Lab Work - Texture synthesis

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In this lab work, we'll synthesize textures from examples using the Efros Leung model as seen in class [1]. This method is patch-based. Refer to course 2 on Markov Random Field. The data for this lab work are due to Efros, Leung (textures 0,1,2,6), Brodatz (texture 3) and the IPOL archive (4,5), it can be downloaded here: `http://liris.cnrs.fr/julie.digne/cours/textures_data.zip`

1 Algorithm

B will denote the set of pixels in I that are not yet filled.
Input: image I_{smp}, output size, n neighborhood size,

1. Initialize I by pasting a $l \times l$ random patch of I_{smp} (with $3 \leq l \leq n$) at the center of I (or randomly in I).
2. While output I not filled
   (a) Pick an empty pixel p with maximal number of filled neighboring pixels
   (b) Compute the distance of $w(p)$ to all patches of input I_{smp}
   (c) Find $w_{best} = argmin_{w \in I_{smp}} d(w, w(p))$ in I_{smp}
   (d) Compute $\Omega'(p) = \{w \in I_{smp} | d(w, w(p)) \leq (1 + \varepsilon) d(w, w_{best})\}$
   (e) Pick randomly one of the similar neighborhood $w(p')$ in $\Omega'(p)$
   (f) Set $I(p) = I_{smp}(p')$ (= Fill p with central value)

The distance d is the partial Sum of Squared Differences (SSD with only the filled pixels taken into account).

2 Texture synthesis implementation

- Implement the Efros-Leung algorithm described above.
- Given the input textures synthesize larger textures.
- Change the size of the patch and comment on your experiments.
- Change ε and comment on your experiments.
- Can you think of a way to make the algorithm faster?

References

[1] A. Efros and T. Leung. Texture synthesis by non-parametric sampling. In Proceedings of the International Conference on Computer Vision Volume 2, ICCV '99, pages 1033–1068, Washington, DC, USA, 1999. IEEE Computer Society.