Blur's noise and distortion reversed

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Errant pixels and blurry regions in a photo, whether digital or scanned, are the bane of photographers everywhere. Moreover, in vision processing research degraded photos are common and require restoration to a high-quality undegraded state. Research published this month in the *International Journal of Signal and Imaging Systems Engineering* could provide new insights.

There are countless examples of image editors and photo cleanup software that have built-in tools designed to remove noise and sharpen up edges. Some of these are very powerful others less so. Any "cleanup" process that works by changing individual pixels leads to overall degradation of the image and loss of information. However, a delicate touch with the most subtle tools can produce acceptable quality results.

Now, S. Uma of the Department of Electronics and Communication Engineering, at Coimbatore Institute of Technology, and S. Annadurai of the Government College of Technology, Coimbatore, India, have turned to neural networks to help them clean up their image. The approach could significantly reduce information loss while reversing blurring caused by lens aberrations and faults and reducing noise that distorts the appearance of an image. The team suggests that distortions in an image due to atmospheric disturbances between camera and distant subjects could be unraveled and a photo taken on a hot, hazy day made acceptable.

The researchers point out that earlier attempts at this kind of inverse filtering of an image rely on the image having a high signal-to-noise

(SNR) ratio. Other approaches require huge amounts of computing power and are generally untenable. This is especially true in the fledgling field of artificial vision, whether robotic or prosthetic. However, some success with neural networks has been achieved.

Now, Uma and Annadurai have developed a modified recurrent Hopfield neural network that builds and extends the work of others to allow them to quickly process an image reducing distortion, noise and blurring. The team has tested their approach on square grayscale images just 256 pixels across. They were able to reverse severe blurring and noise deliberately added to the original photographic sample to much more acceptable levels in a short time using limited computing resources than was possible with previous neural network approaches or any other inverse filtering techniques.

An analysis of the before and after quality shows that quality is improved by between 39% and 67% using the team's approach and results take half the time of other methods that produce lesser improvements. The success bodes well for image processing, in various fields including vision research, art, homeland security, and science.

More information: "Image restoration using Modified Recurrent Hopfield Neural Network" in *Int. J. Signal and Imaging Systems Engineering*, 2009, 1, 264-272

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