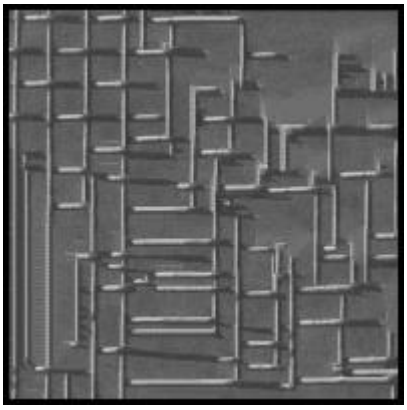
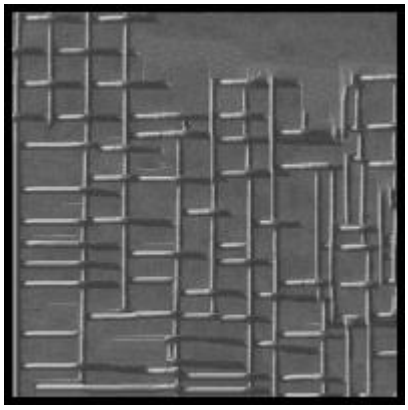
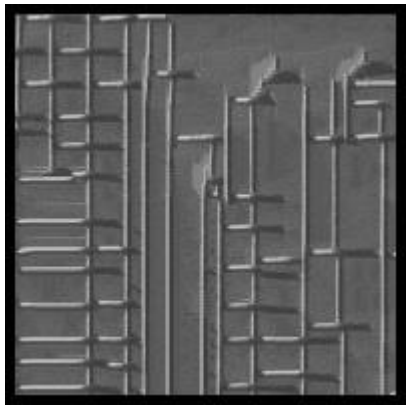
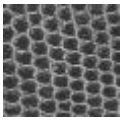
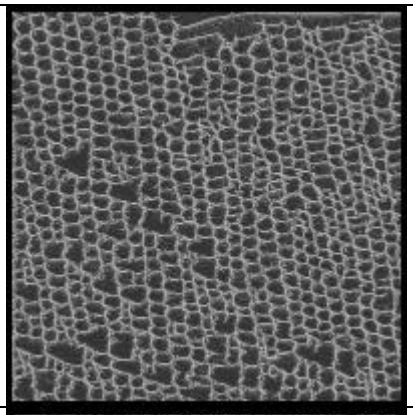
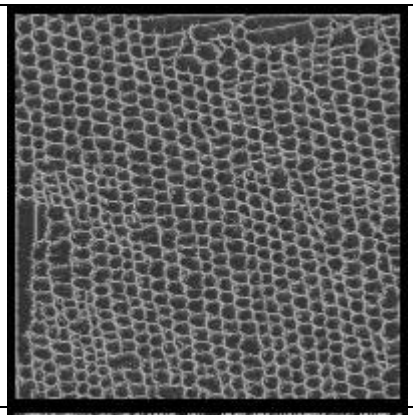
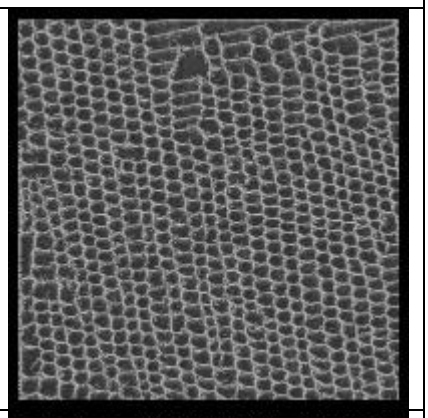
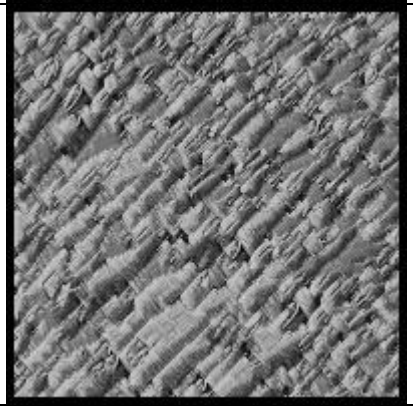
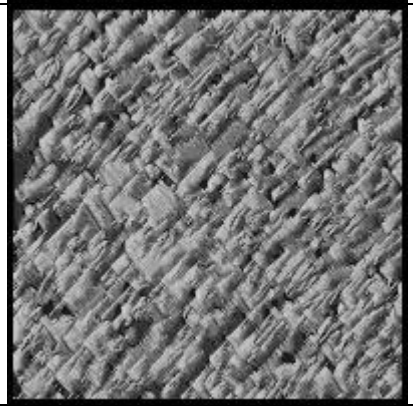
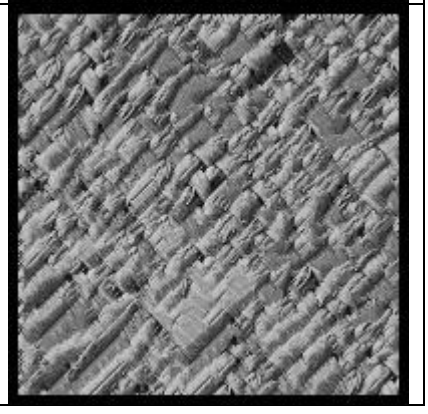
REPORT

