

Chapter 15

SUPER-RESOLUTION VIDEO ANALYSIS FOR FORENSIC INVESTIGATIONS

Ashish Gehani and John Reif

Abstract Super-resolution algorithms typically improve the resolution of a video frame by mapping and performing signal processing operations on data from frames immediately preceding and immediately following the frame of interest. However, these algorithms ignore forensic considerations. In particular, the high-resolution video evidence they produce could be challenged on the grounds that it incorporates data or artifacts that were not present in the original recording.

This paper presents a super-resolution algorithm that differs from its counterparts in two important respects. First, it is explicitly parameterized, enabling forensic video analysts to tune it to yield higher quality in regions of interest at the cost of degraded quality in other regions. Second, the higher resolution output is only constructed in the final visualization step. This allows the intermediate refinement step to be repeatedly composed without tainting the original data.

Keywords: Video recordings, super-resolution analysis, parameterization

1. Introduction

Surveillance cameras are ubiquitous – monitoring potential interlopers, vehicular traffic and pedestrians, ATM users, and shoppers at stores. When a crime occurs, the recorded footage is often used to identify the perpetrator, the location of the incident and the sequence of events that transpired. Meanwhile, video cameras are commonly embedded in mobile devices such as cell phones and PDAs, enabling users to opportunistically produce recordings of incidents that may subsequently serve as evidence in legal proceedings.

Obviously, the better the quality of a video recording, the greater its value to an investigation and subsequent legal proceedings. However, for a variety of reasons, including lighting, camera features, distance,

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Advances in Digital Forensics III Philip Craiger, Sujeet Sheno, 2007-11-14 In 2006 the Federal Bureau of Investigation FBI processed more than two petabytes of digital evidence in 2007 the volume of digital evidence processed will exceed four petabytes Electronic devices are becoming smaller and more diverse memory capacities are increasing according to Moore's Law distributed networks are growing massively in size and scale As society embraces new technologies and applications with gusto digital information will become even more pervasive Digital investigations already involve searching for the proverbial needle in the haystack In five years possibly sooner investigators will have to find the one needle in unimaginably large stacks of needles How will the FBI approach digital investigations of the future How will state and local law enforcement agents cope Digital forensics the scientific discipline focused on the acquisition preservation examination analysis and presentation of digital evidence will have to provide solutions The digital forensics research community must initiate serious efforts to develop the next generation of algorithms procedures and tools that will be desperately needed This book Advances in Digital Forensics III is the third volume in the annual series produced by the IFIP Working Group 11.9 on Digital Forensics an international community of scientists engineers and practitioners dedicated to advancing the state of the art of research and practice in the emerging discipline of digital forensics The book presents original research results and innovative applications in digital forensics

Handbook of Digital Forensics of Multimedia Data and Devices
Anthony T. S. Ho, Shujun Li, 2015-07-24 Digital forensics and multimedia forensics are rapidly growing disciplines whereby electronic information is extracted and interpreted for use in a court of law These two fields are finding increasing importance in law enforcement and the investigation of cybercrime as the ubiquity of personal computing and the internet becomes ever more apparent Digital forensics involves investigating computer systems and digital artefacts in general while multimedia forensics is a sub topic of digital forensics focusing on evidence extracted from both normal computer systems and special multimedia devices such as digital cameras This book focuses on the interface between digital forensics and multimedia forensics bringing two closely related fields of forensic expertise together to identify and understand the current state of the art in digital forensic investigation Both fields are expertly attended to by contributions from researchers and forensic practitioners specializing in diverse topics such as forensic authentication forensic triage forensic photogrammetry biometric forensics multimedia device identification and image forgery detection among many others Key features Brings digital and multimedia forensics together with contributions from academia law enforcement and the digital forensics industry for extensive coverage of all the major aspects of digital forensics of multimedia data and devices Provides comprehensive and authoritative coverage of digital forensics of multimedia data and devices Offers not only explanations of techniques but also real world and simulated case studies to illustrate how digital and multimedia forensics techniques work Includes a companion website hosting continually updated supplementary materials ranging from extended and updated

coverage of standards to best practice guides test datasets and more case studies **Selfie Biometrics** Ajita Rattani,Reza Derakhshani,Arun Ross,2019-09-21 This book highlights the field of selfie biometrics providing a clear overview and presenting recent advances and challenges It also discusses numerous selfie authentication techniques on mobile devices Biometric authentication using mobile devices is becoming a convenient and important means of verifying identity for secured access and services such as telebanking and electronic transactions In this context face and ocular biometrics in the visible spectrum has gained increased attention from the research community However device mobility and operation in uncontrolled environments mean that facial and ocular images captured with mobile devices exhibit substantial degradation as a result of adverse lighting conditions specular reflections and motion and defocus blur In addition low spatial resolution and the small sensor of front facing mobile cameras further degrade the sample quality reducing the recognition accuracy of face and ocular recognition technology when integrated into smartphones Presenting the state of the art in mobile biometric research and technology and offering an overview of the potential problems in real time integration of biometrics in mobile devices this book is a valuable resource for final year undergraduate students postgraduate students engineers researchers and academics in various fields of computer engineering **Advanced Fingerprint Recognition: From 3D Shape to Ridge Detail** Feng Liu,Qijun Zhao,David Zhang,2020-05-22 Fingerprints are among the most widely used biometric modalities and have been successfully applied in various scenarios For example in forensics fingerprints serve as important legal evidence and in civilian applications fingerprints are used for access and attendance control as well as other identity services Thanks to advances in three dimensional 3D and high resolution imaging technology it is now feasible to capture 3D or high resolution fingerprints to provide extra information and go beyond the traditional features such as global ridge patterns and local ridge singularities used in conventional fingerprint recognition tasks This book presents the state of the art in the acquisition and analysis of 3D and high resolution fingerprints Based on the authors research this book focuses on advanced fingerprint recognition using 3D fingerprint features i e finger shape level 0 features or high resolution fingerprint features i e ridge detail level 3 features It is a valuable resource for researchers professionals and graduate students working in the field of computer vision pattern recognition security biometrics practice as well as interdisciplinary researchers

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