## TABLE OF CONTENTS

### Invited Lecture

- Recollections of Conversations with Professor J.C. Simon .......................... 1  
  *Th. Pavlidis*

### 1A: On-Line Recognition

- Cross-Domain Searching using Handwritten Queries ................................. 3  
  *Daniel Lopresti and Gordon Wilfong*
- Adaptive Character Recognizer for a Hand-held Device: Implementation and Evaluation Setup ................................................................. 13  
  *Vuokko Vuori, Matti Aksela, Jorma Laaksonen, Erkki Oja and Jari Kangas*
- On-line Character Recognition Adaptively Controlled by Handwriting Quality 23  
  *Masahiko Hamanaka and Keiji Yamada*

### 1B: Preprocessing and Feature computation (I)

- Inter-line Distance Estimation and Text Line Extraction for Unconstrained Online Handwriting ................................................................. 33  
  *Eugene Ratzlaff*
- Line Removal and Character Restoration using BAG Representation of Form Images ................................................................. 43  
  *Soo Hyung Kim, Seon H. Jeon and Hee K. Kwag*
- Slant Estimation for Handwritten Words by Directionally Refined Chain Code 53  
  *Yimei Ding, Fumitaka Kimura, Yasuji Miyake and Malayappan Shridhar*
- A Generic System to Extract and Clean Handwritten Data from Business Forms 63  
  *Xiangyun Ye, Ching Y. Suen and Mohamed Cheriet*
- A Framework for Document Pre-processing in Forensic Handwriting Analysis 73  
  *Katrin Franke and Mario Köppen*
1C: Preprocessing and Feature computation (II)

Background Elimination in Bank Checks using Greyscale Morphology . . . . 83
Santhosh Shetty, M. Shridhar and Gilles Houle

Stroke Level Modelling of On Line Handwriting through Multi-modal Segmental Models ............................................................. 93
T. Artières, J-M. Marchand, P. Gallinari and B. Dorizzi

Feature Selection using Genetic Algorithms for Handwritten Character Recognition .............................................................. 103
Gyeonghwan Kim and Sekwang Kim

A New Strategy for Improving Feature Sets in a Discrete HMM-based Handwriting Recognition System .................................................. 113
F. Grandidier, R. Sabourin, C.Y. Suen and M. Gilloux

1D: Multiple Classifiers, Agents and Combination Schemes (I)

On the Rejection Ability Required in Multiple Hypothesis Techniques . . . 123
Hiroshi Sako, Tastuhiro Kagehiro and Horomichi Fujisawa

Recognition Method for Cursive Japanese Word Written in Latin Characters 133
Kenichi Maruyama and Yasuaki Nakano

Classifier Combination: The Role of A-priori Knowledge ................. 143
V. Di Lecce, G. Dimauro, A. Guerriero, S. Impedovo, G. Pirlo and A. Salzo

Improvement of Recognition Accuracy using 2-stage Classification ....... 153
K. Ianakiev and V. Govindaraju

Support Vector Machines for the Classification of Western Handwritten Capitals .......................................................... 167
F. Wang, L. Vuurpijl and L. Schomaker

Invited Lecture

Reading Research in Motion .......................................................... 177
A.W. Hendriks
2A: Off-Line Recognition

Recognition and Verification of Touching Handwritten Numerals .......................... 179
Jie Zhou, Adam Krzyzak and Ching Y. Suen

Results from a Performance Evaluation of Handwritten Address Recognition Systems for the United States Postal Service ................................. 189
Donald P. D'Amato, Edward J. Kuebert and Alfred Lawson

A New Hybrid Approach for Legal Amount Recognition ................................. 199
V. Di Lecce, G. Dimauro, A. Guerriero, S. Impedovo, G. Pirlo and A. Salzo

2B: Hidden-Markov Modeling

HMM based High Accuracy Off-line Cursive Handwriting Recognition by a Baseline Detection Error Tolerant Feature Extraction Approach ................. 209
W. Wang, A. Brakensiek, A. Kosmala and G. Rigoll

Verification of Graphemes using Neural Networks in HMM based On-line Korean Handwriting Recognition System ................................. 219
Sung J. Cho, Jahwan Kim and Jin H. Kim

