Sparsity in Data Analysis and Computation

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Abstract: In a wide range of applications, we seek to capture efficiently the most salient characteristics of a signal or phenomenon. In other words, we seek a presentation of a family of functions or objects that manages to be both accurate (with respect to the particular aspects in which we are interested) and succinct – that is, a *sparse* representation. Such sparse representations have many advantages for analysis, storage or computation. In some cases, we have sufficient insight in the mathematical properties of what we are studying to "guess" ways of obtaining sparse representations – with hindsight, the use of wavelets for images can be viewed as a particular instance. In other cases, we try to use mathematical tools to guide us to the construction of such a sparse representation; very exciting current developments in this direction bring differential geometry and topology to bear on applications in ways that would probably have surprised mathematicians of past generations.

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