Joint Estimation and Restoration of confocal images

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1 DESCRIPTION OF THE METHOD

We present a novel method for joint estimation of the degradation and restoration of a confocal image. In a first step, we reduce noise and estimate the psf of an image, followed by a deconvolution step. The noise reduction is performed using wavelets, in which the image details at different resolution levels are considered, in order to make an efficient separation between noise and signal, thus enabling us to suppress noise. Wavelets have proven to be very successful in this context [1].

Next, the blur in the image is estimated. Our estimation is based on measuring the sharpness of the sharpest edges in the blurred image. The wavelet coefficients for these edges are followed through scales, from which the image blur is estimated [2]. As a last step Maximum Likelihood (ML) deconvolution is applied [3]. These steps are iterated, and blur estimation is used to control the number of iterations, thus providing a complete automatic algorithm where no prior information of the image is required.

2 EXPERIMENTS AND RESULTS

Our technique is illustrated above. This raw confocal image displays a human cell nucleus in mitosis treated with taxol, a microtubuli fixator. Image (a) shows the raw confocal image. In (b), restoration with unregularized ML is applied. Remark the appearance of granular artefacts. In (c), ML was applied with slight blurring after each iteration to reduce artefacts (as used in some confocal restoration software). Finally, in (d) the result of our combination of ML with a wavelet-based noise reduction technique is shown. Note that this image is the sharpest, and artefacts are suppressed . Full pictures can be viewed at: http://telin.rug.ac.be/~frooms/research/steer/www/

REFERENCES

