History of the International Workshops on Frontiers in Handwriting Recognition

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Abstract

In the last years, the series of International Workshop on Frontiers in Handwriting Recognition (IWFHR) has become a solid reference point for people working in the field and in fact a large scientific community is growing and consolidating.

The papers published in the eight proceedings of the IWFHR and referred in this paper give the possibility to discover the extraordinary evolution of the field and the enormous progress achieved.

1. The IWFHR Series

At the first time an International Workshop on Frontiers in Handwriting recognition was held at Concordia University in Montreal, Canada, on the 2nd and 3rd of April 1990. It was organized by Prof. C.Y. Suen. Seventeen papers were presented during the workshop, attended by about twenty-five participants.

The papers were collected in a book published by the "Centre for Pattern Recognition & Machine Intelligence" (CENPARMI) of the Concordia University (see Fig. 1) [1]. The book is organized into seven sections covering the most advanced topics in handwriting recognition at the date: "Handwriting Recognition and Cursive Scripts", "Preprocessing and Syntactic Analysis", "Structural Approach and Automatic Learning and Chinese Character Recognition", "Reading Unconstrained Handwriting with Bounded Context", "Handwritten Zipcode Recognition by Neural Networks", "On-going problems in Handwriting Recognition" and "Motor Aspects and Human Recognition".

Immediately after, Prof. S. Impedovo who was interested toward Handwriting Recognition since the beginning of the 70's years [2, 3, 4], a field that in the past had been considered of minor interest, had the idea to continue the meetings on Handwriting Recognition and to ask to Prof. J.C. Simon to cooperate with him in organizing a new workshop in handwriting recognition. On the bases of their exchanges, Impedovo and Simon decided together to organize, in September 1991, at the Chateau de Bonas – France, a new workshop in Handwriting Recognition with the aim to reach the important goal of how to understand, design and build systems for handwriting recognition. In this direction, a special effort was devoted to attract scientists from Industrial Companies. Many researchers, coming from AEG, ALCATEL, AT&T Bell Labs, Calera Recognition Systems, Daimler-Benz, Data Systems, ELSAG Bailey, Hitachi, IBM, Microsoft, Ricoh, Toshiba and WRITE participated to the workshop enriching the scientific community working in the field with their own viewpoints and prospects. In this manner was confirmed the opportunity to have a series of stable workshops on frontiers in Handwriting Recognition and the second meeting was celebrated.

Even though the second edition was organized just one year after the Workshop held in Montreal, the rapidly growing interest of researchers from Universities and Industrial Companies in the field of Handwriting Recognition, required a well-defined organization of the workshop. In particular, due to the large number of papers that were submitted, a five-day workshop was necessary to discuss them. The workshop was attended by seventy-six participants; thirty-one lectures were presented and eleven posters were shown.

The papers presented at the workshop were collected in the book "From Pixels to Features III - Frontiers in Handwriting Recognition", edited by S.Impedovo and J.C. Simon and published by North-Holland, in 1993 (see Fig. 2) [5]. The book contains 42 papers covering a wide variety of topics collected into five sections: "Data Acquisition and Preprocessing", "Character and Numeral Recognition", "Cursive Words Recognition" , "Signature Verification Systems" and "Parallel Architectures and Neural Networks for Handwriting Recognition". Several relevant papers are contained in the book.

Furthermore, in order to facilitate the introduction of young researchers to the field of handwriting recognition, and to give them both theoretically and practically powerful tools for the development of handwriting recognition systems, immediately after the second

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workshop an application was submitted by S. Impedovo to the NATO for organizing an Advanced Study Institute on "Fundamentals in Handwriting Recognition".

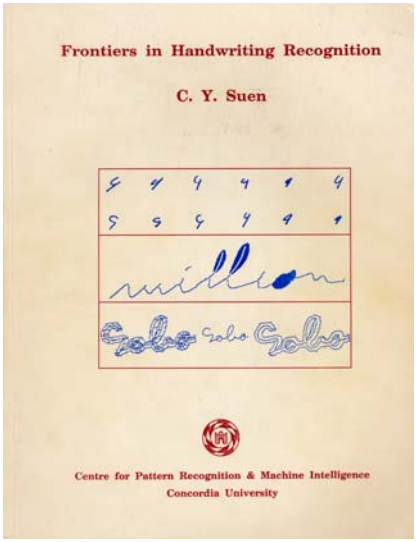

Figure 1.

