Book Review

Image Processing, the Fundamentals

By Maria Petrou and Panagiota Bosdogianni. John Wiley and Sons Ltd, Chichester, (www.wiley.com), 1999. ISBN 0-471-9988303-4. 174x251mm. xx + 333 pages. 74 figures. Price £34.95 hard cover.

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This book is intended to provide a step by step guide to the basic principles underlying all image processing tasks and is the result of eleven years of teaching experience by the authors at undergraduate and postgraduate degree level. According to its cover, the text is directed towards research students and is intended as a self-teaching aid.

In the preface the authors state that "trying to do image processing without mathematics is like trying to fly by flapping the arms". To provide a text that will appeal both to those who are as accomplished as Icarus and to those who are simply at the flapping stage, the authors have designed the book on two levels. The first level is intended to be easy to follow with a limited level of mathematical ability, whilst the second is more sophisticated and includes detail of the mathematical intricacies and the proofs required. Whilst this may be the intention, the uninitiated user may feel daunted by the first casual flick through the text where large blocks of mathematical background are immediately apparent. On closer inspection, one sees that those following the uninitiated path are advised to avoid all those boxes and examples that are marked with a "B". Such sections constitute approximately one quarter of the book.

The book is divided into seven sections designed to guide the reader through the basics of image transformations, statistical descriptions of images, image enhancement, two dimensional filters, image restoration, image segmentation and edge detection. Each chapter commences with a clearly stated "what is this chapter is about?" section and is summarised with a "what is the take home message of this chapter?" section. Buried in the back of the introduction is a series of short but useful statements defining the purpose of image processing and its role in solving the fundamental four problems of: image enhancement; image compression; image restoration; and the preparation of an image for automatic vision. It is then stated that the book is about introducing the mathematical foundations of image processing in the context of specific applications under these four

main themes. Whilst the book is primarily concerned with linear techniques, several non-linear techniques associated with image enhancement and automatic vision are presented.

The style of presentation is rather unusual in that each chapter consists of a series of short questions that have been structured to lead the reader through the subject content in a logical way. Such a style is useful if the question in the reader's head, or a similar question, is readily apparent; otherwise, the reader is left with the need to read the complete chapter to determine if information germane to their specific problem is included. The book is illustrated throughout with black and white pictures, figures and diagrams that enable the reader to appreciate the processing techniques described.

The first section is typical of the style and approach used throughout the book. It is concerned with such questions as: "what is an image?"; "what is the meaning of the point spread function?"; and "how can we express in practice the effect of a linear operator on an image?". Answers to these questions contain some short descriptive text but generally jump directly into an appropriate mathematical description. It is clear that those who simply want to flap their arms with a basic appreciation of the concepts behind image processing should invest in a different book. This having been said, in its intended aim as an additional supporting text for a lecture programme or associated program of study, the contents represent a useful change from the traditional textbook format.

Overall, the book achieves its aim of providing a companion to the student who requires a machine vision teaching aid. However the question and answer structure, whilst excellent if one's particular question is answered, does take some careful exploration if one is trying to find a solution. To the reader who is unfamiliar with the mathematics and the mathematical notation used by the image processing community, it is necessary to wade through several sections before one can plug all of the necessary pieces of information together to solve a particular problem.