1. Texture Synthesis *(Efros-Leung method)*

Texture Sample	Window Size = 7	Window Size = 9	Window Size = 11
			
			
			

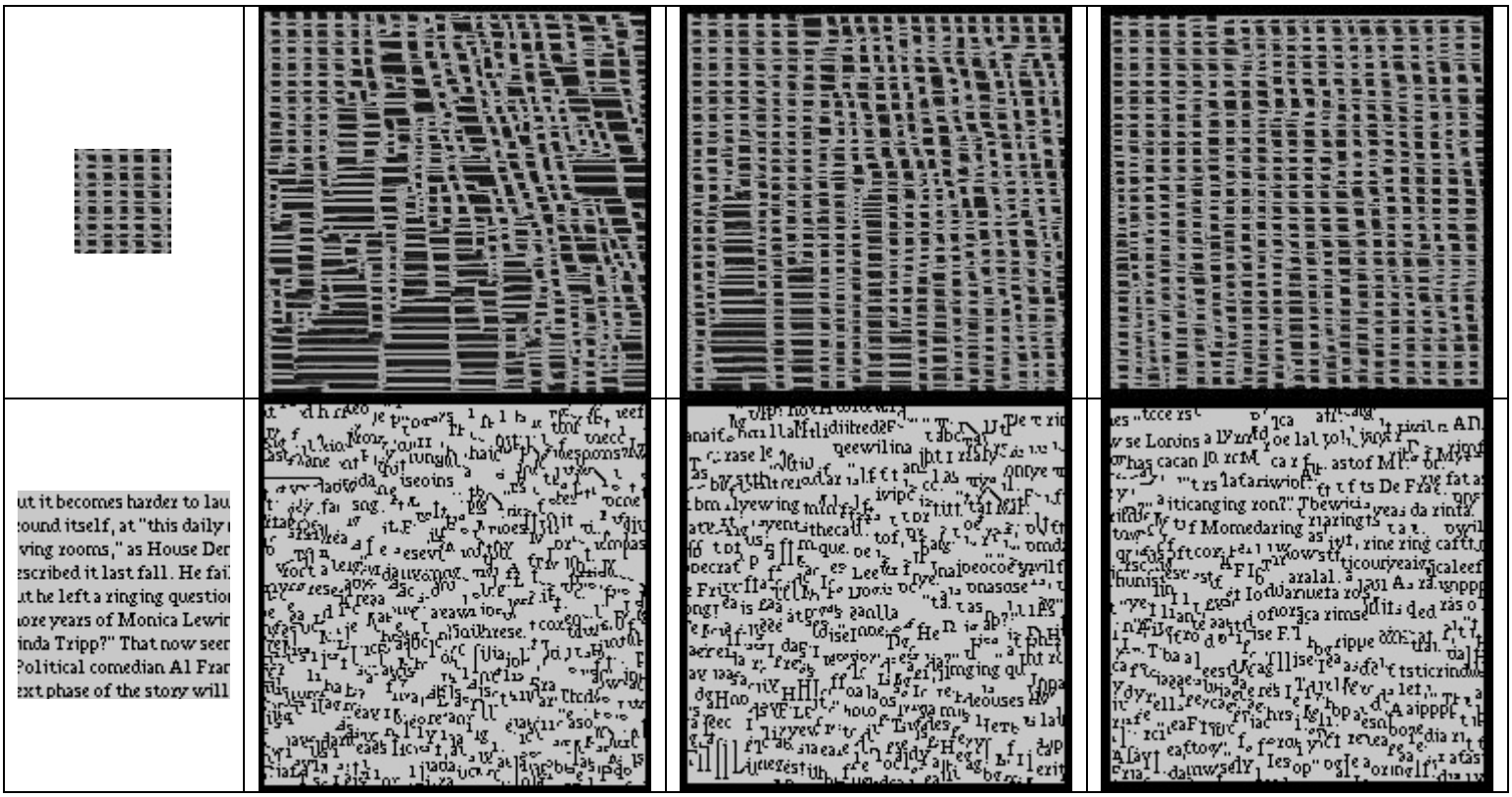


Fig 1. Texture Synthesis using Efros-Leung method

2. **Image Inpainting** *(Efros-Leung method)*

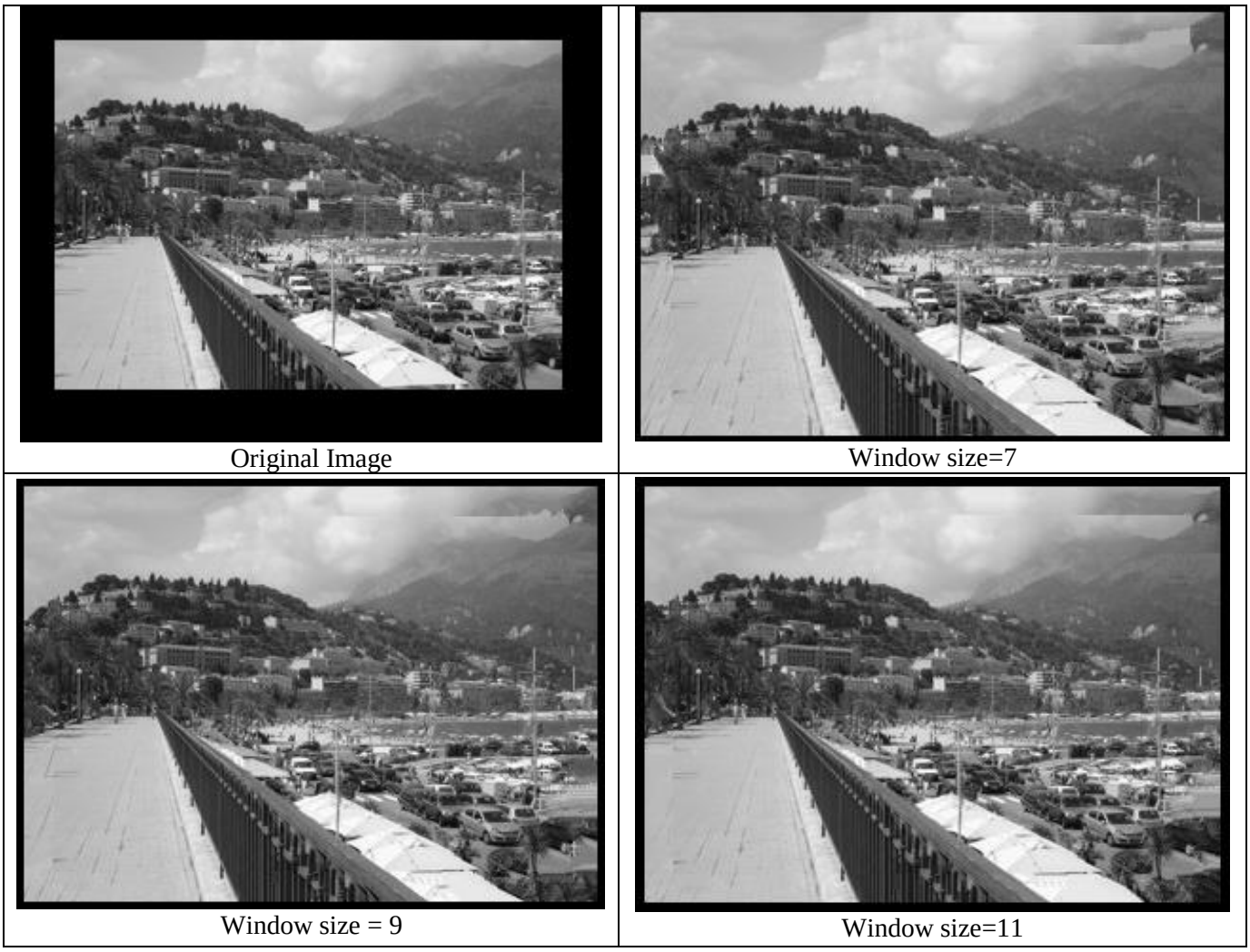


