

Commenced Publication in 1973

Founding and Former Series Editors:

Gerhard Goos, Juris Hartmanis, and Jan van Leeuwen

Editorial Board

David Hutchison

Lancaster University, Lancaster, UK

Takeo Kanade

Carnegie Mellon University, Pittsburgh, PA, USA

Josef Kittler

University of Surrey, Guildford, UK

Jon M. Kleinberg

Cornell University, Ithaca, NY, USA

Alfred Kobsa

University of California, Irvine, CA, USA

Friedemann Mattern

ETH Zurich, Zürich, Switzerland

John C. Mitchell

Stanford University, Stanford, CA, USA

Moni Naor

Weizmann Institute of Science, Rehovot, Israel

Oscar Nierstrasz

University of Bern, Bern, Switzerland

C. Pandu Rangan

Indian Institute of Technology, Madras, India

Bernhard Steffen

TU Dortmund University, Dortmund, Germany

Demetri Terzopoulos

University of California, Los Angeles, CA, USA

Doug Tygar

University of California, Berkeley, CA, USA

Gerhard Weikum

Max Planck Institute for Informatics, Saarbruecken, Germany

For further volumes:

<http://www.springer.com/series/7412>

Masakazu Iwamura · Faisal Shafait (Eds.)

Camera-Based Document Analysis and Recognition

5th International Workshop, CBDAR 2013
Washington, DC, USA, August 23, 2013
Revised Selected Papers

Editors

Masakazu Iwamura
Graduate School of Engineering
Osaka Prefecture University
Osaka
Japan

Faisal Shafait
The University of Western Australia
Crawley, WA
Australia

ISSN 0302-9743

ISBN 978-3-319-05166-6

DOI 10.1007/978-3-319-05167-3

Springer Cham Heidelberg New York Dordrecht London

ISSN 1611-3349 (electronic)

ISBN 978-3-319-05167-3 (eBook)

Library of Congress Control Number: 2014933578

CR Subject Classification (1998): I.4, I.5, I.7, I.2.7, H.3, H.5, H.4

LNCS Sublibrary: SL6 – Image Processing, Computer Vision, Pattern Recognition and Graphics

© Springer International Publishing Switzerland 2014

This work is subject to copyright. All rights are reserved by the Publisher, whether the whole or part of the material is concerned, specifically the rights of translation, reprinting, reuse of illustrations, recitation, broadcasting, reproduction on microfilms or in any other physical way, and transmission or information storage and retrieval, electronic adaptation, computer software, or by similar or dissimilar methodology now known or hereafter developed. Exempted from this legal reservation are brief excerpts in connection with reviews or scholarly analysis or material supplied specifically for the purpose of being entered and executed on a computer system, for exclusive use by the purchaser of the work. Duplication of this publication or parts thereof is permitted only under the provisions of the Copyright Law of the Publisher's location, in its current version, and permission for use must always be obtained from Springer. Permissions for use may be obtained through RightsLink at the Copyright Clearance Center. Violations are liable to prosecution under the respective Copyright Law.

The use of general descriptive names, registered names, trademarks, service marks, etc. in this publication does not imply, even in the absence of a specific statement, that such names are exempt from the relevant protective laws and regulations and therefore free for general use.

While the advice and information in this book are believed to be true and accurate at the date of publication, neither the authors nor the editors nor the publisher can accept any legal responsibility for any errors or omissions that may be made. The publisher makes no warranty, express or implied, with respect to the material contained herein.

Printed on acid-free paper

Springer is part of Springer Science+Business Media (www.springer.com)

Preface

The pervasiveness and wide-spread availability of camera phones and hand-held digital still/video cameras has led the community to recognize document analysis and recognition of digital camera images as a promising and growing sub-field of Document Analysis and Recognition. Constraints imposed by the memory, processing speed, and image quality are leading to new interesting open problems that cannot be directly resolved by traditional techniques.

To cater for the demands of camera-based document processing, the idea of a new satellite workshop of International Conference on Document Analysis and Recognition (ICDAR) was conceived by Prof. Koichi Kise. Together with Prof. David Doermann, he took the responsibility of organizing the first workshop on Camera-Based Document Analysis and Recognition as a satellite workshop of ICDAR 2005 in Seoul, South Korea. The workshop was very well received by the community and hence it was held in 2007 (Curitiba, Brazil), 2009 (Barcelona, Spain), and 2011 (Beijing, China) with the corresponding ICDAR conferences. It is our pleasure to hold the Fifth International Workshop on Camera-Based Document Analysis and Recognition (CBDAR 2013) in Washington D.C., USA, following the success of the past four workshops. The workshop is aimed to provide an opportunity to researchers and developers from various backgrounds to exchange their ideas and explore new research directions through the presentation of recent research activities and discussions.

