



### C28 Validation of Image Processing Methods for Fingerprints

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Attendees will learn about which risks exist in different image processing methods. This presentation will demonstrate which kind of image enhancement methods can be used and what the limitations of the techniques are.

Forensic image processing has been used in forensic science for several decades. It started with publications concerning image processing on fingerprints, documents and video. Most forensic fields use some kind of image processing nowadays.

In Netherlands Forensic Institute laboratory several image processing methods are used for processing fingerprints :

- contrast stretching
- convolution filtering
- separation of colors
- dilation and erosion
- FFT techniques for filtering regular patterns

These methods are also used in combination and in local areas of the image. A question that arises when using these methods is if the methods have been validated (in order that no information is added that does not exist). Furthermore there is interest in new techniques that can be used for fingerprint enhancement with image processing (e.g. wavelet filtering).

The most common image processing methods as contrast enhancements are common knowledge, and do not have much risk of altering an image in such a way that the image alters in another image.

It is important to have new image processing methods validated and know what the risks are of these methods. For video image processing it is known that in some cases image processing, especially with methods such as super resolution, will result in the wrong conclusion. Another issue is that the software that will be used should be tested if it really does the image processing function that is requested.

More complicated methods such as FFT can degrade the image in such a way that the data can be altered. In 1993 this was mentioned in literature by E. Berg and in 1994 by S. Bramble.

In a *Frye* hearing in 1991 and a *Daubert* hearing in 1998 concerning image processing of fingerprints the methods were accepted in court without much discussion.

The authors will show several examples of image processing where this can be done in a proper way, without risk. The highest risk is when two fingerprints are overlapping and using FFT to filter one out.

For quality assurance, a test similar to the WSQ-validation test of the NIST has been carried out in the Netherlands. Images of fingerprints with different types and degrees of image processing are used and compared with the rolled prints. In a time frame of several weeks between the different sets, the latent print examiners are requested to find the minutiae that can be used for the comparison. The convincing points in the visible images should be pointed out. The points which were questionable are also pointed by the latent print examiner. Several latent print examiners were asked to do this test to have a more statistical sound evaluation of this test. The results of the comparison between processed images and the rolled prints are discussed. It appears that with extreme image processing some of the points are not correct. This situation can be avoided by always giving the processed and the image before image processing to the latent print examiner.

#### Fingerprints, Validation, Image Processing