

ICFHR 2010 Tutorial

Signature Verification - Forensic Examiners' Perception and Solutions for Off-Line and On-Line Signatures (Duration: 6 Hrs.)

Speakers

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Marcus Liwicki received his PhD degree from the University of Bern, Switzerland, in 2007. Currently he is a senior researcher and lecturer at the German Research Center for Artificial Intelligence (DFKI). His research interests include knowledge management, semantic desktop, electronic pen-input devices, on-line and off-line handwriting recognition and document analysis. For six months he visited Prof. Uchida in Kyushu University as a research fellow (after a successful application at the Japanese Society for the Promotion of Science). Marcus Liwicki is a member of the IAPR and frequent reviewer for international journals, including IEEE Transactions on Pattern Analysis and Machine Intelligence, IEEE Transactions on Audio, Speech and Language Processing, Pattern Recognition, and Pattern Recognition Letters. He is a member of the program committee of the IEEE ISM Workshop on Multimedia Technologies for E-Learning, and a reviewer of several IAPR conferences and the IGS conference. Marcus Liwicki is a co-author of the book "Recognition of Whiteboard Notes – Online, Offline, and Combination", published by World Scientific in October 2008. He has more than 30 publications, including seven journal papers.

Marcus Liwicki wrote several publications for international conferences and journals in the area of writer identification and verification. He participated in the SigComp09 and is member of the organizers of the 4NSigComp2010. He is a lecturer at the University of Kaiserslautern and gave already a series of invited lectures with international audience.

Michael Blumenstein is an Associate Professor and Dean (Research) of the Science, Environment, Engineering and Technology Group at Griffith University in Queensland, Australia where he previously served as Head of the School of Information and Communication Technology. Michael obtained his PhD in 2001 in the area of Intelligent Techniques for Handwriting Recognition from Griffith University. As part of his PhD work he proposed a novel technique for the automatic segmentation of cursive handwriting using neural-based techniques. His current research interests include the areas of Pattern Recognition, specializing in Handwriting Recognition and Signature Verification as well Artificial Intelligence (specifically Machine learning and Neural Networks) and its applications. He has published over 80 papers in refereed conferences, journals and books in these areas. Michael has successfully secured a number of internal/nationally competitive grants to undertake research in these areas with funds exceeding \$3.5 Million Dollars. Michael has also been invited to serve on a number of Journal Editorial Boards and to act as organizing chair, program chair and committee member for a number of national/international conferences in his areas of expertise. Most recently he has been invited to serve on the program committees of the International Conference on Document Analysis and Recognition (ICDAR 2009 & 2011) and the International Conference on the Frontiers of Handwriting Recognition (ICFHR 2010) where he also serves as competition co-chair. Michael is the Gold Coast Chapter Convener of the Australian Computer Society, a Board Member of Software Queensland, and a Member of the IEEE. In 2009 he was named as one of Australia's Top 10 Emerging Leaders in Innovation in the Australian's Top 100 Emerging Leaders Series supported by Microsoft.

Michael has been invited to give numerous presentations and lectures in the areas of handwriting recognition and off-line signature verification at a number of universities and research institutes around the world. He has also been invited to present as a Keynote Speaker at national and international conferences. In addition, Michael is one of the organizing members of the 4NSigComp2010 at ICFHR.

Elisa van den Heuvel started in 2005 as scientific forensic handwriting expert at Netherlands Forensic Institute. Her scientific background lies primarily in human motor control with special emphasis on handwriting/signature movement execution. In chronology, she received her M.Sc. from Radboud University of Nijmegen in 1996, and her Ph.D. at Vrije Universiteit Amsterdam (VUA) in 2000. During her PhD research she also worked at Motor Control Lab, Arizona State University, Tempe, USA as a visiting research scholar. In 2000, she started as postdoc at Biomechanics at VUA where she studied preclinical symptoms of Parkinson's disease. Since 1997, Elisa van den Heuvel has published several journal articles and peer reviewed conference articles. She is a board member of the International Graphonomics Society since 2008. Elisa co-organized a Signature Verification Competition for on- and offline Skilled Forgeries (SigComp09) facilitated by the conference organization of ICDAR 2009, Barcelona, Spain, and co-presented Tutorials on Computational Forensics and Forensic Handwriting Expertise at ICDAR2007 and ICDAR2009. She has been invited to give lectures and workshops at international forensic conferences about the current status of and her ongoing research in forensic handwriting analysis and is one of the organizing members of the 4NSigComp2010 at ICFHR2010.