In the eight years since the first CBDAR was held, the situation surrounding the CBDAR field has been evolving. New technologies have brought a shift in the paradigm from static camera-captured scene image reading to real-time video-based OCR using cameras on wearable devices, possibly complementing the camera input with other sensors (e.g., eye tracking). Such sensors and recent technologies have the potential to understand a user's behavior, habit, and thought, as well as improve user experience while reading.

The program of CBDAR 2013 was organized in a single-track one-day workshop. It consisted of two oral sessions and one poster session. In addition to that, a keynote talk was given by Dr. Kai Kunze from Osaka Prefecture University. Finally, a panel discussion on the state of the art and new challenges was organized as the concluding session of CBDAR 2013.

After the workshop, authors of selected contributions were invited to submit expanded versions of their papers for this edited volume. The authors were encouraged to include the ideas and suggestions that arose during the discussions at the workshop. Thus, this volume contains refereed and improved versions of papers presented at CBDAR 2013. We intend to give a snapshot of state-of-the-art research in the field of camera-based document analysis and recognition.

Finally, we would like to sincerely thank those who are helping to ensure this workshop is a success: Dr. David Doermann (ICDAR General Chair), Prof. Daniel

Lopresti (ICDAR Executive Co-chair), Prof. Apostolos Antonacopoulos (ICDAR Workshop Chair), and other ICDAR organizers for their generous support; the members of the program committee and additional reviewers for reviewing and commenting on all of the submitted papers; IAPR for its sponsorship of the workshop.

The Sixth International Workshop on Camera-Based Document Analysis and Recognition (CBDAR 2015) is planned to be held in Tunis, Tunisia.

December 2013

Masakazu Iwamura
Faisal Shafait

Contents

Text Detection and Recognition in Scene Images

Spatially Prioritized and Persistent Text Detection and Decoding	3
<i>Hsueh-Cheng Wang, Yafim Landa, Maurice Fallon, and Seth Teller</i>	
A Hierarchical Visual Saliency Model for Character Detection in Natural Scenes	18
<i>Renwu Gao, Faisal Shafait, Seiichi Uchida, and Yaokai Feng</i>	
A Robust Approach to Extraction of Texts from Camera Captured Images . . .	30
<i>Sudipto Banerjee, Koustav Mullick, and Ujjwal Bhattacharya</i>	
Scene Text Detection via Integrated Discrimination of Component Appearance and Consensus	47
<i>Qixiang Ye and David Doermann</i>	
Accuracy Improvement of Viewpoint-Free Scene Character Recognition by Rotation Angle Estimation	60
<i>Kanta Kuramoto, Wataru Ohyama, Tetsushi Wakabayashi, and Fumitaka Kimura</i>	
Sign Detection Based Text Localization in Mobile Device Captured Scene Images	71
<i>Jing Zhang and Rangachar Kasturi</i>	
Font Distribution Observation by Network-Based Analysis	83
<i>Chihiro Nakamoto, Rong Huang, Sota Koizumi, Ryosuke Ishida, Yaokai Feng, and Seiichi Uchida</i>	

Camera-Based Systems

Dewarping Book Page Spreads Captured with a Mobile Phone Camera	101
<i>Chellwon Kim, Patrick Chiu, and Surendar Chandra</i>	
A Dataset for Quality Assessment of Camera Captured Document Images. . . .	113
<i>Jayant Kumar, Peng Ye, and David Doermann</i>	
A Morphology-Based Border Noise Removal Method for Camera-Captured Label Images.	126
<i>Mengyang Liu, Chongshou Li, Wenbin Zhu, and Andrew Lim</i>	

Robust Binarization of Stereo and Monocular Document Images Using Percentile Filter.	139
<i>Muhammad Zeshan Afzal, Martin Krämer, Syed Saqib Bukhari, Mohammad Reza Yousefi, Faisal Shafait, and Thomas M. Breuel</i>	
Hyperspectral Document Imaging: Challenges and Perspectives	150
<i>Zohaib Khan, Faisal Shafait, and Ajmal Mian</i>	
Mobile Phone Camera-Based Video Scanning of Paper Documents	164
<i>Muhammad Muzzamil Luqman, Petra Gomez-Krämer, and Jean-Marc Ogier</i>	
Real-life Activity Recognition – Focus on Recognizing Reading Activities . . .	179
<i>Kai Kunze</i>	
Author Index	187