

DAS
176
94

International Association for Pattern Recognition Workshop on
**DOCUMENT ANALYSIS
SYSTEMS**

Editors

A. Lawrence Spitz & Andreas Dengel

S E R I E S I N
MACHINE PERCEPTION
ARTIFICIAL INTELLIGENCE
Volume 14

World Scientific

Series in Machine Perception and Artificial Intelligence – Vol. 14

International Association for Pattern Recognition Workshop on

DOCUMENT ANALYSIS SYSTEMS

Editors

A. Lawrence Spitz

Fuji Xerox Palo Alto Laboratory

Andreas Dengel

DFKI



World Scientific

Singapore • New Jersey • London • Hong Kong

Published by

World Scientific Publishing Co. Pte. Ltd.

P O Box 128, Farrer Road, Singapore 9128

USA office: Suite 1B, 1060 Main Street, River Edge, NJ 07661

UK office: 57 Shelton Street, Covent Garden, London WC2H 9HE

1195

DOCUMENT ANALYSIS SYSTEMS

International Association for Pattern Recognition Workshop

Copyright © 1995 by World Scientific Publishing Co. Pte. Ltd.

All rights reserved. This book, or parts thereof, may not be reproduced in any form or by any means, electronic or mechanical, including photocopying, recording or any information storage and retrieval system now known or to be invented, without written permission from the Publisher.

For photocopying of material in this volume, please pay a copying fee through the Copyright Clearance Center, Inc., 27 Congress Street, Salem, MA 01970, USA.

ISBN 981-02-2122-3

This book is printed on acid-free paper.

Printed in Singapore by Uto-Print

PREFACE

The first International Association for Pattern Recognition workshop on Document Analysis Systems was held in Kaiserslautern, Germany in October 1994. In planning this workshop, we were aware that the rapid growth of document analysis technology reflects considerable contemporary interest and anticipates large market potential and an important economic role in the coming decades. Therefore, we not only tried to attract academic and industrial researchers, but also vendors and end-users of document analysis technology. In total, we received 51 papers and 20 abstracts from 12 countries. The program committee was careful to uphold a high standard for contributions. We accepted 26 papers for oral presentation.

In assembling this book, we selected the papers most representative of progress in this field and augmented that selection with a few papers invited specifically for this volume.

The book is divided into sections about document analysis system architectures, classification and performance evaluation, handwriting and line-drawing recognition as well as innovative techniques and applications. We have also incorporated the reports of the eight working group sessions that took place during the Document Analysis Systems workshop.

We owe a special debt of gratitude to Henry Baird whose idea it was to hold a workshop on systems and who effectively and energetically promoted it. Finally, we would like to thank all authors for their contribution to this volume. We hope that this book will be useful and serve to promote further research in document analysis.

Palo Alto, California, USA
Kaiserslautern, Germany

Larry Spitz
Andreas Dengel

CONTENTS

System Architecture

Data Structures for Page Readers <i>H. S. Baird and D. J. Ittner</i>	3
Palace: A Multilingual Document Recognition System <i>A. L. Spitz and M. Ozaki</i>	16
Experiences with High-Volume, High Accuracy Document Capture <i>H. R. Stabler</i>	38
OfficeMAID – A System for Office Mail Analysis, Interpretation and Delivery <i>A. Dengel, R. Bleisinger, F. Fein, R. Hoch, F. Hones and M. Malburg</i>	52
Programmable Contextual Analysis <i>D. J. Ittner and H. S. Baird</i>	76
A System for Exploiting Context in Automatic Recognition <i>R. A. Lorie</i>	93
An Adaptive Approach to Document Classification and Understanding <i>S. W. Lam</i>	114

Class Evaluation

Document Image Analysis: Automated Performance Evaluation <i>G. Nagy</i>	137
Using Consensus Sequence Voting to Correct OCR Errors <i>D. Lopresti and J. Zhou</i>	157
A Handwritten Character Recognition System by Efficient Combination of Multiple Classifiers <i>T. Suzuki, H. Nishida, Y. Nakajima, H. Yamagata, M. Tachikawa and G. Sato</i>	169

A Region-Based System for the Automatic Evaluation of Page Segmentation Algorithms	188
<i>S. Randriamasy and L. Vincent</i>	

Integration of Contextual Knowledge Sources into a Blackboard-Based Text Recognition System	206
<i>R. Sennhauser</i>	

Automatic Construction of Recognition Procedures for Musical Notes by Genetic Algorithm	225
<i>I. Yoda, K. Yamamoto and H. Yamada</i>	

Recognition of Handwritten Responses on US Census Forms	237
<i>T. M. Breuel</i>	

A System for the Recognition of Handwritten Literal Amounts of Checks	265
<i>J.-C. Simon, O. Baret and N. Gorski</i>	

Handwritten Text Recognition	288
<i>V. Govindaraju, R. K. Srihari and S. N. Srihari</i>	

Line Drawing

Knowledge Organization and Interpretation Process in Engineering Drawing Interpretation	307
<i>P. Vaxiviere and K. Tombre</i>	

Processing Imprecise and Structural Distorted Line Drawings by An Adaptable Drawing Interpretation Kernel	318
<i>B. Pasternak</i>	

Vector-Based Arc Segmentation in the Machine Drawing Understanding System Environment	338
<i>D. Dori</i>	

Robust Drawing Recognition Based on Model-Guided Segmentation	363
<i>S. Shimotsuji, O. Hori and M. Asano</i>	

Innovations

Document Image Matching and Retrieval with Multiple Distortion-Invariant Descriptors	379
<i>J. J. Hull</i>	

Off-Line Interpretation and Execution of Corrections on Text Documents <i>D. Möri and H. Bunke</i>	397
Analysis of Scanned Braille Documents <i>R. T. Ritchings, A. Antonacopoulos and D. Drakopoulos</i>	413
Document Analysis by Fractal Signatures <i>H. Ma, D.-H. Xi, X.-G. Mao, Y.-T. Tang and C.-Y. Suen</i>	422
Working Groups	
Possibilities for International Collaboration <i>A. Dengel and B. B. Jean</i>	445
Document Analysis and Learning <i>J. Hull and T. Bayer</i>	450
Needs of the Market and User Requirements <i>H. Stabler and H. Fujisawa</i>	452
Evaluation—Criteria <i>H. S. Baird and J. Kanai</i>	455
Handwriting <i>T. Breuel and J. M. Simon</i>	458
Line Drawing and Music Recognition <i>S. Bauman and K. Tombre</i>	462
Multilingual Documents and Natural Language Processing <i>M. Malburg and A. L. Spitz</i>	465
Form Recognition <i>T. Caesar and R. G. Casey</i>	469