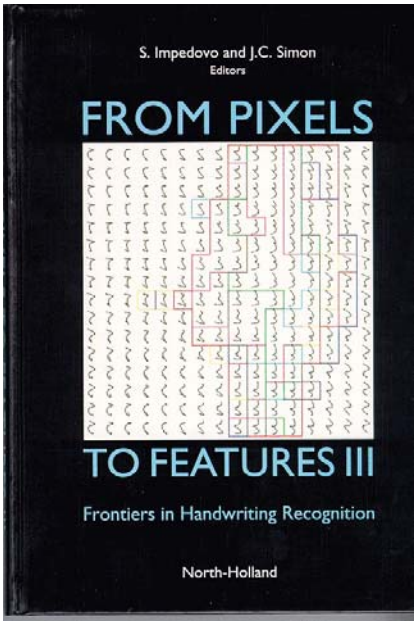

Figure 2.

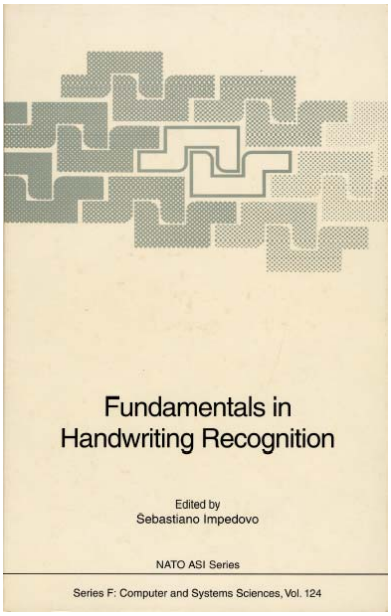

Figure 3.

It took place from June 21st to July 3rd , 1993. The aim of the Institute was to focus on the fundamental tools and ideas generally used in the handwriting recognition field. The most important algorithms for data acquisition, preprocessing, feature extraction, the most common databases and devices for online and off-line recognition were presented. The role of parallel machines and special networks in solving problems in the field was also discussed during the school. Seventy-eight participants attended eighteen lecturers and sixty students from fifteen different countries. The lectures presented were edited by Prof. S.Impedovo and published by Springer-Verlag, in the book entitled "Fundamentals in Handwriting Recognition" (see Fig. 3) [6]. The book contains several fundamental contributions.

The Third International Workshop on Frontiers in Handwriting Recognition was organized by Prof. Sargur N. Srihari, and was held at CEDAR, the Centre for Document Analysis and Recognition, in Buffalo, New York, from 25th to 27th of May 1993. The workshop underlined the necessity to work with specific data sets and some standard databases were distributed to participants. They have been then increased both with new data and new database type. Thirty oral presentations and twenty-five posters were included in the Workshop program and the papers were collected in a book published by the CEDAR (see Fig. 4) [7].

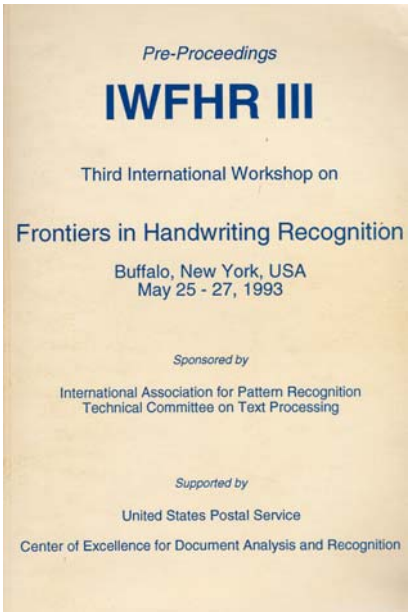

Figure 4.

Successively, the fourth International Workshop on Frontiers in Handwriting Recognition was organized for the first time in Asia, where there are many groups active in this field. The Workshop was held from 7th to 9th December 1994, in Taipei, Taiwan, and was organized by Prof. Jhing-Fa Wang. The program included thirty oral presentations and twenty-eight posters. The papers were collected in the book of proceedings (see Fig. 5) [8].

