Book Review

Fundamentals of Digital Image Processing (A Practical Approach with Examples in Matlab), by Chris Solomon and Toby Breckon (Wiley, 2011).

The primary target for this book is undergraduate or postgraduate students and is well suited as a course text. The philosophy of the book seems to be somewhere along the lines that whilst you can spend forever reading about a topic, the best approach to really understand it is to get on and use it. This is where the combination with Matlab is of value: the theory presented in each chapter is shown implemented in Matlab.

The book makes extensive use of the Image Processing Toolbox so don't expect a very low-level "numerical recipes in Matlab" description of the work presented in each chapter. High-level image processing functions are used throughout, which forces the reader to focus on the behaviour of each method under different circumstances or settings, rather than getting involved in the exact details of the implementation.

This is also backed up by the exercises presented at the end of each chapter or on the book's website (www.fundipbook.com), which are not designed to check that the reader has been paying attention but more to reinforce and explore the material presented in each chapter.

Each new concept is well described and as such the book is valuable as a text even if Matlab is not being used. Matlab code is not randomly interspersed through the chapters and is generally reserved for the end of a section or chapter. As a guide, I'd estimate that example Matlab code takes up roughly 10% of available space.

An important question is whether the book is competing with others, such as Gonzalez et. al.'s *Digital Image Processing using Matlab*. The answer I think is "no", not because it is better or worse, but because the motivations are very different. *Fundamentals of Digital Image Processing* is not written to provide a guide on how to use the Image Processing Toolbox, but rather uses Matlab as a tool to take the ideas from the book into the lab. With the exception of the first chapter, where basic image handling functions are discussed, you get the distinct feeling that Matlab has been used to serve the book and not vice versa (i.e. the contents of the book have not been guided by the contents of the Image Processing Toolbox).

The book has 328 pages and is printed in black and white (which always seems a shame for a vision book), though the key figures are reproduced in colour on the central pages. The book consists of eleven chapters which I will briefly (but by no means completely) describe.

The first covers the basics of how an image is represented and describes areas such as colour spaces, compression and an introduction to handling images in Matlab. Chapter 2 discusses image formation, the point spread function and image convolutions. A brief description of camera models and projections is given and different sources of image noise are discussed.

Chapter 3 focuses on operations performed on individual pixels, from basic arithmetic to topics such as Gamma correction, histogram equalization and matching. Chapter 4 covers image enhancement, describing various filtering methods for noise removal and basic edge detection.

Chapter 5 covers Fourier transforms and Chapter 6 image restoration using methods such as the inverse Fourier Transform, the Wiener–Helstrom filter and least squares. Chapter 7 discusses the geometry of shapes, introduces homogeneous coordinates, Procrustes alignment and piecewise warps.

Chapter 8 covers Morphological processing and Chapter 9 Image Features. Shape signatures and statistical moments are introduced and Principal Components Analysis is covered in some detail.

Chapter 10 discusses Image segmentation, covering split and merge and also edge detection methods, such as Difference of Gaussian and Canny edge detectors. The chapter finishes with a discussion of using Markov Random Fields for segmentation.

Chapter 11 presents methods used for classification. Linear discriminant functions are introduced as are Bayesian classifiers. Finally, AdaBoost is discussed and the *K*-means algorithm presented.

Overall I found the book clearly written and a good reference to have to hand. It is well designed for getting someone new to the field quickly up to speed. I lent it to an MSc project student who had the following to say: "As a foreign student who is new to this field I found it clear and very understandable, the structure of the book is well organised and the sequence of the information is good. I like the paper type of this book, maybe it is silly but glossy paper makes a reflection on my glasses." The last comment is perhaps something for all publishers to consider!

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