Abstract

Exploiting Saliency in Compressive and Adaptive Sensing

The notion of visual saliency plays a central role in many modern imaging applications. In medical imaging, for example, salient or anomalous regions could indicate areas of pathological significance such as a tumors or lesions, and are thus a primary focus of interest in diagnostics. The identification of salient regions in an image or video also comprises an essential step in automated surveillance systems, where the goal may be to quickly identify potential anomalies or threats.

In an abstract sense, saliency can be interpreted as a generalization of sparsity. Sparse vectors have many entries that are zero (or “uninteresting”) and a small number that are nonzero (or “interesting”), while the notion of visual saliency loosely corresponds to an assignment of labels – “uninteresting” or “interesting” – to distinct regions of an image. One particularly challenging (and complicating) aspect of the salient region identification task, however, is that the notion of saliency is relative – the specific criteria used to identify regions as salient is often not fixed or known a priori, but instead is an implicit function of the image data itself.

Motivated by recent developments in compressive and adaptive sensing, which have established that tremendous improvements in sensing resource efficiency can be achieved by exploiting sparsity in high-dimensional inference tasks, it is natural to ask whether similar techniques can be successfully employed to identify salient regions in an image. In this talk I will discuss results of our recent work that answers this question in the affirmative. I will describe a novel saliency-based compressive sensing procedure, and provide a theoretical justification showing explicitly how the performance of the approach depends on the saliency level (the number of “interesting” regions). Finally, I will demonstrate the performance of our procedure in the context of a two-stage active compressive imaging application.

Bio

Jarvis Haupt received the B.S. (with highest distinction), M.S., and Ph.D. degrees in Electrical Engineering from the University of Wisconsin - Madison in 2002, 2003, and 2009, respectively. From August 2009 - August 2010, he was a Postdoctoral Research Associate in the Department of Electrical and Computer Engineering at Rice University. He joined the Department of Electrical and Computer Engineering at the University of Minnesota as an Assistant Professor in August 2010. His research interests include high dimensional statistical inference, sparse recovery, adaptive sampling techniques, statistical signal processing and learning theory, and applications in communications, network science, remote sensing, and imaging.