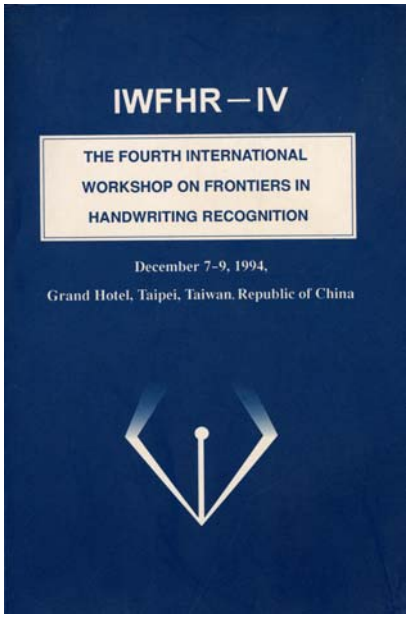

Figure 5.

The fifth edition of the International Workshop on Frontiers in Handwriting Recognition was held from 2nd to 5th of September 1996 at Colchester, in England. Chairmen of the Workshop were Prof. S. Impedovo and Prof. A.C.Downton. For the fifth edition of the Workshop, more than one hundred and fifty papers were submitted whereas only thirty oral presentations and fifty-five posters were selected. Representatives of several industrial companies were also present at the workshop: AEG Electro Com. Konstanz, AT & T Bell Lab., A2IA, Daimler Benz, ELSAG-Bailey, ERA Technology, Hyunday Electronics Industries, IBM, Motorola, Panasonic, Sanyo, SRTP/RD/RVA, Toshiba, Toyota.

Figure 6.

Due to the enormous technological progress, the Workshop dealt not only with the basic issues concerning the theoretical aspects of handwriting recognition, the new algorithms for handwritten character and word recognition, the problems of string recognition, gesture recognition and signature verification, but also with the emerging aspects related to other areas, like software engineering for designing complete reading systems. For this reason the program of the Workshop was planned specifically to provide a path linking the traditional research areas with the new trends of interest.

Three invited lectures were scheduled. The first one entitled "Recent Advances in offline handwriting recognition" was presented by Prof. S. N. Srihari and deals with general aspects of off-line handwriting recognition. It reported the most significant recent research advances achieved at the "Center of Excellence for Document Analysis and Recognition" (CEDAR) in Buffalo, USA. The lecture entitled "Improving

recognition rates by classifier combination" was presented by Prof. Josep Kittler, of the University of Surrey, UK. He focused on statistical classifiers, multi-expert systems and neural networks. The third invited lecture entitled: "The role of handwriting recognition in future reading systems" was presented by Dr. N. Bartneck of the Daimler-Benz Research Center, Germany.

The papers presented at the workshop were published by World-Scientific, in the book entitled "Progress in Handwriting Recognition", edited by Prof. A. C. Downton and Prof. S. Impedovo (see Fig. 6) [9]. The contents of this book have been divided into ten chapters each one corresponding to a specific topic. The first chapter is entitled "Word Recognition". The second chapter concerns with "Character Recognition", which is probably the most traditional field of handwriting recognition. It still remains attractive to researchers and research issues emerge continuously in this field. Chapter three is entitled "Feature Extraction" and points out the crucial relevance of features in the recognition process. It presents some new key ideas successfully used in handwriting recognition. The fourth chapter deals with "Statistical Approaches and Neural Networks". Chapter five is entitled "Multi-experts" and addresses the problems concerning with the use of multi-classifiers, which was becoming an established strategy for the development of recognition systems. The sixth and seventh chapters are devoted to "Classifiers" and "Future trends", respectively. The eighth chapter concerns to "Post-Processing". The title of the ninth chapter is "Reading Systems" while in the last chapter the "Applications" are presented.

