

Commenced Publication in 1973

Founding and Former Series Editors:

Gerhard Goos, Juris Hartmanis, and Jan van Leeuwen

Editorial Board

David Hutchison

Lancaster University, UK

Takeo Kanade

Carnegie Mellon University, Pittsburgh, PA, USA

Josef Kittler

University of Surrey, Guildford, UK

Jon M. Kleinberg

Cornell University, Ithaca, NY, USA

Friedemann Mattern

ETH Zurich, Switzerland

John C. Mitchell

Stanford University, CA, USA

Moni Naor

Weizmann Institute of Science, Rehovot, Israel

Oscar Nierstrasz

University of Bern, Switzerland

C. Pandu Rangan

Indian Institute of Technology, Madras, India

Bernhard Steffen

University of Dortmund, Germany

Madhu Sudan

Massachusetts Institute of Technology, MA, USA

Demetri Terzopoulos

New York University, NY, USA

Doug Tygar

University of California, Berkeley, CA, USA

Moshe Y. Vardi

Rice University, Houston, TX, USA

Gerhard Weikum

Max-Planck Institute of Computer Science, Saarbruecken, Germany

Simone Marinai Andreas Dengel (Eds.)

Document Analysis Systems VI

6th International Workshop, DAS 2004
Florence, Italy, September 8 - 10, 2004
Proceedings

Volume Editors

Simone Marinai

Università di Firenze, Dipartimento di Sistemi e Informatica

Via S. Marta, 3 - 50139 Firenze, Italy

E-mail: marinai@dsi.unifi.it

Andreas Dengel

German Research Center for Artificial Intelligence (DFKI)

P.O.Box 2080, 67608 Kaiserslautern, Germany

E-mail: Andreas.Dengel@dfki.de

Library of Congress Control Number: 2004111168

CR Subject Classification (1998): I.5, H.3, I.4, I.7, J.1, J.2

ISSN 0302-9743

ISBN 3-540-23060-2 Springer Berlin Heidelberg New York

This work is subject to copyright. All rights are reserved, whether the whole or part of the material is concerned, specifically the rights of translation, reprinting, re-use of illustrations, recitation, broadcasting, reproduction on microfilms or in any other way, and storage in data banks. Duplication of this publication or parts thereof is permitted only under the provisions of the German Copyright Law of September 9, 1965, in its current version, and permission for use must always be obtained from Springer. Violations are liable to prosecution under the German Copyright Law.

Springer is a part of Springer Science+Business Media

springeronline.com

© Springer-Verlag Berlin Heidelberg 2004

Printed in Germany

Typesetting: Camera-ready by author, data conversion by Olgun Computergrafik

Printed on acid-free paper SPIN: 11321026 06/3142 5 4 3 2 1 0

Preface

This volume contains papers selected for presentation at the 6th IAPR Workshop on Document Analysis Systems (DAS 2004) held during September 8–10, 2004 at the University of Florence, Italy. Several papers represent the state of the art in a broad range of “traditional” topics such as layout analysis, applications to graphics recognition, and handwritten documents. Other contributions address the description of complete working systems, which is one of the strengths of this workshop. Some papers extend the application domains to other media, like the processing of Internet documents.

The peculiarity of this 6th workshop was the large number of papers related to digital libraries and to the processing of historical documents, a taste which frequently requires the analysis of color documents. A total of 17 papers are associated with these topics, whereas two years ago (in DAS 2002) only a couple of papers dealt with these problems.

In our view there are three main reasons for this new wave in the DAS community. From the scientific point of view, several research fields reached a thorough knowledge of techniques and problems that can be effectively solved, and this expertise can now be applied to new domains. Another incentive has been provided by several research projects funded by the EC and the NSF on topics related to digital libraries. Last but not least, the organization of focused events, like the recent DIAL workshop chaired by Henry Baird and Venu Govindraj in Palo Alto (CA), had a strong impact on the definition of new research directions. However, it is indeed a lucky coincidence that this new trend in DAS research emerged in this edition organized in a town such as Florence, which keeps such an exceptional artistic and cultural heritage.