Bryan Found, is the Head and Senior Research Fellow of the Forensic Expertise Profiling Laboratory, School of Human Biosciences, Latrobe University, Australia. He is also a Senior Forensic Officer in the Document Examination Unit of the Victoria Police Forensic Services Department. Bryan holds a Bachelor of Science, a Graduate Diploma in Education, a Graduate Diploma in Neurosciences and a PhD in forensic handwriting

science. He is a former president of the Victorian Branch of the Australian and New Zealand Forensic Science Society, a member of the American Society of Questioned Document Examiners, a member of the International Graphonomics Society, an Editorial Board member of the Journal of Forensic Document Examination and a member of the Advisory council for Skill-Task, Training and Research, Inc. (USA). Dr Found provides sessional teaching in forensic document science and interpretive evidence at Latrobe, Deakin, Swinburne and Melbourne Universities. He regularly provides expert workshops in forensic handwriting science and interpretative evidence at conferences in Australasia, America, Canada, Africa and Europe. Dr Found has an extensive international publication record and is the author of the chapter on handwriting and signature examination in the recently released Wiley Encyclopaedia of Forensic Science. He has been accepted as an expert at all levels of the Victorian Court system. His research interests include the characterisation of the probative value of expert opinions on pattern evidence, the objective assessment of forensic practitioner skill characteristics and the study of handwriting behaviours to model the usefulness of movement outcome examinations with respect to forensic individualisation.

Abstract

In this tutorial we will give insights into the daily work to be performed by professional FHEs and give examples for their case-work. Furthermore, we will give an overview on the work done in the pattern recognition area and a comparison of state-of-the-art automatic verification systems. In the second half we will introduce two automatic approaches for off-line and on-line signature verification with more detail and explain all the processing steps. Additionally, we will provide parts of these systems as a starting point for the development of identification systems for the participants.

Topics to be Covered

Part 1: morning session - overview and background

Introduction

Forensic handwriting examination in general

- How experts make comparisons (similarities versus differences, subjectivity)
- Natural variation
- Line quality (including writing instruments)
- Known versus questioned handwriting and signatures
- Quality versus quantity
- What can be learned from movement control studies

FDE Conclusions

- Conclusion scales
- Bayesian framework
- Proficiency tests, problems for FDEs
- How much can the FDE say, how far can we go

Example Cases

Tools for FHE

- Existing forensic systems: FISH, WANDA, CEDAR-FOX, FBI-system
- Searching a database of threatening letters

History of automatic signature verification

- Problem classification
- On-Line vs. off-Line
- Related tasks

State-of-the-art verification techniques

- Seminal work
- Recent advances

Comparison issues

- General problems
- Data sets
- Benchmarks
- ICDAR'09 competition
- ICFHR'10 competition

Part 2: afternoon session - implement an automated system

Off-line signature verification

- Data processing
- Recovery of temporal information from off-line data
- Features
 - o Local vs. Global
 - o Modified Direction Feature
 - o Curvature
- Neural Networks
- Example experiments

On-line signature verification

- Data processing
- Features
 - o Combined on-line and off-line features
 - o Feature subset selection
- Gaussian Mixture Models and Support Vector Machines
- Example experiments

Conclusion, Remarks, and Future Work

- Open problems
- Other languages
- Demands of FHEs
- Next competitions