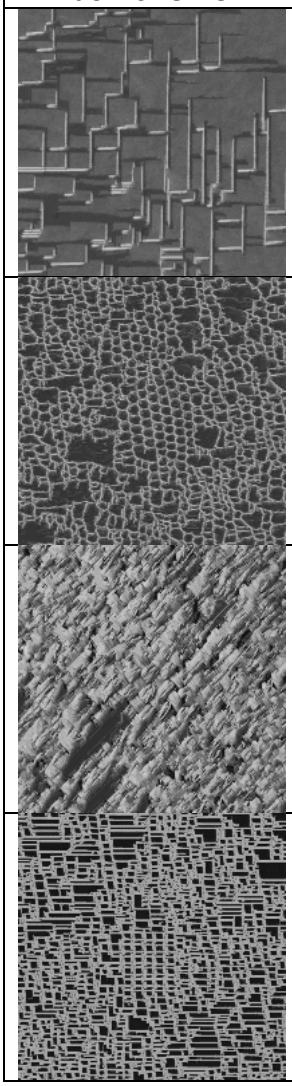
Assignment 2
bf289
Texture Synthesis and Image Inpainting

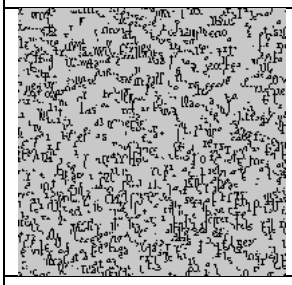
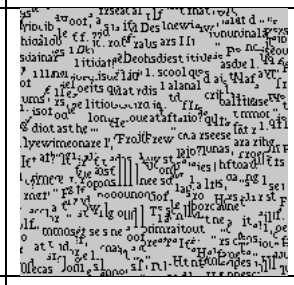
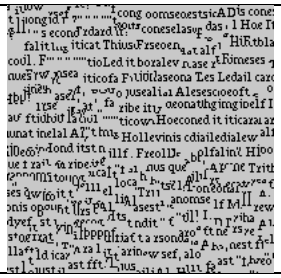
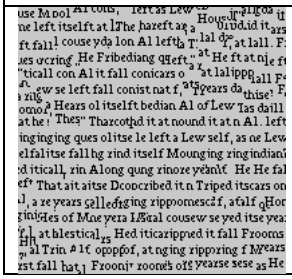
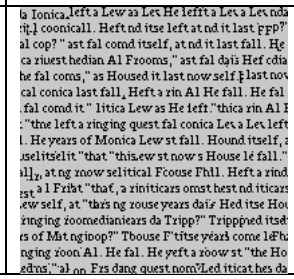
- ## Texture Synthesis

  Totally, the performance for texture synthesis will be better with the increment of the window size. We first use window size parameter to 5, 9, 11 pixels to do the texture synthesis, and the T5 still did not perform well, so we also use window size 15, 21 to do texture on T5, which is apparently better than previous parameters.

  T1, T2, T3, T4

Window size = 5	Window size = 9	Window size = 11
		

  T5

Window size = 5	Window size = 9	Window size = 11
		
Window size = 15	**Window size = 21**	
		

And here is the running time for different images and different window size.

```
Texture :T1.gif Windows Size :5 Time :129.313119173 seconds
Texture :T1.gif Windows Size :9 Time :193.906089067 seconds
Texture :T1.gif Windows Size :11 Time :251.079768181 seconds

Texture :T2.gif Windows Size :5 Time :88.852558136 seconds
Texture :T2.gif Windows Size :9 Time :121.760793924 seconds
Texture :T2.gif Windows Size :11 Time :157.60354805 seconds

Texture :T3.gif Windows Size :5 Time :89.0545659065 seconds
Texture :T3.gif Windows Size :9 Time :120.837645054 seconds
Texture :T3.gif Windows Size :11 Time :161.412675858 seconds

Texture :T4.gif Windows Size :5 Time :70.8592510223 seconds
Texture :T4.gif Windows Size :9 Time :86.9934499264 seconds
Texture :T4.gif Windows Size :11 Time :115.035634995 seconds

Texture :T5.gif Windows Size :5 Time :411.663320065 seconds
Texture :T5.gif Windows Size :9 Time :568.823732138 seconds
Texture :T5.gif Windows Size :11 Time :694.184584856 seconds
Texture :T5.gif Windows Size :15 Time :988.866293192 seconds
Texture :T5.gif Windows Size :21 Time :1520.98673487 seconds
```

- # Image Inpainting

Make some changes on the code in question 1, make the black region as the unfilled part, and to find the best matches in the rest part. And we also use the window size parameter to 5, 9, 11 to do the image inpainting.

Test Image 1	Test image 2

Test image 1

Window size = 5	
Window size = 9	

Window size = 11	

Test image 2

Window size = 5	

Window size = 9	
Window size = 11	

And here is the running time for different images and different window size.

