Forensic Image Processing

Borengasser, M.; Rettich, K.L.; Vorder Bruegge, R.; Geradts, Z.J.

Publication date
2018

Document Version
Final published version

Published in
Proceedings of the American Academy of Forensic Sciences

Citation for published version (APA):

General rights
It is not permitted to download or to forward/distribute the text or part of it without the consent of the author(s) and/or copyright holder(s), other than for strictly personal, individual use, unless the work is under an open content license (like Creative Commons).

Disclaimer/Complaints regulations
If you believe that digital publication of certain material infringes any of your rights or (privacy) interests, please let the Library know, stating your reasons. In case of a legitimate complaint, the Library will make the material inaccessible and/or remove it from the website. Please Ask the Library: https://uba.uva.nl/en/contact, or a letter to: Library of the University of Amsterdam, Secretariat, Singel 425, 1012 WP Amsterdam, The Netherlands. You will be contacted as soon as possible.
The Proceedings of the American Academy of Forensic Sciences is an official publication of the American Academy of Forensic Sciences (AAFS). It is devoted to the publication of the abstracts of technical oral papers and posters presented at the AAFS Annual Scientific Meeting. These include various branches of the forensic sciences such as anthropology, criminalistics, digital evidence, engineering, immunology, jurisprudence, odontology, pathology, psychiatry, questioned documents, and toxicology. Similar submissions dealing with forensic-oriented aspects of the social sciences are also included.

Please note that some of the abstracts included in the Proceedings deal with topics, results, and/or conclusions that are controversial. The publication of abstracts does not imply that the AAFS, its sections, or the individual section program chairs/committee members have verified or agree with the studies, results, and/or conclusions of each abstract. During the process of planning a scientific program, it is impossible to “peer-review” each abstract and presentation to the degree that is accomplished during manuscript review. Abstracts and presentations are accepted, in part, so they can be critiqued and reviewed by other scientists. Thus, a forum is created to discuss controversial issues.

The views expressed in this publication are not those of the AAFS. The data and opinions appearing in the published material were prepared by and are the responsibility of the contributor(s), not of the AAFS nor its respective employees, employers, officers, and agents. The AAFS does not supply copies of meeting papers. Please write directly to individual authors to obtain copies of specific papers. Presentation of some abstracts may have been scheduled or canceled after the publication of this document.

English is the official language of the AAFS and its meetings; neither oral nor written translations will be provided.

Copyright 2018 by the AAFS. Unless stated otherwise, non-commercial photocopying of editorial material published in this periodical is permitted by the AAFS. Permission to reprint, publish, or otherwise reproduce such material in any form other than photocopying must be obtained from the AAFS.

Articles from the AAFS Proceedings should be officially cited in the following format:

Contents

Special Sessions ................................................................. 4

Breakfast Seminars ........................................................... 6

Luncheon Seminar ............................................................ 11

Evening Session ............................................................... 13

Workshops ........................................................................ 14

Scientific Sessions
  Anthropology ................................................................. 38
  Criminalistics ................................................................. 197
  Digital & Multimedia Sciences ........................................ 394
  Engineering Sciences ...................................................... 429
  General .................................................................... 463
  Jurisprudence .............................................................. 574
  Odontology ................................................................ 611
  Pathology/Biology ........................................................ 657
  Psychiatry & Behavioral Science ....................................... 800
  Questioned Documents .................................................. 840
  Toxicology ................................................................ 860
  Last Word Society ......................................................... 914

Financial Disclosure Index ................................................. 921

Key Word Index ................................................................ 951

Presenting Author Index ................................................... 966
The goal of this presentation is to provide a working knowledge of forensic image processing to enable an analyst to apply the optimum image processing algorithms to surveillance video and digital photography.

This presentation will impact the forensic science community by providing basic forensic image processing skills for the analyst. Surveillance video is nearly ubiquitous and a successful analyst is one who is familiar with forensic image processing and how to use it.

**Contrast:** A histogram can provide information about the amount of contrast in an image. Since image contrast is the difference in brightness between pixel values in a scene, the shape of the histogram is directly related to image contrast. For example, an image with a high level of contrast will have a broad-shaped histogram, but an image with low contrast will have a narrow histogram.

Pixel values in an image can be redistributed to a different range in an output image (i.e., histogram modification). This process has the effect of “stretching” or “compressing” the intensity range in the output image. If the pixel values are stretched to the full available range, then all pixel intensity values are utilized. This process can optimize the contrast and brightness of the output image.

**Spatial Filters:** Spatial filtering, or convolution, is an aspect of image processing. The process of filtering involves a moving window of array coefficients (i.e., weights). The size of an array, or kernel, is usually an odd number of pixels such as 3 x 3, 5 x 5, or 7 x 7. As the kernel is incrementally positioned through an image, the value of the pixel at the center of the kernel is multiplied by the value of the corresponding pixel in the image. For a given kernel position, all the kernel values are multiplied similarly and summed to produce a new output image. The next kernel step associates the next image pixel with the center of the kernel, and this process continues for the entire image.

The value of an output pixel from spatial filter is a function of the adjacent pixels in the original image. Spatial filters can be used to isolate the high and low frequency components of an image. High frequency components can be removed by either a low-pass filter or a rank filter.

**Low-Pass Filters:** Low-pass spatial filters are typically used to minimize Gaussian, or random noise. Ideally, the frequency of the noise is different from the frequency of the information in the image. The output pixel from a low-pass filter is a weighted sum of the adjacent pixels in the input image.

**Edge Operations:** Edge operations are types of spatial filtering in which each pixel is replaced with a weighted sum of the adjacent pixels. The type of edge operation is controlled by the weights that are applied to each of the adjacent pixels. For example, vertical or horizontal edge detection can be performed by choosing specific weights. There are two general objectives for edge operations: (1) increase image contrast; and, (2) detect edges within an image.

**Smoothing:** Image noise suppression via smoothing is a fundamental procedure in image enhancement. The trade-off for noise suppression is image blurring, which can be problematic for edges in a digital image. Noise suppression is usually accomplished with an averaging filter or a Gaussian filter.

Reference(s):


Image Processing, Surveillance Video, Digital Photography