Texture Synthesis by Non-parametric Sampling

Team Members

1. Divyam Bansal - 110050086
2. Vipul Venkataraman - 110050084

Problem Statement

Our project dealt with the classical problem of Texture Synthesis. It is useful to verify texture analysis methods and also in its own right. Potential application of texture synthesis algorithms included image inpainting, image extrapolation, noise/object removal etc.

We implemented a non-parametric method proposed by Efros and Leung. The texture synthesis process grows the new image outwards, pixel by pixel. The conditional distribution of a pixel given all its neighbors synthesized so far is estimated by querying the sample image and finding all similar neighborhoods. We controlled the degree of randomness using the window size used to obtain similar neighborhoods.

Results

The algorithm produces good results for a wide range of textures. The only parameter set by the user is the width of the context window. This parameter appears to intuitively correspond to the human perception of randomness for most textures.

Image Expansion

![Image 1](image1.png)

![Image 2](image2.png)
Image Extrapolation

Hole filling
Working of the window size parameter

Original Window size = 5

Original Window size = 9

Window size = 13 Window size = 17 Window size = 21
Comments

The results seem pretty good for such a simple algorithm. The speed of the pretty algorithm is pretty slow and it predictably varies in proportion to the window size parameter we provide. The algorithm has a tendency to occasionally slip into a wrong part of the search space and starts throwing garbage.

Future Extensions

Improvements that can be made

1. Avoid getting into the wrong part of the texture
2. Automatic window size selection
3. Non square windows - shape dependent on the image
4. Fastening the algorithm through heuristics

References

1. Texture Synthesis by Non-parametric Sampling, Alexei A. Efros and Thomas K. Leung