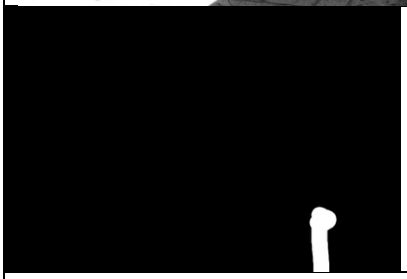
```
Image :test_im1.bmp Windows Size :5 Time :1086.48941088 seconds
Image :test_im1.bmp Windows Size :9 Time :1680.17870116 seconds
Image :test_im1.bmp Windows Size :11 Time :2082.07063198 seconds

Image :test_im2.bmp Windows Size :5 Time :568.088115931 seconds
Image :test_im2.bmp Windows Size :9 Time :864.564464092 seconds
Image :test_im2.bmp Windows Size :11 Time :1060.98718214 seconds
```

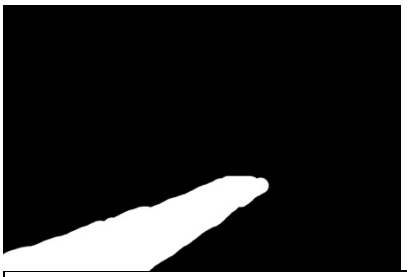
- **Object Removal**

Creminis, Perez and Toyama's algorithm has better performance, which has higher quality than the Efros and Leung's algorithm, but both way cost so much time to remove object from the image.

Efros and Leung's algorithm	Creminis, Perez and Toyama's algorithm
	



Efros and Leung's algorithm	Creminis, Perez and Toyama's algorithm
	

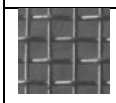
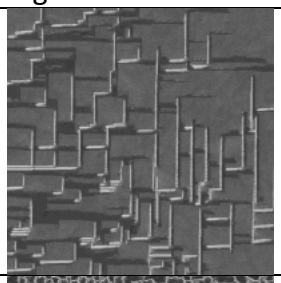
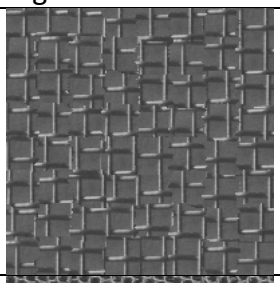
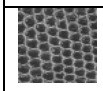
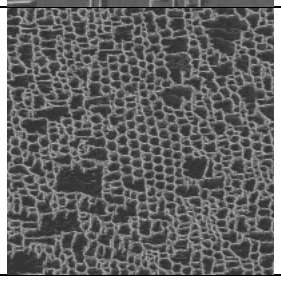
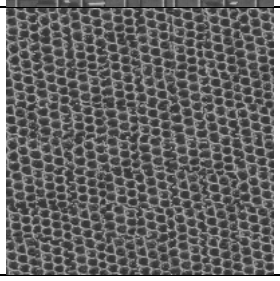


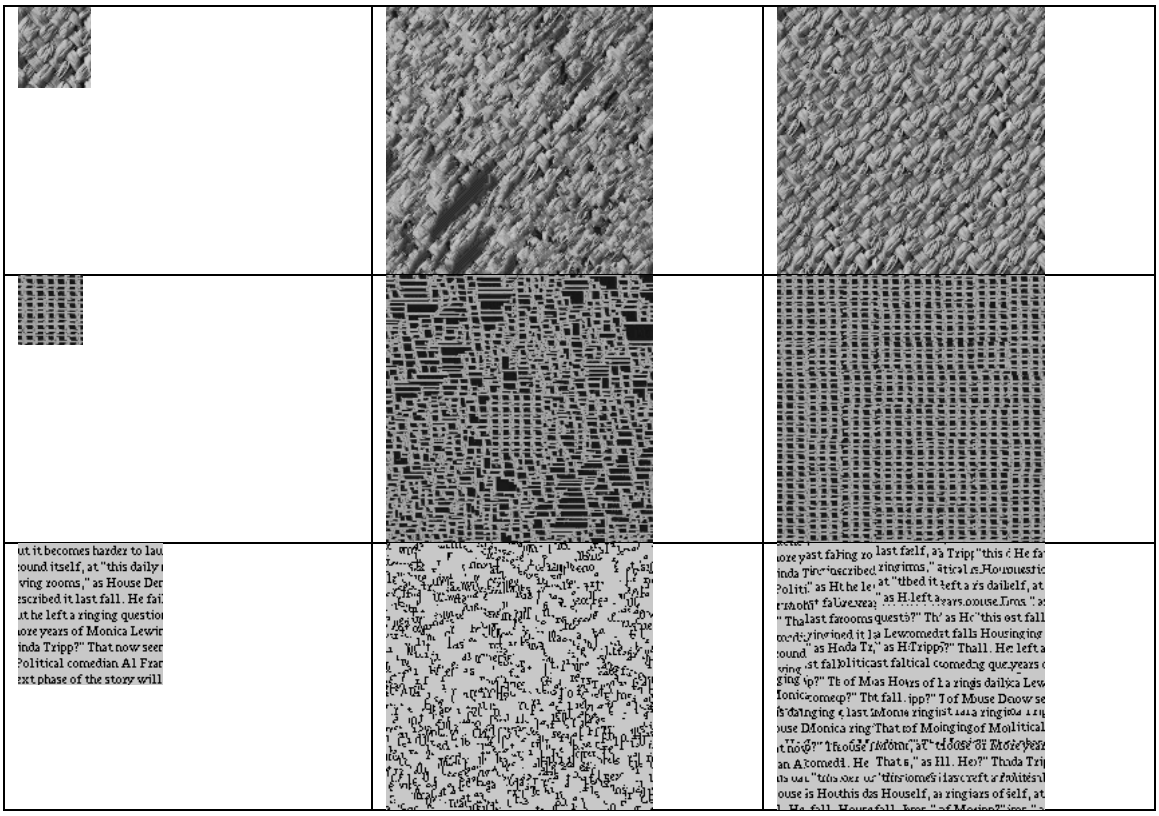
Efros and Leung's algorithm	Creminis, Perez and Toyama's algorithm
	