We received a total of 79 submissions from 19 countries, and we selected 31 oral presentations and 22 posters highlighted with short oral introductions. As a supplement to this proceedings, notes from the workshop discussions and other material related to presented papers will be posted on the DAS 2004 website: <http://www.dsi.unifi.it/DAS04>. Each paper was reviewed by three reviewers whom we would like to warmly thank here. We should mention the valuable support and hints provided by members of the Program Committee and past DAS chairs. We also wish to acknowledge the generosity of our sponsors: the International Association for Pattern Recognition, the University of Florence, the DFKI, ABBYY, Hitachi, and Siemens.

Special thanks are due to Alessio Ceroni, Cristina Dolfi, and Emanuele Marino for their invaluable contributions to the local organization.

June 2004

Simone Marinai
Andreas Dengel

Organization

Workshop Co-chairs

Simone Marinai	University of Florence, Italy
Andreas Dengel	DFKI, Germany

Program Committee

Apostolos Antonacopoulos	University of Liverpool, UK
Henry Baird	Lehigh University, USA
Francesca Cesarini	University of Florence, Italy
David Doermann	University of Maryland, USA
Andrew Downton	University of Essex, UK
Hiromichi Fujisawa	Hitachi Central Research Laboratory, Japan
Jianying Hu	IBM T.J. Watson Research Center, USA
Rolf Ingold	University of Fribourg, Switzerland
Ramanujan Kashi	Avaya Labs Research, USA
Koichi Kise	Osaka Prefecture University, Japan
Dan Lopresti	Lehigh University, USA
Donato Malerba	University of Bari, Italy
Udo Miletzki	Siemens Dematic, Germany
Yasuaki Nakano	Kyushu University, Japan
Lambert Schomaker	Rijksuniversiteit Groningen, The Netherlands
Giovanni Soda	University of Florence, Italy
Larry Spitz	Document Recognition Technologies, New Zealand
Karl Tombre	LORIA-INPL, France
Luc Vincent	LizardTech, USA
Marcel Worring	University of Amsterdam, The Netherlands

Additional Referees

Annalisa Appice	Dimosthenis Karatzas	T.R. Roth-Berghofer
Margherita Berardi	Michele Lapi	Jane Snowdon
Alain Biem	Larry O’Gorman	Salvatore Tabbone
Thomas Breuel	Huanfeng Ma	Yefeng Zheng
Michelangelo Ceci	Gérald Masini	Gary Zi
Philippe Dosch	Eugene Ratzlaff	
Stefan Jaeger	Maurizio Rigamonti	

Table of Contents

Digital Libraries

Document Analysis Systems for Digital Libraries: Challenges and Opportunities	1
<i>Henry S. Baird, Venugopal Govindaraju, and Daniel P. Lopresti</i>	
The Trinity College Dublin 1872 Online Catalogue	17
<i>John G. Byrne</i>	
DL Architecture for Indic Scripts	28
<i>Suryaprakash Kompalli, Srirangaraj Sethur, and Venugopal Govindaraju</i>	
A Semantic-Based System for Querying Personal Digital Libraries	39
<i>Luigi Cinque, Alessio Malizia, and Roberto Navigli</i>	
Toward Personalized Digital Library for Providing “Information JIT”	47
<i>Hisashi Ikeda, Naohiro Furukawa, Katsumi Marukawa, and Hiromichi Fujisawa</i>	

