CS663: Digital Image Processing - Homework 2

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1 Homework 2 - Question 4

Laplacian:

The Laplacian operator $\nabla^2 I(x, y)$ is a second derivative operator that highlights regions of rapid intensity change (edges).

Iterative operations:

$I(x, y) \leftarrow I(x, y) + \alpha \nabla^2 I(x, y)$

Adding the Laplacian term smooths or blurs the image because the operator enhances edges, and by adding this term, you are effectively diffusing intensity across edges.

So for over many iterations, the image will blur progressively, eventually becoming a uniformly gray image because the intensity differences (edges) are diffused out.

$I(x, y) \leftarrow I(x, y) - \alpha \nabla^2 I(x, y)$

In this case, the image sharpens over iterations. However, if run too long, the image will develop exaggerated edges and noise, leading to an unrealistic over-sharpened appearance or even numerical instability.