



B10 A Review On Automatic Footwear Retrieval Systems From Crime Scene Shoe Marks

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After attending this presentation, attendees will have a clear understanding of the state of the art systems for the automatic retrieval of the footwear that left the shoe mark found at the crime scene and will gain a basic understanding of automatic “one to one” comparison techniques between the shoe mark and the suspect’s footwear.

This presentation will impact the forensic science community by providing knowledge of state of art automatic footwear retrieval systems, developed to help forensic scientists in finding the shoe that left the mark at the crime scene.

The activities performed during the crime scene analysis are of paramount importance for the investigation. The crime scene expert is in charge of the detailed documentation of the crime scene status, as well as the search for fingerprints, shoe prints, biological fluids, chemicals, firearms ammunition, and the collection of the items pertaining the crime for a later and deeper analysis in the laboratory.

In particular, shoe marks play a key role to understand the crime and can help investigators gain precious information: when there is no suspect or few elements are available, knowing the make and model of the shoe sole that left the shoe mark on the scene can point a path, while, on the other hand, if there is a known suspect, his or her shoes can be compared to the shoe mark found on the crime scene to evaluate his or her involvement in the criminal act.

Two different approaches can be followed in order to find the make and the model of the shoe which produced the shoe mark on the crime scene: (1) a forensic shoe print expert analyzes the shoe mark and looks for the corresponding shoe on electronic and paper catalogs; and (2) a footwear retrieval system is queried with the crime scene shoe mark, and the results of the query are then analyzed by the expert.

Some semi-automatic systems have been proposed and face the problem: shoe prints are classified by a human expert which describes them with a series of geometric patterns. This work will guide the audience through the systems proposed in literature, starting from the very first work to current algorithms. Fourier based systems, fractals based systems, invariant moments systems, and feature based systems will be shown and their working principles will be explained in all relevant details to guarantee their understanding. A comparison among

the different approaches will be made showing the advantages and disadvantages of each method under a forensic point of view.

Results of the performance of some of the most successful methods will be presented, both on synthetic and on real shoe marks, showing the difference between ideal and practical performance from the perspective of the forensic expert in the need to choose among one of the available approaches.

The presentation will end with a brief overview on automatic method to compare the shoe mark with the suspect’s footwear.

The audience will be aware of the advantages and disadvantages of the current state of the art on automatic footwear retrieval systems. **Shoe Mark, Automatic Retrieval System, Footwear**