Historical Documents

Tilting at Windmills: Adventures in Attempting to Reconstruct <i>Don Quixote</i>	51
<i>A. Lawrence Spitz</i>	
A Segmentation-Free Recognition Technique to Assist Old Greek Handwritten Manuscript OCR	63
<i>Basilios Gatos, Kostas Ntzios, Ioannis Pratikakis, Sergios Petridis, T. Konidakis, and Stavros J. Perantonis</i>	
Automatic Metadata Retrieval from Ancient Manuscripts	75
<i>Frank Le Bourgeois and Hala Kaileh</i>	
A Complete Approach to the Conversion of Typewritten Historical Documents for Digital Archives	90
<i>Apostolos Antonacopoulos and Dimosthenis Karatzas</i>	
An Adaptive Binarization Technique for Low Quality Historical Documents	102
<i>Basilios Gatos, Ioannis Pratikakis, and Stavros J. Perantonis</i>	
Segmentation of Handwritten Characters for Digitalizing Korean Historical Documents	114
<i>Min Soo Kim, Kyu Tae Cho, Hee Kue Kwag, and Jin Hyung Kim</i>	

Self-organizing Maps and Ancient Documents	125
<i>Eddie Smigiel, Abdel Belaid, and Hatem Hamza</i>	

Enriching Historical Manuscripts: The Bovary Project	135
<i>Stéphane Nicolas, Thierry Paquet, and Laurent Heutte</i>	

Layout Analysis

Word Grouping in Document Images Based on Voronoi Tessellation	147
<i>Yue Lu, Zhe Wang, and Chew Lim Tan</i>	

Multi-component Document Image Coding Using Regions-of-Interest	158
<i>Xiao Wei Yin, Andy C. Downton, Martin Fleury, and J. He</i>	

Physical Layout Analysis of Complex Structured Arabic Documents Using Artificial Neural Nets	170
<i>Karim Hadjar and Rolf Ingold</i>	

An Integrated Approach for Automatic Semantic Structure Extraction in Document Images	179
<i>Margherita Berardi, Michele Lapi, and Donato Malerba</i>	

Multi-view HAC for Semi-supervised Document Image Classification	191
<i>Fabien Carmagnac, Pierre Héroux, and Éric Trupin</i>	

Configurable Text Stamp Identification Tool with Application of Fuzzy Logic	201
<i>J. He and Andy C. Downton</i>	

Layout and Content Extraction for PDF Documents.....	213
<i>Hui Chao and Jian Fan</i>	

Automatic Extraction of Filled-In Items from Bank-Check Images.....	225
<i>Katsuhiko Ueda, Hirotohi Maegawa, and Kenichi Matsuo</i>	

Color Documents

Bleed-Through Removal from Degraded Documents Using a Color Decorrelation Method.....	229
<i>Anna Tonazzini, Emanuele Salerno, Matteo Mochi, and Luigi Bedini</i>	

Colour Map Classification for Archive Documents	241
<i>J. He and Andy C. Downton</i>	

Serialized k -Means for Adaptative Color Image Segmentation – Application to Document Images and Others	252
<i>Yann Leydier, Frank Le Bourgeois, and Hubert Emptoz</i>	

Adaptive Region Growing Color Segmentation for Text Using Irregular Pyramid	264
<i>Poh Kok Loo and Chew Lim Tan</i>	

Preprocessing and Segmentation of Bad Quality Machine Typed Documents	276
<i>Mariusz Szwoch and Wioleta Szwoch</i>	

Handwritten Documents

Ensembles of Classifiers for Handwritten Word Recognition Specialized on Individual Handwriting Style	286
<i>Simon Günter and Horst Bunke</i>	

Information Retrieval System for Handwritten Documents	298
<i>Sargur Srihari, Anantharaman Ganesh, Catalin Tomai, Yong-Chul Shin, and Chen Huang</i>	

Word-Wise Script Identification from Indian Documents	310
<i>Suranjit Sinha, Umapada Pal, and B.B. Chaudhuri</i>	

Recognizing Freeform Digital Ink Annotations	322
<i>Michael Shilman and Zile Wei</i>	

