BOOK REVIEWS

The Image Processing Handbook

John C. Russ, 445 pages, ISBN 0-8493-4233-3, CRC Press, 2000 Corporate Boulevard NW, Boca Raton, Florida 33431 (1992) $89.95 hardbound.

Reviewed by Lawrence A. Ray
Eastman Kodak Research Laboratories
Imaging Science Division
901 Elmgrove Road
Rochester, New York 14653-5719

The title of this book initially put me off because I first thought of it as a self-help book for the imaging challenged. However, I decided not to prejudge the book by its title and to see what was contained in the 445 glossy pages. What is there is not so much a handbook, but rather a travel guide to image processing geared toward those interested in using the image processing tools and methods that have evolved over the years. As a result, one finds many examples and images displaying the types of results that come from different approaches, as well as the limitations. There are sections on topics that do not normally appear in texts on image processing, such as three-dimensional imaging and data visualization—clearly topics that are important to the scientist struggling with complex data sets.

The book is full of image examples, which unfortunately are not always on the same page as the text that describes the image. This is distracting, and the constant flipping between image and text should have been minimized. In fact, as difficult as it might be to accept, there are too many examples.

The topics are arranged in a good order. The initial topic is image acquisition, a topic usually ignored by most image processing texts. Since it is assumed that readers of this text are planning to employ image processing methods, knowledge of the image capture system is of fundamental importance when trying to enhance the information contained in the image. In fact, immediately after the section on image capture is a section on correction of imaging defects. These two topics are valuable to those who only want to use image processing as a method to scrutinize scientific data.

The discussion in the sections on digital halftones is very out of date. The common methods have long since surpassed the simplistic methods described in the text. All work on error diffusion and dither methods is ignored, and only a center-growing dot method is mentioned. At least some mention or reference to these significant improvements should have been noted, or else the topic should have been deleted.

The section on Fourier analysis is superb, although I was a bit annoyed with some of the introductory remarks about "integral-o-phobia." Having an image and an image of its transform is quite useful. A good deal of insight can be gained by careful examination of these images. The examples showing common shapes and their respective transforms is illuminating. In addition, the examples showing the image effects of tinkering with the frequency information are invaluable warnings.

The section on segmentation and thresholding is full of good ideas and ways to apply these concepts to "real-world" applications. Methods extend beyond the obvious and use multispectral information. This is done for both the analysis of multispectral data as well as the visualization of data into a multispectral environment.

I was very pleased to see the scope of the material concerned with three-dimensional imaging. Commercial software packages are available that are powerful additions to the scientific toolbox. This area has not had the level of attention that has been paid to two-dimensional images, and, as such, the image processing methods are not as mature and stable as those for two-dimensional imagery. As the utility of these methods permeates the user community, the image processing community will respond with an outpouring of methods and tools.

The author briefly discusses image compression and does a major disservice to those planning to use compression techniques. The section is far too short, and one has the notion that the Joint Photographic Experts Group (JPEG) is all one needs. That is not the case, because discrete cosine transform may produce serious artifacts that will become highly objectionable to a demanding user. This could be remedied by including a note about the artifacts created by JPEG, a mention of other common compression methods, and a reference to sources of information on image compression.

The author suffers from a need to keep up with many of the current chic topics, and there are pages of information dealing with fractals. All of this adds little to the discussion and could be eliminated, and I question the validity of some of the statements made by the author. The room saved by the deletion of these topics could have been used to give slightly deeper presentations of other topics. If the author needed to include in-vogue topics, I would have preferred a discussion on applications of wavelets instead.

I enjoyed the book and consider it a reasonable addition to the library of any image processor. For the scientist using imaging to understand the results of experiments, this book should only be considered an introduction to the utility of image processing. Much like a travel guide, it points out highlights and points of interest but does not have enough depth to cover the topic adequately. Just as one cannot truly understand a foreign land by travel guides, so one must go beyond this book to find the utility of image processing. However, a good travel guide is invaluable when one is unsure of local customs, languages, or resources.

Lawrence A. Ray received his BS degree in mathematics from Union College in Schenectady, New York, in 1971. He received MS and PhD degrees in mathematics from the University of Rochester, New York, in 1974 and 1978, respectively. Between 1986 and 1990, Ray was the senior on-site representative from Eastman Kodak at the National Center for Supercomputing Applications at the University of Illinois. Currently, he is a research associate at the Imaging Science Division of the Eastman Kodak Research Laboratories.