# Using Deep Learning Methods for Forensic Image and Video Investigation

Geradts, Z.J.; Ruifrok, A.C.

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**AMERICAN ACADEMY OF FORENSIC SCIENCES**
410 North 21st Street
Colorado Springs, CO 80904
Phone: (719) 636-1100
Fax: (719) 636-1993
E-mail: membship@aafs.org
Website: www.aafs.org

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## C2 Using Deep Learning Methods for Forensic Image and Video Investigation

*Zeno J. Geradts, PhD*, Netherlands Forensic Institute, Laan van Ypenburg 6, Den Haag, SH 2497 GB, NETHERLANDS; and Arnout C. Ruifrok, PhD, Laan van Ypenburg 6, Den Haag 2497 GB, NETHERLANDS*

After attending this presentation, attendees will understand how to search through images based on deep learning methods.

This presentation will impact the forensic science community by illustrating how newly developed algorithms become available for use in forensic science and how they can be applied in casework. The possibilities and limitations will be discussed.

The amount of stored digital images and video material is growing very rapidly since the number of cameras are rapidly increasing, ranging from cameras of Closed-Circuit Television (CCTV) systems to smartphones, computers, and drones in combination with social networks. In complex crime cases or terrorist attacks, the number of images and videos that require processing are often too much to handle in a short period of time. Searching for a certain suspect or tracking persons in video images is often a challenge. To make the pre-processing for further forensic investigation more efficient, there are several approaches for assisting investigators with this process.

Deep learning techniques are now commonly used for searching through many images and videos. In this presentation, an overview is given of methods that are state of the art and which can help the forensic investigation with man-machine interaction. Due to increasing processing power, the deep learning techniques are more feasible to use, and searching in videos and images is easier; however, real-world images are often from different angles, have poor lighting, and other conditions are present that may make the retrieval more complicated.

In this presentation, several examples of deep learning are presented. Several computer vision techniques in combination are presented and the results for a database are also discussed.

More research in deep learning techniques is needed for optimizing the methods that can be used for searching quickly through many hours of video material and classifying the material by user-defined classes. One such example is the search of images of feet or hands that may be useful in child pornography cases in which suspects are only partially visible. Another interesting area is the example of an investigator searching for the brand and model of a camera based on images, where the images of known cameras and models are used as training materials. Another briefly discussed comparison is that of facial comparison.

Additionally, the presentation of retrieval results is a challenge, since most people can only actively search through image material for less than 30 minutes before they become tired and make too many mistakes in the retrieval process. More time is needed for forensic comparison, since it often requires a 1:1 comparison, which takes longer. A good pre-selection is important, and perhaps in the future, the results of deep learning methods can help in finding a likelihood ratio of a certain shape of a feature. Validation of these methods for use in forensic science is important; however, the current research is focused on how deep learning can assist forensic image and video investigation.

**Deep Learning, Multimedia, Searching**