Post-processing of Handwritten Pitman's Shorthand Using Unigram and Heuristic Approaches	332
<i>Swe Myo Htwe, Colin Higgins, Graham Leedham, and Ma Yang</i>	

Multiscale Handwriting Characterization for Writers' Classification	337
<i>Véronique Eglin, Stéphane Bres, and Carlos Rivero</i>	

Graphics Recognition

A Hybrid Approach to Detect Graphical Symbols in Documents	342
<i>Salvatore Tabbone, Laurent Wendling, and Daniel Zuwala</i>	

Performance Evaluation of Symbol Recognition	354
<i>Ernest Valveny and Philippe Dosch</i>	

The Search for Genericity in Graphics Recognition Applications: Design Issues of the Qgar Software System	366
<i>Jan Rendek, Gérald Masini, Philippe Dosch, and Karl Tombre</i>	

Attributed Graph Matching Based Engineering Drawings Retrieval	378
<i>Rujie Liu, Takayuki Baba, and Daiki Masumoto</i>	

A Platform to Extract Knowledge from Graphic Documents. Application to an Architectural Sketch Understanding Scenario	389
<i>Gemma Sánchez, Ernest Valveny, Josep Lladós, Joan Mas, and Narcís Lozano</i>	

Internet Documents

A Graph-Based Framework for Web Document Mining	401
<i>Adam Schenker, Horst Bunke, Mark Last, and Abraham Kandel</i>	
XML Documents Within a Legal Domain: Standards and Tools for the Italian Legislative Environment	413
<i>Carlo Biagioli, Enrico Francesconi, Pierluigi Spinosa, and Mirco Taddei</i>	
Rule-Based Structural Analysis of Web Pages	425
<i>Fabio Vitali, Angelo Di Iorio, and Elisa Ventura Campori</i>	
Extracting Table Information from the Web	438
<i>Yeon-Seok Kim and Kyong-Ho Lee</i>	
A Neural Network Classifier for Junk E-Mail	442
<i>Ian Stuart, Sung-Hyuk Cha, and Charles Tappert</i>	

Document Analysis Systems

Results of a Study on Invoice-Reading Systems in Germany	451
<i>Bertin Klein, Stevan Agne, and Andreas Dengel</i>	
A Document Analysis System Based on Text Line Matching of Multiple OCR Outputs	463
<i>Yasuaki Nakano, Toshihiro Hananoi, Hidetoshi Miyao, Minoru Maruyama, and Ken-ichi Maruyama</i>	
DocMining: A Document Analysis System Builder	472
<i>Sébastien Adam, Maurizio Rigamonti, Eric Clavier, Éric Trupin, Jean-Marc Ogier, Karl Tombre, and Joël Gardes</i>	
Automatic Fax Routing	484
<i>Paul Viola, James Rinker, and Martin Law</i>	

Applications

Contextual <i>Swarm</i> -Based Multi-layered Lattices: A New Architecture for Contextual Pattern Recognition	496
<i>David G. Elliman and Sherin M. Youssef</i>	
Natural Language Processing of Patents and Technical Documentation . . .	508
<i>Gaetano Cascini, Alessandro Fantechi, and Emilio Spinicci</i>	
Document Image Retrieval in a Question Answering System for Document Images	521
<i>Koichi Kise, Shota Fukushima, and Keinosuke Matsumoto</i>	
A Robust Braille Recognition System	533
<i>Apostolos Antonacopoulos and David Bridson</i>	

Document Image Watermarking Based on Weight-Invariant Partition Using Support Vector Machine	546
<i>Shiyan Hu</i>	
Video Degradation Model and Its Application to Character Recognition in e-Learning Videos	555
<i>Jun Sun, Yutaka Katsuyama, and Satoshi Naoi</i>	
Unity Is Strength: Coupling Media for Thematic Segmentation	559
<i>Dalila Mekhaldi, Denis Lalanne, and Rolf Ingold</i>	
Author Index	563