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REVIEWS AND DESCRIPTIONS OF TABLES AND BOOKS

The numbers in brackets are assigned according to the American Mathematical Society classification scheme. The 2000 Mathematics Subject Classification can be found in print starting with the 1999 annual index of *Mathematical Reviews*. The classifications are also accessible from `www.ams.org/msc/`.

3[65F15, 65F25, 68T01]—*Matrix methods in data mining and pattern recognition*, by Lars Eldén, SIAM, Philadelphia, PA, 2007, x+224 pp., softcover, $69.00, ISBN 978-0-898716-26-9

The book is a straightforward guide to data mining and pattern recognition algorithms based on matrix decomposition. In faithful agreement with the title, the development of the material proceeds by providing a tutorial on the results from numerical linear algebra needed to understand the algorithms specifically addressing data mining and pattern recognition applications. In view of the vast amount of material that can go under the header of numerical linear algebra, it is quite appropriate—and extremely convenient—that the book provides a review of the most appropriate matrix decompositions. The book, which was intended by the author as an undergraduate text for students with some training in numerical analysis, is quite suitable also for a beginning graduate course. The subdivision of the material into three main parts leaves many possibilities open for an instructor to adjust the syllabus according to the students' background. The first nine chapters address the fundamental concept of linear algebra, in a crescendo which quickly advances from the basics of matrix and vector operations to more complex topics including the Singular Value Decomposition and Krylov subspace methods for solving least squares problems. Readers without a solid background in numerical linear algebra will find this material particularly useful and will appreciate having it presented in a coherent and concise fashion. The most exciting portion of the book, and what really sets it apart from a text on numerical linear algebra, consists of the following five chapters. In each of these chapters, the author considers one topic in data mining or pattern recognition, analyzes it within the framework of matrix decompositions, and derives the matrix analysis results specifically needed to understand the algorithms proposed for its solution.

The linear algebraic manipulations and theoretical results presented in this portion of the book are definitely more advanced and application specific than the content of the first part. The selected applications, which include some rather complex topics, such as the classification of handwritten digits or face recognition, are distilled so as to become tractable in the classroom. The clarity of the presentation of the algorithms, on the other hand, is an excellent foundation for generalizing them to be suitable for real applications. The third and final part of the book, consisting merely of the last chapter, is devoted to presenting results which are more pertinent for the actual computation of the matrix decompositions in finite precision arithmetic. One might wonder if this chapter should not come earlier, given how important it is to compute the matrix decomposition accurately for the final result of the algorithms. The targeted readership of the book, however, might

need the motivation provided by the applications to delve into the details of the computation of the QR decomposition or the results on perturbation theory. The book contains several snips of MATLAB code and provides data that can be used to reproduce some of the examples, a very helpful feature for students and newcomers to the field.

The book is delivering what the author claims in the introduction: there is no doubt after reading it that matrix methods are a very useful tool in data mining and pattern recognition applications, and I would not be surprised if it would be motivational for investigating numerical linear algebra more deeply. I expect that after having served as a nice introduction to matrix methods in data mining and pattern recognition, it will become a handy reference for years to come.

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