Fig 2. Image Inpainting (test_im1)

Original Image

Window size = 7

Window Size = 9

Window size = 11

Fig 3. Image Inpainting (test_im2)

3. Object Removal / Hole Filling

Efros and Leung

Criminis et al.

Original Image

Fig 4a. Hole filling (test_im3 : man on left)

Efros and Leung

Criminis et al.

Original Image (Sign and pole on right)

Fig 4b. Hole filling (test_im3: sign and pole on right-bottom)

(Note: the following has been modified to aid in handling image borders)

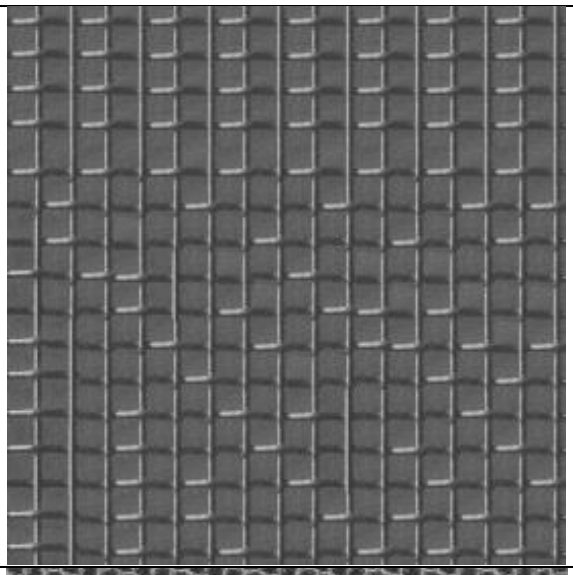
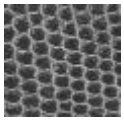
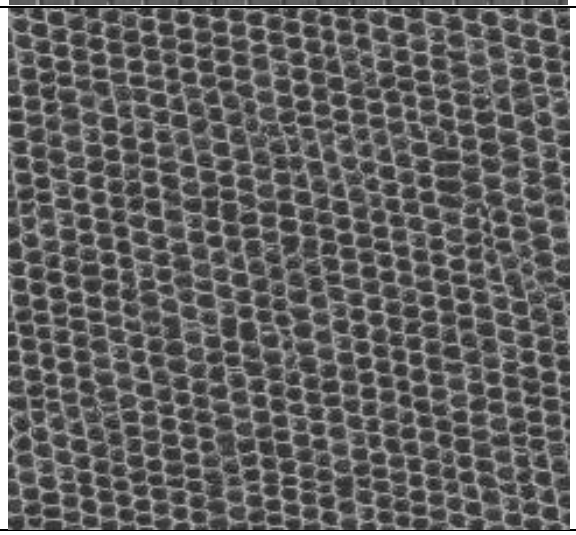
Elfos and Leung

