Lecture Notes in Computer Science 6010

Commenced Publication in 1973
Founding and Former Series Editors:
Gerhard Goos, Juris Hartmanis, and Jan van Leeuwen

Yun Q. Shi (Ed.)

Transactions on Data Hiding and Multimedia Security V

Volume Editor

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Library of Congress Control Number: Applied for

CR Subject Classification (1998): K.6.5, E.3, C.2, D.4.6, I.4, I.5

LNCS Sublibrary: SL 1 – Theoretical Computer Science and General Issues

ISSN 0302-9743 (Lecture Notes in Computer Science)
ISSN 1864-3043 (Transactions on Data Hiding and Multimedia Security)
ISBN-10 3-642-14297-4 Springer Berlin Heidelberg New York
ISBN-13 978-3-642-14297-0 Springer Berlin Heidelberg New York

Typesetting: Camera-ready by author, data conversion by Scientific Publishing Services, Chennai, India
Printed on acid-free paper 06/3180

Preface

This issue contains a special section on "Forensic Image Analysis for Crime Prevention," edited by Yan, Bouridane and Kankanhalli, containing two papers. In addition, the issue also contains four regular papers. The first paper by Cha and Kuo reviews recent development of multi-carrier code division multi-access (MC-CDMA)-based fingerprinting systems, presents new results on capacity, throughput, and distortion of a colluded media file, and points out important open research problems. To prevent illegal matching, Ito and Kiya propose in the second paper a phase correlation-based image matching in scrambled domain. The last two papers by Weir and Yan deal with visual cryptography. In the former, a comprehensive survey on visual cryptography is presented, which summarizes the latest developments, introduces the main research topics, and outlines directions and trends for future research. In the latter, a more powerful visual cryptographic scheme is proposed, in which multiple secrets are considered and a key share is generated for all the secrets.

We hope that this issue is of great interest to the research community and will trigger new research in the field of data hiding and multimedia security. Finally, we want to thank all the authors, reviewers, editors and special section organizers, who have devoted their valuable time to the success of this fifth issue. Special thanks go to Springer and Alfred Hofmann for their continuous support.

April 2010

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LNCS Transactions on Data Hiding and Multimedia Security

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Introduction to the Special Section on Forensic Image Analysis for Crime Prevention

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Digital image forensics involves performing complex analysis tasks on a large set of image data, which are of usually low quality, to detect useful and highly discriminative patterns. Pattern recognition has been suggested as a possible solution, and a lot of research has been devoted to the development of highly efficient systems for digital image forensic problems.

This special section on "Forensic Image Analysis for Crime Prevention" aims at presenting some of the recent research results in the area of digital image forensics. The objective of this special section is to highlight some quality research efforts that address the challenges in the emerging area of image-based evidence for forensic science and crime prevention applications with a view to provide the readers (researchers and forensic scientists) with an overview of the state of the art in this field. After several rounds of reviews, two papers were selected for publication in this special section.

The first contribution introduces partial palmprint matching using invariant local minutiae descriptors. In forensic investigations, it is common for forensic investigators to obtain a photograph of evidence left at the scene of crimes to aid them catch the culprit(s). Although fingerprints are the most popular evidence that can be used, crime scene officers claim that more than 30% of the evidence recovered from crime scenes originates from palms. Usually, the palmprint evidence left at crime scenes is partial with full palmprints obtained very rarely. In particular, partial palmprints do not exhibit a structured shape and often do not contain a reference point that can be used for their alignment to achieve efficient matching. This makes conventional matching methods based on alignment and minutiae pairing, as used in fingerprint recognition, to fail in partial palmprint recognition problems. In this paper, a new partial-to-full palmprint recognition approach based on invariant minutiae descriptors is proposed where the partial palmprint's minutiae are extracted and considered as the distinctive and discriminating features for each palmprint image. This is achieved by assigning to each minutiae a feature descriptor formed using the values of all the orientation histograms of the minutiae at hand. This allows for the descriptors to be rotation invariant, thus avoiding any image alignment at the matching stage. The results obtained show that the proposed technique yields a recognition rate of 99.2%. The solution can potentially provide high confidence to judicial juries in their deliberations and decisions.

The second contribution is concerned with color-based tracing in real-life surveillance data where variations in viewpoint, light source, background and shading are encountered. Tracing is a new problem in the area of surveillance video analytics – it is related to, but is substantially different from, tracking. Given that a suspect can be captured on multiple cameras distributed over time and space, tracing aims to link the tracked person across such multiple data collections. All these variations in

ambient conditions impact on the appearance of the person in the data in many ways. Moreover, the suspect can deliberately alter his appearance in order to avoid detection. To develop automated systems for analytics, methods needed are that are robust to all these variations. In this paper, the authors discuss what types of invariance can be introduced to deal with these variations. They discuss tracing methods that can use these invariance characteristics to deal with real-life data and show that tracing algorithms can obtain better results if the algorithm is made invariant to specific changes in the data. This empirical work is a first toward developing robust tracing algorithms.

Both of the papers in this section were selected after stringent peer review and expert scrutiny. It represents the leading front of research in this very vital area of forensic image analysis. Overcoming the challenging research problems in this area requires a significant amount of intellectual resources, but we are very confident that it will attract substantial efforts in the future. In a certain sense, this special section is a small sampler of the exciting future of digital forensics.

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