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Object Recognition

Fundamentals and Case Studies

With 133 Figures

Springer

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British Library Cataloguing in Publication Data
A catalogue record for this book is available from the British Library

Library of Congress Cataloging-in-Publication Data
Bennamoun, M. (Mohammed)
Object recognition : fundamentals and case studies / Mohammed Bennamoun and George Mamic.
p. cm. – (Advances in pattern recognition, ISSN 1617-7916)
Includes bibliographical references and index.
ISBN 978-1-4471-3724-5 ISBN 978-1-4471-3722-1 (eBook)
DOI 10.1007/978-1-4471-3722-1
1. Image processing. 2. Pattern recognition systems. I. Mamic, George, 1977
III. Title. IV. Series.

TA1632 .B45 2002
621.36'7—dc21

2001049625

Advances in Pattern Recognition ISSN 1617-7916

ISBN 978-1-4471-3724-5

Originally published by Springer-Verlag London Berlin Heidelberg in 2002
Softcover reprint of the hardcover 1st edition 2002

Typesetting: Camera ready by authors

34/3830-543210 Printed on acid-free paper SPIN 10785377

To my father whose image is always before my eyes and whose values run my life. To my mother, my wife and my kids whose presence is as precious as life.
M. Bennamoun

To my parents whose unconditional love, intelligence, compassion and tenacity are a source of awe and inspiration.
G.J. Mamic

Preface

Automatic object recognition is a multidisciplinary research area using concepts and tools from mathematics, computing, optics, psychology, pattern recognition, artificial intelligence and various other disciplines. The purpose of this research is to provide a set of coherent paradigms and algorithms for the purpose of designing systems that will ultimately emulate the functions performed by the Human Visual System (HVS). Hence, such systems should have the ability to recognise objects in two or three dimensions independently of their positions, orientations or scales in the image.

The HVS is employed for tens of thousands of recognition events each day, ranging from navigation (through the recognition of landmarks or signs), right through to communication (through the recognition of characters or people themselves). Hence, the motivations behind the construction of recognition systems, which have the ability to function in the real world, is unquestionable and would serve industrial (e.g. quality control), military (e.g. automatic target recognition) and community needs (e.g. aiding the visually impaired).

Scope, Content and Organisation of this Book

This book provides a comprehensive, yet readable foundation to the field of object recognition from which research may be initiated or guided. It represents the culmination of research topics that I have either covered personally or in conjunction with my PhD students. These areas include image acquisition, 3-D object reconstruction, object modelling, and the matching of objects, all of which are essential in the construction of an object recognition system.

The book is divided into three parts. Part A provides the reader with an introduction into object recognition and covers the acquisition of images. Part B details the 3-D object reconstruction, modelling and matching, and forms the fulcrum of the manuscript. Finally, Part C describes typical recognition systems using case studies, which illustrates the application of the fundamentals covered in the previous parts. The code used to generate the results that are presented in the case studies may be found at the following FTP site: ftp://ftp.springer.de/pub/cs/object_recognition/. The reader is given a road map through all of this literature in the form of a taxonomy that is

constructed in the introduction. In addition, each chapter in Parts A and B of the manuscript contains an extensive literature survey of state-of-the-art systems available in specific areas. These surveys are summarised in detailed tables and taxonomies at the beginning of each of the chapters.

Who Should Read this Book?

The book should appeal to both engineers and computer scientists, in particular advanced undergraduate students, postgraduate students and researchers. Hopefully, researchers in other disciplines, such as psychology, will also find the manuscript useful.

Acknowledgements

First I would like to thank my co-author George Mamic for his patience, hard work, perseverance, contribution and support. Particular thanks to my past students whose research has contributed enormously to this manuscript, namely, Jasmine Banks, John Williams, and Anthony Cheung. Thanks to the series editor S. Singh for encouraging us to write the manuscript and to our reviewers for their valuable comments and constructive inputs. Also, special thanks to my past and current students, namely (in alphabetical order): Jason Baker, Adriana Bodnarova, PiChi Chou, Clinton Fookes, Greg Hislop, Haris Pandzo, Birgit Planitz, Alex Pongpech and Jeremy Tay. I would also like to acknowledge the support of the Queensland University of Technology for all the research support that I have received over the years. Thanks to Professor Kurt Kubik for his numerous technical discussions and continual support. Thanks also to Professors M. Bayoumi, N. Bergmann and A. Zoubir for their collaboration. Acknowledgements also go to the Australian Research Council (ARC) for their grant support of some projects directly related to the area of object recognition. Finally, I would like to thank the "Laboratoire de Traitement et Transport de l'Information", L2TI in Paris 13, France; particularly Professor A. Beghdadi for hosting me whilst the finishing touches were being applied to this manuscript.

Mohammed Bennamoun
July 2001

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