

Mather, P.M., 1999: Computer processing of remotely-sensed images. An Introduction. Chichester: Wiley, xiv + 292pp. £29.95 paper. ISBN 0 471 98550 3.

This is the long-awaited second edition of a popular textbook targeted at senior undergraduates, researchers and those with a 'hands-on' interest in digital image processing. It is not a book that will attract those who seek the immediate pleasure of browsing colourful satellite images, but to dismiss it so quickly would be a grave mistake as it offers much more 'added value' than most remote sensing text books currently available. To fully appreciate Paul Mather's achievement in producing this book one has to consider the whole package, and not just the printed book. The first indication that it is something special is the CD-ROM inside the back cover, which contains the MIPS image processing package, over 30 additional programs and some sample data sets. Closer inspection reveals numerous links to Internet sites and a lengthy list of references for further reading. Clearly, there is the basis here for a complete self-paced introductory course in image processing for Earth observation, and it is on that basis that it should be judged.

The book maintains the basic structure of the first edition (Mather, 1987), but each of the eight chapters have been revised to varying degrees and most of the images used in the first edition have been replaced. In the first edition, a rather confusing image of the Peak District was used to demonstrate many of the processing tasks; this has now been replaced with a much simpler Landsat sub-scene from an agricultural area near Peterborough. It is perhaps unfortunate that the size of reproduction has been reduced, but the overall effect is an improvement in clarity and understanding.

The first chapter sets a cracking pace, taking the reader from the colours of the spectrum to complex issues such as atmospheric correction and BRDF in under thirty pages. Physicists and those with experience of the subject will find this a useful refresher, but novices may find it hard-going, and some of the graphs (e.g. the ASTER spectral library plots) are potentially confusing and need more explanation. The second chapter, on platforms and sensors, is inevitably slightly out-of-date, but fortunately Professor Mather maintains an excellent, regularly updated website on behalf of the Remote Sensing Society which provides a much better way of presenting this material [1]. There is still considerable scope for innovation in the presentation of some of this type of material, for example, a computer-based animation would be a much better way of explaining the Sun-synchronous orbit than the diagram repeated from the first edition (Figure 2.1, page 29).

The next five chapters comprise the heart of the book and the energetic pace of the first two chapters on physical principles gives way to a more gradual unfolding of the issues at the heart of digital image processing. The emphasis throughout is on 'learning by doing' and, whilst the author does not shrink from the mathematical concepts and formulae needed to understand the material, he does not use equations to intimidate the reader. It is not easy to make such material readable, but Paul Mather has the knack of knowing when the reader is in need of a diversion, and slips in a quote from Queen Victoria or to a discussion on how best to distinguish a vulture from a dog. More serious diversions are provided by exercises using MIPS, the image processing package produced by the author. This comprises two parts: an image display and enhancement module with a Windows-based graphical user interface and a suite of stand-alone DOS programs to perform more complicated tasks.

MIPS (Mather's Image Processing System) is introduced in a heavily revised Chapter 3 and described further in an Appendix to the book. I installed MIPS on a 450MHz desktop computer with an AMD processor and on a 300MHz Intel Pentium notebook PC. In both cases the installation was trouble-free and, once I had got used to the idiosyncrasies of the program it ran with few problems. The install routine was not the Windows standard, and the menu structure is similarly non-standard, but everything worked, even though some of the options and choices seemed counter-intuitive at times. The real revelation, however, was the wealth of additional programs provided on the CD-ROM. These went far beyond the simple image display and enhancement routines found in other low-cost packages, and included routines for advanced procedures such as non-linear mapping, spectral unmixing and feature extraction. This is a real treasure trove for anyone wishing to develop their own image processing skills or undertake a research project on image classification.

The final chapter on image classification has been extended and updated to take account of developments during the last decade and provides an excellent, up-to-date review of the subject, focusing upon land applications and optical wavelengths especially. Throughout, Mather pays great attention to the statistical principles underlying the various techniques, and the importance of understanding the assumptions inherent in each. This chapter should be required reading for anyone embarking upon the classification of a remotely sensed image, no matter what level they are at. The chapter covers non-parametric classifiers such as those based on neural networks and evidential reasoning, although it is disappointing that there are no programs for these on the CD-ROM. Hopefully they will feature in the next edition, or will appear before then on the MIPS website.

The book is nicely produced and those errors that have been reported to the author are listed on a website set up for the purpose. There is also a website providing limited support for MIPS [2], but this is more for bug reports and points of clarification, than for full technical support.

For those looking to kick-start their adventure with digital image processing and remote sensing through a hands-on approach, there is no better book. It is excellent value-for-money, and to those who bought the first edition and are wondering whether to upgrade, I would recommend that they do so. The second edition updates and adds another dimension to a justifiably popular textbook and is highly recommended.

## **References**

**Mather, P.M., 1987.** *Computer Processing of Remotely-Sensed Images. An Introduction*, 1st Edition, Wiley, Chichester.

## **URLs cited**

1. [http://www.geog.nottingham.ac.uk/~mather/useful\\_links.html](http://www.geog.nottingham.ac.uk/~mather/useful_links.html)
2. [http://www.geog.nottingham.ac.uk/~mather/Book\\_Update.html](http://www.geog.nottingham.ac.uk/~mather/Book_Update.html)

*Ted Milton  
University of Southampton*