K-Means Clustering for Hidden Markov Models ................................. 229
Michael P. Perrone and Scott D. Connell

Data Driven Design of HMM Topology for On-line Handwriting Recognition 239
Jay J. Lee, Jahwan Kim and Jin H. Kim

NPen++: An On-line Handwriting Recognition System ................................. 249
S. Jaeger, S. Manke and A. Waibel

2C: Miscellaneous data processing

Two Tree-formation Methods for Fast Pattern Search using Nearest-neighbour and Nearest-centroid Matching ........................................ 261
L. Schomaker, D. Mangalagiu, L. Vuurpijl and M. Weinfeld

Accuracy Improvement of Handwritten Character Recognition by GLVQ 271
T. Fukumoto, T. Wakabayashi, F. Kimura and Y. Miyake

Generating New Samples from Handwritten Numerals based on Point Correspondence ........................................ 281
Minoru Mori, Akira Suzuki, Akio Shio and Sakuichi Ohtsuka
3A: On-Line and Off-Line

On the Complexity of Cognition
S. Jaeger

From Off-line to On-line Handwriting Recognition
P. Lallican, C. Viard-Gaudin and S. Knerr

A Fast Lexically Constrained Viterbi Algorithm for On-line Handwriting Recognition
Alain Lifchitz and Frederic Maire

3B: Usage of heterogeneous Information Sources

Improvement in Handwritten Numeral String Recognition by Slant Normalization and Contextual Information
Alceu de S. Britto Jr., Robert Sabourin, Edouard Lethelier, Flavio Bortolozzi and Ching Y. Suen

Multiple Feature Integration for Writer Verification
Sung-Hyuk Cha and Sargur Srihari

Off-line Handwriting Recognition using various Hybrid Modeling Techniques and Character N-grams
A. Brakensiek, J. Rottland, A. Kosmala and G. Rigoll

Neural Network-based Context Driven Recognition of On-line Cursive Script
Predrag Neskovic and Leon N. Cooper

Enhancing Cursive Word Recognition Performance by the Integration of all the Available Information
C. Scagliola, G. Nicchiotti and F. Camastra

3C: Post processing and Lexicon-driven Methods

Word Lexicon Reduction by Character Spotting
Didier Guillevic, Daisuke Nishiwaki and Keiji Yamada

Quantifying the Contribution of Language Modeling to Writer-independent On-line Handwriting Recognition
John F. Pitrelli and Eugene H. Ratzlaff
3D: Multiple Classifiers, Agents and Combination Schemes (II)

<table>
<thead>
<tr>
<th>Title</th>
<th>Pages</th>
</tr>
</thead>
<tbody>
<tr>
<td>Word Level Discriminative Training for Handwritten Word Recognition</td>
<td>393</td>
</tr>
<tr>
<td><em>Wen-Tsong Chen and Paul Gader</em></td>
<td></td>
</tr>
<tr>
<td>Active Handwritten Word Recognition</td>
<td>403</td>
</tr>
<tr>
<td><em>Jaehwa Park and Venu Govindaraju</em></td>
<td></td>
</tr>
<tr>
<td>Handwritten Text Recognition using a Multiple-agent Architecture to Adapt the Recognition Task</td>
<td>413</td>
</tr>
<tr>
<td><em>L. Heutte, T. Paquet, A. Nosary and C. Hernoux</em></td>
<td></td>
</tr>
<tr>
<td>Two-stage character Classification: A Combined Approach of Clustering and Support Vector Classifiers</td>
<td>423</td>
</tr>
<tr>
<td><em>L. Vuurpijl and L. Schomaker</em></td>
<td></td>
</tr>
<tr>
<td>Hybrid Schemes of Homogeneous and Heterogeneous Classifiers for Cursive Word Recognition</td>
<td>433</td>
</tr>
<tr>
<td><em>Jin Ho Kim, Kye Kyung Kim and Ching Y. Suen</em></td>
<td></td>
</tr>
<tr>
<td>Variants of the Borda Count Method for Combining Ranked Classifier Hypotheses</td>
<td>443</td>
</tr>
<tr>
<td><em>M. van Erp and L. Schomaker</em></td>
<td></td>
</tr>
<tr>
<td>Cascading Multiple Classifiers and Representations for Optical and Pen-based Handwritten Digit Recognition</td>
<td>453</td>
</tr>
<tr>
<td><em>E. Alpaydin, C. Kaynak and F. Alimoglu</em></td>
<td></td>
</tr>
</tbody>
</table>
Posters

