

TECHNIQUES FOR OBJECT EDGE DETECTION AND MULTISCALE CONTEXTUAL INFORMATION

Dr. P.V. GOPI KRISHNA RAO

Professor

Dept. of Electronics and Communication Engineering
Rajeev Gandhi Memorial College of Engineering & Technology,
Nandyal, Andhra Pradesh, INDIA

Dr. V.N.V. SATYA PRAKASH

Professor

Dept. of Electronics and Communication Engineering
Rajeev Gandhi Memorial College of Engineering & Technology,
Nandyal, Andhra Pradesh, INDIA

Dr. R. HANUMA NAIK

Associate Professor

Dept. of Electronics and Communication Engineering
Rajeev Gandhi Memorial College of Engineering & Technology,
Nandyal, Andhra Pradesh, INDIA

Dr. Y. MADHUSUDHANA REDDY

Associate Professor

Department of Electronics and Communication Engineering
Rajeev Gandhi Memorial College of Engineering & Technology,
Nandyal, Andhra Pradesh, INDIA

TECHNIQUES FOR OBJECT EDGE DETECTION AND MULTISCALE CONTEXTUAL INFORMATION

Copyright© : Dr. P.V. Gopi Krishna Rao
Publishing Rights© : VSRD Academic Publishing
A Division of Visual Soft India Pvt. Ltd.

ISBN-13: 978-81-972449-7-1
FIRST EDITION, JULY 2024, INDIA

Printed & Published by:
VSRD Academic Publishing
(A Division of Visual Soft India Pvt. Ltd.)

Disclaimer: The author(s) / Editor(s) are solely responsible for the contents compiled in this book. The publishers or its staff do not take any responsibility for the same in any manner. Errors, if any, are purely unintentional and readers are requested to communicate such errors to the Author(s) or Editor(s) or Publishers to avoid discrepancies in future.

All rights reserved. No part of this publication may be reproduced, stored in a retrieval system, or transmitted, in any form or by any means, electronic, mechanical, photocopying, recording or otherwise, without the prior permission of the Publishers & Author.

Printed & Bound in India

VSRD ACADEMIC PUBLISHING
A Division of Visual Soft India Pvt. Ltd.

REGISTERED OFFICE

154, Tezab mill Campus, Anwarganj, KANPUR–208003 (UP) (IN)
Mb:9899936803, Web: www.vsrdpublishing.com, Email: vsrdpublishing@gmail.com

MARKETING OFFICE

340, FF, Adarsh Nagar, Oshiwara, Andheri(W), MUMBAI–400053 (MH) (IN)
Mb:9956127040, Web: www.vsrdpublishing.com, Email: vsrdpublishing@gmail.com

PREFACE

With the widespread usage of digital multimedia and the rapidly growing use of internet, Forensic detection, image classification etc., becomes an important issue. This book intends to provide a comprehensive overview of different aspects of mechanisms and techniques for information determination using Edge detection techniques. It is written for students, researchers, and professionals who convey the related courses, want to improve their knowledge, and want to learn experiences pertaining to the use of Image processing techniques for applications in the field of pattern recognition, object identification, information retrieval etc.

Steganographic messages are often first encrypted by some traditional means, and then a covert text is altered in some manner to hold the encrypted message. The demand for information security exists everywhere, every day.

This volume proposes to supply scholars, researchers, with the technical information regarding Edge detection and preserving information, as well as guide them in the fundamental theoretical framework in developing the extensive advanced techniques. By comprehensively considering the essential principles one cannot only obtain novel ideas in implementing the advanced algorithms, but also discover the new problems. The principles of Edge detection and information preserving in this book are illustrated with graphs, figures and examples with implementation methodologies in the Python environment in order to simplify the understanding of even complicated principles.

 *Authors*

ACKNOWLEDGEMENT

At the outset, we express our heartfelt gratitude to the *Almighty*, and *Lord Hanuman* who has been with us during each step that we have taken towards completion of this book.

We would like to express our gratitude to *Dr. M. Shanthiramudu*, Chairman, *Er. M. Sivaram*, *Managing Director*, Rajeev Gandhi Memorial College of Engineering & Technology, Nandyal for giving us moral and infrastructural facilities to bring out this book in more meaningful form.

We would like to express our sincere gratitude to *Dr. T. Jayachandra Prasad*, *Principal*, Rajeev Gandhi Memorial College of Engineering & Technology, Nandyal for his inputs and encouragement in every step towards the completion of this book.