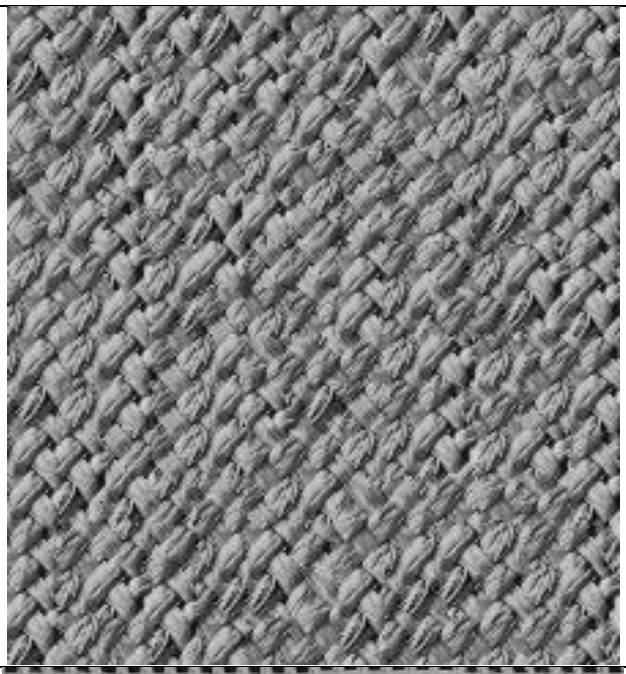
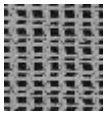
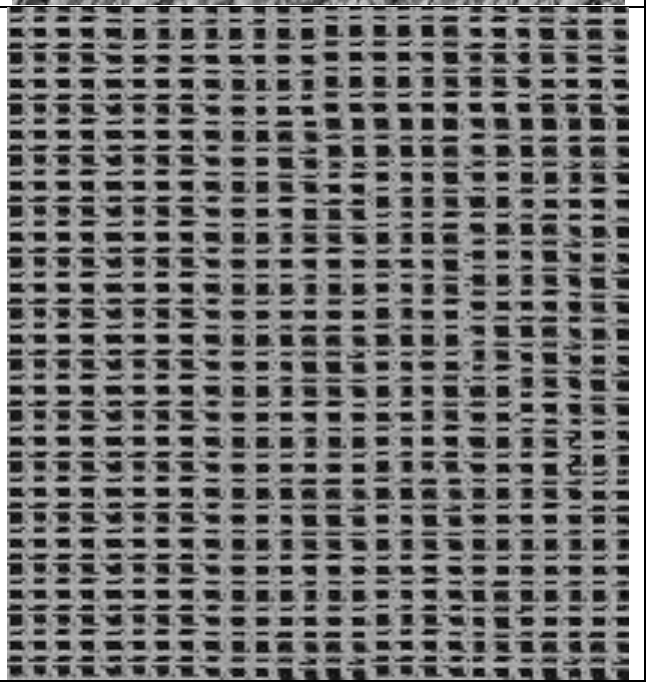
Criminis et al.

Original Image

Fig 4c. Hole filling (test_im3: Illuminated ground)

