

*Bringing Order to  
High-Dimensional Datasets*

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It's a data-driven world out there. Every day, streams of data in the form of images, videos, biomedical observations, Internet links, and more are fed to scientific organizations, businesses, and governments worldwide. And while management and warehousing of these prodigious amounts of data are important, equally important is developing the technological capability to understand the structure of the datasets.

Much of the data collected today is in digital imagery, each made up of several million pixels. With millions upon millions upon millions of pixels residing in any given dataset, finding order within those datasets is critical to being able to efficiently search and find specific data. Add to that the challenge when data in any set is unreliable (e.g., “dead” pixel(s), a disguised face, shadows, or occlusions), and the classical algorithms used to search and find specific data break down.

John Wright considers the area of high-dimensional data analysis a gold mine for great mathematical and algorithmic problems, with the potential for profound impact on applications that can deal intelligently with imagery data.

His research has developed new theory and algorithms for uncovering several important types of low-dimensional structure in high-dimensional datasets, even in the presence of gross observation errors. This combination of efficient algorithm and good theoretical understanding has led to new, highly accurate algorithms for recognizing human faces, even with occlusion or disguise; for recovering the shape of three-dimensional objects from two-dimensional images; and for building three-dimensional models of urban environments.

He is currently working on new techniques for finding good representations of data—searching for a “dictionary” that can most compactly represent a given set of data samples. Recent results have shown that if it is possible to find efficient data representations, those representations can be used to acquire signals and images more accurately, and using fewer resources. Through collaborations at Microsoft Research, he is investigating the use of these techniques to efficiently acquire images for cultural heritage preservation.

Wright is a member of the Association for Computing Machinery, the Institute for Electrical and Electronic Engineers, and the Society for Industrial and Applied Mathematics.

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