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Image Deblurring and Video Stabilization of Turbulence Distortion

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Image blurring is a diffusion process, and its inverse problem is referred to as "image deblurring," which often involves solving a numerically ill-conditioned backward-diffusion problem. In her talk, Professor Lou will propose a direct deblurring method using an explicitly generative model together with sparse characteristics of natural images. The key observation is that the sparse coefficients that encode a given image with respect to an over-complete basis are the same that encode a blurred version of the image with respect to a modified basis. Therefore, a sparse representation of the blurred image can be computed, and its coefficients can be used to combine elements of the original basis, leading to a restored image. Another real-world problem related to deblurring, called "imaging through turbulence," also will be discussed. The goal is to enhance the image quality of a video sequence captured through a turbulent atmospheric medium. Every snapshot amounts to temporal averaging that produces a blurred version of the "true" image. In addition to blurring, objects appear to be oscillatory due to heat radiating from the ground surface. Professor Lou also will examine a method that combines Sobolev gradient and image diffusion to reduce the artifacts of blurring and oscillation simultaneously.

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