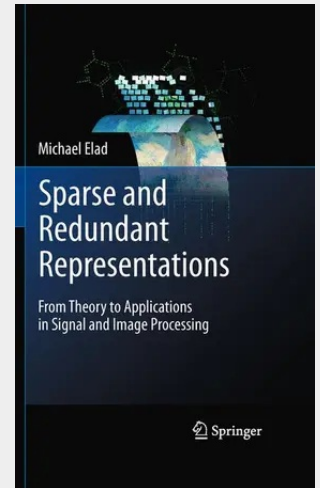


## Sparse and Redundant Representations

From Theory to Applications in Signal and Image Processing

A long long time ago, echoing philosophical and aesthetic principles that existed since antiquity, William of Ockham enounced the principle of parsimony, better known today as Ockham's razor: "Entities should not be multiplied without necessity." This principle enabled scientists to select the "best" physical laws and theories to explain the workings of the Universe and continued to guide scientific research, leading to beautiful results like the minimal description length approach to statistical inference and the related Kolmogorov complexity approach to pattern recognition. However, notions of complexity and description length are subjective concepts and depend on the language "spoken" when presenting ideas and results. The field of sparse representations, that recently underwent a Big Bang like expansion, explicitly deals with the Yin Yang interplay between the parsimony of descriptions and the "language" or "dictionary" used in them, and it became an extremely exciting area of investigation. It already yielded a rich crop of mathematically pleasing, deep and beautiful results that quickly translated into a wealth of practical engineering applications. You are holding in your hands the first guide book to Sparseland, and I am sure you'll find in it both familiar and new landscapes to see and admire, as well as excellent pointers that will help you find further valuable treasures. Enjoy the journey to Sparseland! Haifa, Israel, December 2009 Alfred M. Bruckstein vii Preface This book was originally written to serve as the material for an advanced one semester (fourteen 2 hour lectures) graduate course for engineering students at the Technion, Israel.

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