We would like to express our sincere thanks to Hon'ble Vice Chancellors of Jawaharlal Nehru Technological University, Kakinada and Ananthapuramu for inspiring us to take up this work.

It is our privilege to thank and all the *faculty members* of the Department Electronic & Communication Engineering, Rajeev Gandhi Memorial College of Engineering & Technology, Nandyal, for extending their cooperation and support during the process of writing this book.

We like to attribute all of our success, joy and achievements to our *parents* and *family members*.

 *Authors*

TABLE OF CONTENTS

CHAPTER ONE: IMAGE PROCESSING BASICS	1
1.1. INTRODUCTION.....	1
1.2. IMAGE PROCESSING.....	2
1.3. IMAGE.....	4
1.4. IMAGE FORMATS	6
1.5. COORDINATE CONVENTION	8
1.6. IMAGE AS MATRICES.....	9
1.7. READING IMAGES.....	10
1.8. PHASES OF IMAGE PROCESSING.....	11
1.9. OVERLAPPING FIELDS WITH IMAGE PROCESSING	12
CHAPTER TWO: EDGE DETECTION TECHNIQUES.....	15
2.1. BOUNDARY POINTS HANDLING.....	15
2.2. DETECTING BOUNDARIES IN NATURAL IMAGE	17
2.3. BOUNDARY DETECTION.....	18
2.4. GEOMETRICAL APPROACH TO EDGE DETECTION.....	19
2.5. EDGE DETECTION APPROACH TO PROVIDE BETTER EDGE CONNECTIVITY FOR IMAGE	20
2.6. CANNY EDGE DETECTION ENHANCEMENT BY SCALE MULTIPLICATION.....	21
2.7. OPTIMAL EDGE DETECTION AND EDGE LOCALIZATION IN COMPLEX SAR IMAGES.....	22
2.8. NORMALIZED CUTS AND WATERSHEDS FOR IMAGE SEGMENTATION.....	24

CHAPTER THREE: CANNY EDGE DETECTION.....	26
3.1. INTRODUCTION.....	26
3.2. EDGE PROPERTIES	28
3.3. DEVELOPMENT OF CANNY EDGE DETECTION	28
3.4. PROCESS OF CANNY EDGE DETECTION ALGORITHM.....	30
3.5. IMPROVEMENT ON CANNY EDGE DETECTION	34
3.6. SOBEL OPERATOR.....	35
3.7. EDGE DETECTION PROCESS.....	37
3.8. EDGE DETECTION USING DIFFUSION	42
3.9. ANISOTROPIC DIFFUSION	42
CHAPTER FOUR: OPEN CV USING PYTHON	45
4.1. INSTALLING ANACONDA.....	45
4.2. INSTALLING OPEN CV	49
4.3. ALGORITHM IMPLEMENTATION.....	53
4.4. RESULT ANALYSIS	59
CHAPTER FIVE: APPLICATIONS AND ADVANTAGES	68
5.1. APPLICATIONS OF EDGE DETECTION.....	68
5.2. ADVANTAGES OF EDGE DETECTION.....	72
5.3. DISADVANTAGES OF EDGE DETECTION	73
5.4. CONCLUSION.....	74
CHAPTER SIX: BIBLIOGRAPHY	76

SUMMARY

This book discusses the design and develop an algorithm that helps in detecting an object which attracts most people's attention throughout an image. This can be widely used in forensic detection, image classifications etc. Existing computational models for salient object detection primarily rely on hand-crafted features, which are only able to capture low-level contrast information. The hierarchical contrast features are achieved by formulating salient object detection as a binary labelling problem using deep learning techniques. The edge detection based on the physical law of diffusion is presented in this book. Though the most current studies are using data-based methods such as deep neural networks, these methods on machine learning need big data of labelled ground truth as well as a large number of resources for training. On the other hand, the widely used traditional methods are based on the gradient of the grayscale or color of images with using different sorts of mathematical tools to accomplish the mission.

Instead of treating the outline of an object in an image as a kind of gradient of grayscale or color. The schemes presented deals with the edge detection as a character of an energy diffusing in the space of media such as charge-coupled device. By using the characteristic function of diffusion, the information of the energy will be extracted. The scheme preserves the structural information of images very well. Because it comes from the inhere law of images' physical property, it has a unified mathematical framework for images' edge detection under different conditions, for example, multi scales, different light conditions, and so on. Moreover, it has low computational complexity.