4. **Image Quilting** *(Efros- Freeman method)*

Texture Sample	Efros and Freeman
 T1	
 T2	

 T3	
 T4	

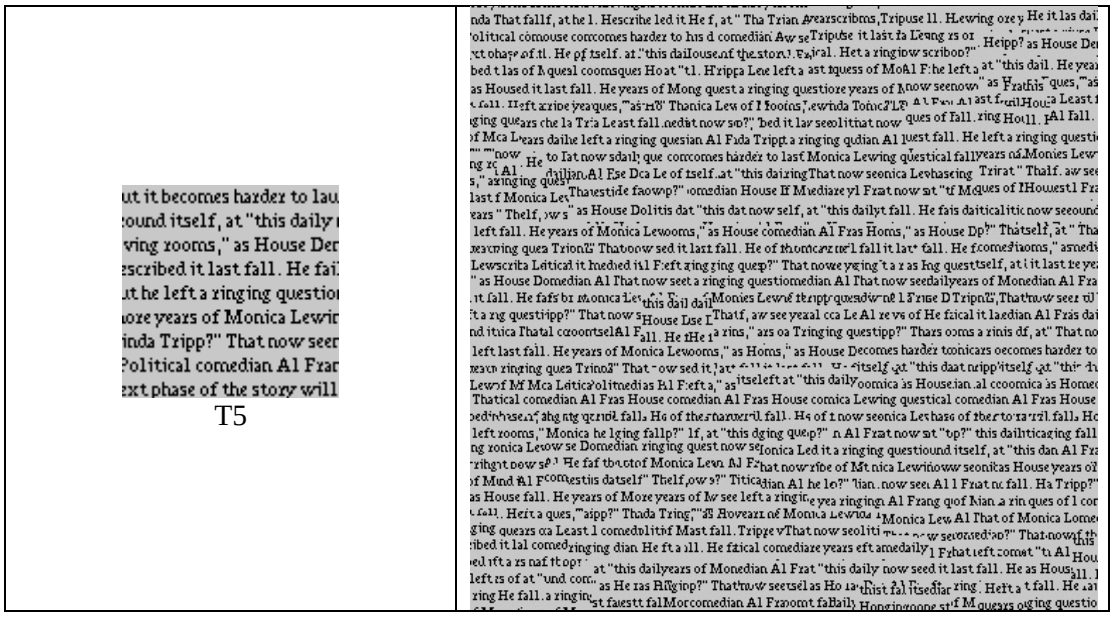


Fig 5. Texture synthesis using Efros-Freeman method

Note: Implementation for the Efros and Leung method acquired at https://github.com/rohitrango/Image-Quilting-for-Texture-Synthesis

4.1 Quilting Algorithm Overview

The quilting algorithm is based on the idea that certain blocks of visual elements or textural elements (texels) repeat themselves throughout a textural pattern. Given the size of a texel block S, the algorithm uses a simple distance/error measure to synthesize patterns using a sample image. The algorithm itself is informally described below:

i. Traverse the pattern that is to be synthesized row wise with a step size S.
ii. For each step in the traversal, find the set of blocks of size S in the sample texture whose distance measure to the step block is less than a tolerance threshold.
iii. Randomly pick a block from the found set.
iv. Find the best boundary between the block and the region of the synthesized image it overlaps using a minimum cost approach. Fill the synthesized image with block at truncated at this boundary.
v. Repeat i to iv till whole synthetic image has been filled.

The distance measure between the block and the overlapped region is nothing but the mean square error of pixelwise elements.

4.2 Comparison with the Efros and Leung approach

The 2 approaches are quite similar in the basic level, particularly in how they identify patterns from the sample image. For example, both use a mean square distance error measure to identify the most similar block from the synthesized image to the sample image.

That said, while their identification mechanism is the same, how they handle the synthesis itself is quite different. The Leung approach builds the synthesized image pixel-by-pixel while the Freeman approach does it block-by-block. Doing this i) increases the execution speed by a significant amount which is a major concern with the Freeman method, and ii) Restricts the divergence of the synthesized image from the real pattern by copying whole blocks of the pattern at once. The latter point is nicely complemented by the fact that the Freeman approach truncates boundaries to ensure the consistency of the pattern. The pixel-by-pixel approach can often lead to local discrepancies in the pattern.

5. Running Times *(All values are approximate in seconds)*

Image name	Window = 7	Window = 9	Window = 11
T1	2315	1966	1712
T2	1729	1511	1376
T3	1902	1558	1444
T4	1568	1132	1021
T5	4500	4326	4181
Test1	1368	1164	1100
Test2	1856	1608	1680