAE](https://www.google.com/url?sa=i&url=https%3A%2F%2Fwww.wallpaperflare.com%2Fnetherlands-amsterdam-sun-street-photography-streets-facades-wallpaper-ezrql&psig=AOvVaw2x_hgJQxJU9exEkyMoFJCd&ust=1664327884865000&source=images&cd=vfe&ved=0CAsQjRxqFwoTCojBmNTms_oCFQAAAAAdAAAAABAE)

Bark photo:

[https://www.google.com/imgres?imgurl=https%3A%2F%2Fmedia.istockphoto.com%2Fphotos%2Ftan-bark-garden-mulch-picture-id153761709&imgrefurl=https%3A%2F%2Fwww.istockphoto.com%2Fphoto%2Ftan-bark-garden-mulch-gm153761709-15515298&tbnid=6UtQmtRiRxorgM&vet=12ahUKEwj1lvvq5rP6AhX7gokEHQ\\_uDIQQMygEegUIARDiAQ..i&docid=MBLbUI4rD6JryM&w=1024&h=682&q=tan%20bark&ved=2ahUKEwj1lvvq5rP6AhX7gokEHQ\\_uDIQQMygEegUIARDiAQ](https://www.google.com/imgres?imgurl=https%3A%2F%2Fmedia.istockphoto.com%2Fphotos%2Ftan-bark-garden-mulch-picture-id153761709&imgrefurl=https%3A%2F%2Fwww.istockphoto.com%2Fphoto%2Ftan-bark-garden-mulch-gm153761709-15515298&tbnid=6UtQmtRiRxorgM&vet=12ahUKEwj1lvvq5rP6AhX7gokEHQ_uDIQQMygEegUIARDiAQ..i&docid=MBLbUI4rD6JryM&w=1024&h=682&q=tan%20bark&ved=2ahUKEwj1lvvq5rP6AhX7gokEHQ_uDIQQMygEegUIARDiAQ)