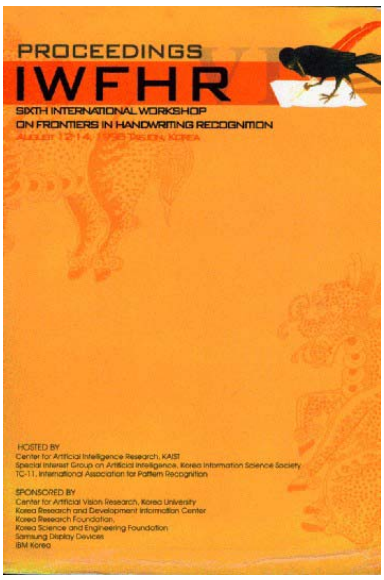

Figure 7.

The Sixth International Workshop on Frontiers in Handwriting Recognition was held on August 12-14, 1998 at KAIST, South Korea. The Workshop was organized by Prof. J.H.Kim. During the workshop thirty-four oral presentations and twenty-nine poster contributions have been arranged into several sessions: "On-line Handwriting Recognition I", "Handwritten Form Processing", "Handwritten Word Recognition", "Segmentation", "On-line Handwriting Recognition II", "Oriental Script Processing", "Numeral Recognition", "Emerging Techniques" and a "Poster" Session. All papers have been collected in a book of proceedings (see Fig. 7) [10].

Figure 8.

In 2000, the Seventh International Workshop on Frontiers in Handwriting Recognition was organized in Amsterdam, The Netherlands, in September 11-13. Chairmen of the workshop were Dr. L. Shomaker and Prof. S. Impedovo. The workshop was dedicated to the memory of Prof. J.C.Simon, who has been commemorated by the Invited Lecture presented by Prof. T. Pavlidis and entitled "Recollections of Conversations with Professor J.C.Simon"and the memorial of Prof. S. Impedovo http://www.iapr.org/simonL.html. Fourty-five oral papers and twenty-five posters were presented at the Workshop. All contributions have been collected in a proceeding book published by the "Nijmegen Institute for Cognition and Information" (NICI) (see Fig. 8) [11]. The book is organized into twelve Sections: "On-line Recognition", "Preprocessing and Feature Computation I", "Preprocessing and Feature Computation II", "Multiple Classifiers, Agents and Combination Schemes I", "Off-line Recognition", "Hidden Markov Models", "Miscellaneous data Processing", "On-line and Off-line",

"Usage of heterogeneous Information Sources", "Post processing and Lexicon-driven Methods", "Multiple Classifiers, Agents and Combination Schemes II" and "Posters", which collects all the poster presentations.

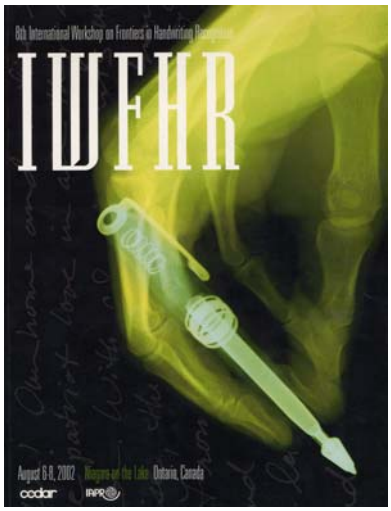

Figure 9.

The Eighth International Workshop on Frontiers in Handwriting Recognition was held in Niagara-on-the-Lake, Canada, from 6th to 8th August 2002. It was organized by Prof. S. N. Srihari and Prof. M. Cheriet. The papers were collected in a proceedings book published by the IEEE (see Fig. 9) [12] and including interesting papers that advance frontiers in the field by introducing new approaches inherited by the speech recognition field. The book is organized into the following Sections: "Classifier Design", "On-line Recognition", "Word Recognition", "Learning Methods", "Multiple Classifiers", "Pen Computing and Document Applications", "Signature Verification and Writer Identification", "Off-line Recognition" plus three Sections dedicated to the poster contributions.

Conclusion

In the last 15 years, the field of Handwriting Recognition has recorded an extraordinary progress and a lot of new algorithms and commercial systems have been produced.

Notwithstanding in this paper only a temporal description of the events is reported, in order to describe the effort made in the world in the direction of handwriting recognition, by reading the papers reported in the referenced proceedings, the evolution of the field can be found. The reader will convince himself of the motivations for the enormous development recorded and will discover the base for the attended extraordinary development that will be exploded in the next future, when more effective man-machine interaction systems will be produced.

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