

B31XM – Advanced Image Analysis

Programming Assignment 4: Variational Image Deblurring

Image deblurring is the problem of recovering a sharp image from its blurry observation. The most commonly used mathematical model for blurring image degradation is given by

$$g(x, y) = \iint h(x - u, y - v) f(u, v) du dv + n(x, y)$$

Here $f(x, y)$ is the latent (unblurred) image, $g(x, y)$ is the degraded image, $h(x, y)$ is a translation-invariant blurring kernel and we can write

The so-called total variation (TV) deblurring method consists of solving the following energy minimization problem

$$E(f) = \int_{\Omega} (h * f - g)^2 dx dy + \lambda \int_{\Omega} \sqrt{(\partial f / \partial x)^2 + (\partial f / \partial y)^2} dx dy \rightarrow \min$$

Your tasks.

Implement a gradient descent minimization scheme

$$f(x, y, t + \tau) = f(x, y, t) - \tau \partial E / \partial f$$

for the above TV energy and test how well it works for Gaussian and motion blur.