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**CAREER: A New Statistical Framework for Natural Images with
Applications in Vision**

This project studies natural image statistics, and their applications in diverse fields such as computational neuroscience, image processing, computer vision, and graphics. The centerpiece of this project is a new image representation based on a simple nonlinear transform that is statistically justified and biologically inspired. This representation provides a new language to describe image signals, and forms the basis to build statistical models to more effectively capture statistical properties of natural image. Built upon this new image representation, this project explores new paradigms to model and interpret visual neural responses and high-level perceptual properties, and provides new tools for image restoration, analysis and synthesis. On the other hand, by applying natural image statistics to the forensic analysis of digital images, this project facilitates forensic practitioners in criminal investigations, and contributes to national security and public safety. Moreover, this project contributes to education by making the learning of Computer Science fun and useful for undergraduate students, promoting the participation of women and undergraduate students in research, and improving the early learning of mathematics and sciences for local high school students.