Nearest-Neighbor Methods in Learning and Vision—G. Shakhnarovich, T. Darrell, and P. Indyk, Eds. (Cambridge, MA: MIT Press, 2006, pp. 262). *Reviewed by F. Gianfelici*

New techniques characterized by low computational complexity, great learning capability, and efficient decision methods are highly desirable in order to regulate and classify nondeterministic phenomena and events in the emerging areas of signal, image, and video processing. The reason for this great interest is closely related to intrinsic nondeterministic nature of real phenomena, taking the deterministic hypothesis just as an approximation of the actual behavior.

The great interest in the nearest-neighbor methods and the absence of reliable solutions for many nondeterministic problems represent the starting points for the formalization and development of specific approaches and suitable techniques. In this excellent book, the editors deal with the state-of-the-art, current best practices, and some innovative applications of nearest-neighbor methods in learning and vision. In fact, this volume brings together contributions of top-level researchers in theory of computation, machine learning, and computer vision with the goal of closing up the gaps between disciplines and current state-of-the-art methods for emerging applications. Therefore, the audience of this volume consists of researchers, scientists, engineers, professionals, and academics, working not only in this field, but also in any field that could benefit from these powerful methods. This book can be particularly useful to researchers working on the basis set expansion networks. Finally, it is worth noting that all the content is well-written, highly relevant, original, and timely.

In order to better appreciate the aforementioned remarks let us briefly introduce the book chapters.

Chapter 1 written by the editors introduces the book and its organization. Chapter 2 entitled "Nearest-neighbor searching and metric space dimension" is authored by K. L. Clarkson. The content deals with the problem definition and its relationship with the concepts of metric space dimension. The state-of-the-art and the current best practices are proposed and properly discussed.

In Chapter 3 entitled "Locality-sensitive hashing using stable distributions," written by A. Andoni, M. Datar, N. Immorlica, P. Indyk, and V. Mirrokni, novel locality-sensitive hashing technique is described, providing an efficient solution to the randomized nearest-neighbor problem.

Chapter 4 is entitled "New algorithms for efficient high-dimensional nonparametric classification," authored by T. Liu, A. W. Moore, and A. Gray. It deals with new balltree algorithms that on real-world data sets give accelerations from twofold to hundredfold compared to highly optimized traditional balltree-based k-nearest-neighbor. These results include data sets with up to 10^6 dimensions and 10^5 records, and demonstrate nontrivial speedups while giving the exact answer.

In Chapter 5, written by S. Vijayakumar, A. D'Souza, and S. Schaal and titled "Approximate nearest neighbor regression in very high dimensions," the content is methodologically divided into two parts. In the first part, the authors deal with an approach for locally weighted regression with locally linear models. In the second part, the authors introduce a novel Bayesian formulation of partial least squares regression that converts a nonparametric regression approach to a probabilistic framework. In order to show the effectiveness of these algorithms, exhaustive evaluations on various synthetic data set and real-time learning examples of anthropomorphic robots are proposed and properly discussed.

Chapter 6 is entitled "Learning embeddings for fast approximate nearest neighbor retrieval " and written by V. Athitsos, J. Alon, S. Sclaroff, and G. Kollios. The content deals with a novel embedding method that reduces nearest-neighbor retrieval time when distance measure is computationally expensive. Database and vision applications are proposed and discussed in the experimental results.

Chapter 7 is entitled "Parameter-sensitive hashing for fast pose estimation" and written by G. Sharkhnarovich, P. Viola, and T. Darrell. The content deals with an innovative approach to learning an embedding of data into a space where a simple metric distance reflects the desired similarity notion.

In Chapter 8 entitled "Contour matching using approximate Earth Mover's Distance" and written by K. Grauman and T. Darrell, the content deals with an innovative matching algorithm that quickly computes a minimal cost correspondence field between sets of descriptive local contour features using a recently introduced low-distortion embedding of the Earth Mover's Distance into a normed space.

Chapter 9 is entitled "Adaptive mean shift based clustering in high dimensions." It was written by I. Shimshoni, B. Georgescu, and P. Meer. Here, it is shown that locality-sensitive hashing is able to reduce the computational complexity of adaptive mean shift. The optimal parameters of the data structure are determined by a pilot learning procedure and the partitions are data driven. As applications, the texture classification and the multispectral images are considered.

Chapter 10 is entitled "Object recognition using locality-sensitive hashing of shape contexts" and written by A. E. Frome and J. Malik. The content deals with the topic of object recognition and the relationship between the complexity of a basic feature-matching approach and the number of object classes. New approaches of feature-based object recognition that grow sublinearly with the number of object recognition are proposed and discussed.

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