Unconstrained Handwriting Recognition: Language Models, Perplexity and System Performance ........................................ (P01) 463
Urs-Viktor Marti and Horst Bunke

Adaptive Context Processing in On-line Handwritten Character Recognition ............................................................... (P02) 469
Naomi Iwayama and Kazushi Ishigaki

An Investigation into the use of Linguistic Context in Automatic Cursive Script Recognition ........................................... (P03) 475
N.H. Brammall, J.H. Connolly and C.J. Hinde

A Method for Handwriting Input and Correction on Smartphones ................................................................. (P04) 481
Gareth Loudon, Olle Pellijeff, Li Zhong-Wei and Hans Hall

Analytic Word Recognition without Segmentation based on Markov Random Fields ................................................. (P05) 487
Christophe Choisy and Abdel Belaid

Off-line Cursive Script Recognition based on Continuous Density HMM ............................................................... (P06) 493
A. Vinciarelli and J. Luettin

A Simple and Effective Cursive Word Segmentation Method ...................................................................................... (P07) 499
G. Nicchiotti, S. Rimassa and C. Scagliola

The Segmentation of a Text Line for a Handwritten Unconstrained Document using Thinning Algorithm ....................... (P08) 505
Shinji Tsuruoka, Yusuke Adachi and Tomohiro Yoshikawa

An Approach for Active Segmentation of Unconstrained Handwritten Korean Strings using Run-Length Code .................. (P09) 511
Jason JeongSuk Yoon and Gyeonghwan Kim

A New Method for Automatic Handwriting Quality Measurement .............................................................................. (P10) 517
Jeong-Seon Park and Seong-Whan Lee

Global and Strict Curve Fitting Method ......................................................................................................................... (P11) 523
Y. Nakajima and S. Mori

A Special Skeletonization Algorithm for Cursive Words .............................................................................................. (P12) 529
Tal Steinherz, Nathan Intrator and Ehud Rivlin

A Fractal Justification of the Normalization Step for Online Handwriting Recognition ...........................................(P13) 535
N. Vincent and B. Dorizzi
Similarity Measures for Writer Clustering

Jayashree Subrahmonia

Novel Rule-based Static and Dynamic Feature Extraction from Figure Copying Tasks for the Detection of Visuo-spatial Neglect

R.M. Guest, M.C. Fairhurst, J.M. Potter and N. Donnelly

A Perturbation-based Approach for Multi-classifier System Design

V. Di Lecce, G. Dimauro, A. Guerriero, S. Impedovo, G. Pirlo and A. Salzo

Word-matching Method based on the Projection of the Voting Matrix

T. Akagi, T. Hamamura and H. Mizutani

Enrolment Model Stability in Static Signature Verification

C. Allgrove and M.C. Fairhurst

Rapid Analytical Verification of Handwritten Alphanumeric Address Fields

C.K. Lee and Graham Leedham

A New Approach to Segment Handwritten Digits

L.S. Oliveira, E. Lethelier, F. Bortolozzi and R. Sabourin

Zoning Design for Handwritten Numeral Recognition

V. Di Lecce, G. Dimauro, A. Guerriero, S. Impedovo, G. Pirlo and A. Salzo

Character Recognition by Matching Sequences of Pseudo-stroke Positions and Directions

Hanhong Xue and Venu Govindaraju

A Moving Window Classifier for Off-line Character Recognition

M.S. Hoque and M.C. Fairhurst

Databases for Recognition of Handwritten Arabic Cheques

Yousef Al-Ouali, Mohamed Cheriet and Ching Suen

Two approaches for Modelling of state duration in Hidden Markov Model Application to On-line PAW Recognition

Mohamed Ali Mahjoub

AUTHOR INDEX