



Deblurring Images



This image was deblurred using code available at <https://www.mathworks.com/help/images/ref/deconvwnr.html>

Imagine snapping a quick picture of a flying bird—the image is likely to come out blurry. But thanks to mathematics, you might be able to use software to improve the photo. Scientists often deal with blurry pictures, too. Linear algebra and clever numerical methods allow researchers to fix imperfect photos in medical imaging, astronomy, and more. In a computer, the pixels that make up an image can be represented as a column of numbers called a vector. Blurring happens when the light meant for each pixel spills into the adjacent pixels, changing the numbers in a way that can be mathematically represented as an enormous matrix. But knowing that matrix is not enough if you want to reconstruct the original (non-blurry) image.

That’s because pixels in the blurred image will have extra errors (or “noise”) resulting from the physical process of taking the photo. If you don’t account for them, trying to recreate the original image amplifies these errors. Mathematicians have developed various

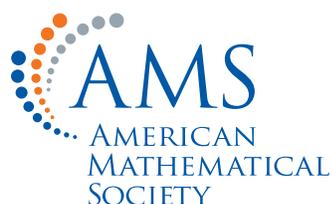
approaches to get rid of the noise while still retaining as much correct information as possible. The best way to do so depends on the cause of the blur, whether the original image had sharp edges or was smooth, and the physics underlying how the image was captured. In ongoing research, experts are working to speed up the necessary computer calculations and store vast amounts of image data efficiently. Whether you’re getting an MRI scan of your body or admiring a photo of a distant galaxy, mathematics helped make the image crystal-clear.

For More Information: “The Image Deblurring Problem: Matrices, Wavelets, and Multilevel Methods,” D. Austin, M. Espanol, M. Pasha, *Notices of the American Mathematical Society* 69, 2022.

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