- # Image Quilting

Quality

The Efros and Freeman's method is much better than the Efros and Leung's method when we use the same image at the same window size 5, which means the patch size is 25.

texture	Efros and Leung's Algorithm	Efros and Freeman's Algorithm
		
		



Running Time

For the running time, the Efros and Freeman's method is not always bettre than the Efros and Leung's method. For different images, the result is different, for T1 to T4, the Efros and Freeman's method is better since these texture is easy and Efros and Leung's method works on one pixel each time, which is slower than one patch each time. And for T5, which is a hard texture, although one patch is quicker than one pixel, but the overlapping cost much time, which makes the total time longer.

Running time for Efros and Freeman's method

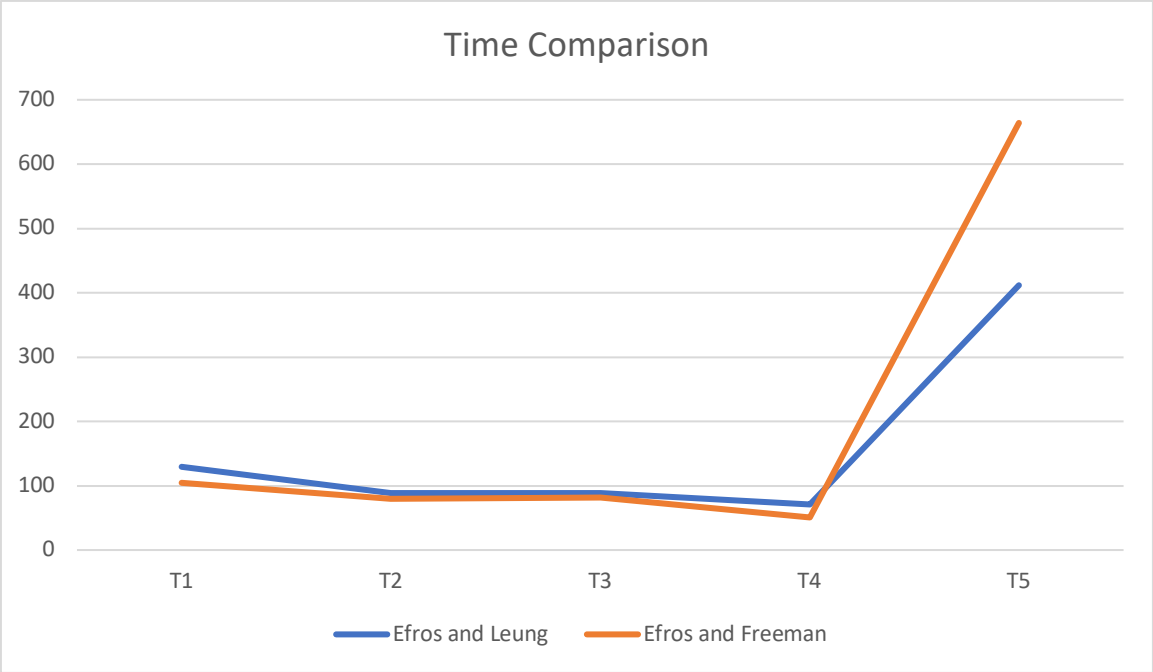
```
Texture :T1.gif Time :104.02799201 seconds

Texture :T2.gif Time :79.6215689182 seconds

Texture :T3.gif Time :81.5578610897 seconds

Texture :T4.gif Time :50.6514790058 seconds

Texture :T5.gif Time :664.048991919 seconds
```



The implementation of the Efros and Freeman's Algorithm is obtained from https://github.com/veslam/Exemplar-Based-Inpaining-Python.

- # How to Run

  The texture synthesis and the image inpainting are implemented in efros.py, and object removal is implemented in exemplarBasedInpainting.py, and to get the results for first three questions, just run the main.py, which has included all these parts.
  The image quilting is implemented in PathBasedSynthesis.py, you can just run this file to get the result for the last question.