

SICAR "OUTSOLE RECOGNITION" AT THE MARYLAND STATE POLICE

Alexander Mankevich
Latent Print Examiner-Expert
Maryland State Police

Abstract:

Computer-based "Outsole Recognition" programs such as SICAR (Shoeprint Image Capture and Retrieval) [1] provide valuable benefits to criminal investigators and to footwear examiners. This program is used to recognize the brand and model of footwear impressions while the investigation is still in its early stages and suspects are not immediately known. The "linking" of outsole recognition installations permits the sharing of footwear crime and suspect information amongst different jurisdictions. An outsole recognition program educates a footwear examiner to comprehend how common or unique certain outsole designs can be regarded, and provides a database of "new" outsoles, whose design and patterns are not altered by erosion from wear. The implementation of the SICAR program at the Maryland State Police Crime Laboratory is described.

Introduction

How SICAR Works:

SICAR consists of three main databases: Reference (i.e. "known" footwear), Active Crimes, and Suspect (i.e. "seized footwear"). These databases can be compared to each other and within each other, such as: Active Crimes to Reference; Suspects to Active Crimes; Active Crimes to Active Crimes; and Reference to Reference.

The pattern and design information depicted in the footwear impression or on the outsole is entered into the program by first selecting a region (toe, ball, arch, etc.) on the footwear or outsole image. Patterns appearing within the selected region are coded into the program by the use of icons that depict the patterns which commonly appear on footwear outsoles. Text which lists the footwear brand and model name, outsole features, and crime information is added to the program's customized text fields.

"When searching a database, a score is calculated for each shoeprint that is based on the number of

matching features with the current shoeprint. Upon completion of a search, a 'Match List' is prepared with the highest scoring prints appearing at the top of the list. All matching images can then be inspected. In this way, potential links can be established between scenes of crimes and with the footwear of suspects." [2]

Unlike CODIS or AFIS, SICAR's matching program is not based upon some biological or physiological uniqueness of the human being. Therefore, the scored "Matches" which are generated are not intended to be exclusively specific for that particular impression or outsole. SICAR's software is not geared toward infallibly generating the correct matching candidate in the number one position. Rather, the "Match List" is geared toward rapidly searching for, then displaying, all the significantly matching candidates so that they can be quickly and effectively viewed and verified by the user.

The computer screen displays side-by-side images of matching candidates that are recognized as corresponding to the footwear impression or outsole in question. Six images are displayed per page alongside an enlarged image of the impression or outsole being searched.

Both the coded impression (outsole or shoeprint) and the matching candidates can be printed out, along with the accompanying text for that image.

Releasing Match Results:

At the Maryland State Police (MSP) Crime Laboratory, matching candidates are passed on to the investigating agency in the form of a "SICAR Release," which is modeled after the concept of a "Press Release." The "SICAR Release" is accompanied by a cover page which clearly designates this

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release as "Preliminary Information," and states that a final shoe print report is to be issued by the Crime Laboratory at a later date.

Since the collection of known footwear outsoles in the database cannot be "up to the minute" current, any declared brand names and models of matching footwear are further accompanied by a disclaimer which states that the footwear depicted in the "SICAR Release" may not be the only Brand/Model which corresponds to the shoe print(s) in the case. Criminal Investigators are advised not to limit their search for footwear exclusively to the Brand/Model depicted in the "SICAR Release."

The "SICAR Release" is mailed to the named case investigator and to the Crime Scene Technician (CST) recovering the footwear evidence. This way, the CST is already informed of the footwear's brand and model if he/she were to continue to encounter this shoe print at future crime scenes. This action also creates a "positive feedback loop" to the CSTs, which encourages additional effort to locate and recover footwear impression evidence.

Forensic Science and Law Enforcement Benefits from Outsole Recognition Programs

All of the computerized database programs in use at crime laboratories are part of a larger effort by law enforcement to solve crimes. Databases represent "Information," which when *processed* becomes "Intelligence." The processed "Intelligence," which when *shared*, helps to solve crimes.

A database of footwear outsoles and footwear impressions, when continually updated, improved, and cross-searched, creates opportunities for law enforcement and forensic science in a number of ways.

Laboratory reports regarding footwear impression evidence are accompanied by print-outs of the images of both the crime scene footwear impression and the matching outsole(s). These images can be copied and distributed by the case investigator in his/her efforts to solve crimes. Of course, recognizing the brand/model of footwear impressions appearing at crime

scenes, along with having an image of the recognized outsole, is very valuable to case investigators prior to requesting or conducting search warrants for suspects' shoes. Likewise, knowing brand and model information prior to performing interviews or interrogations is equally valuable.

The footwear examiner benefits from improved knowledge and insights regarding the many footwear manufacturing aspects. Common outsoles that are placed on a variety of footwear brands and styles are readily recognized using a computerized footwear database. When such a common outsole is encountered, an informed footwear examiner is less likely to issue written reports that suggest that this outsole is placed exclusively on a single brand and model of footwear. The footwear examiner becomes more likely to know the various catalogs and stores at which a common outsole can be found.

A collection of "new" outsoles, whose design and patterns are not altered by erosion from wear, can assist a footwear examiner during shoe print comparisons. By knowing the original state of the outsole's pattern features, a footwear examiner can better judge the weight and significance of the wear pattern and the wear condition influences upon the footwear impression. This insight permits reports to be worded in a manner that conveys the "true" significance of the level of correspondence existing between the footwear and the footwear impression.

The benefit to criminal investigators is even more significant. A collection of footwear impressions from "Active Crimes" can be searched to recognize when a particular outsole is appearing at a number of crime scenes. An Outsole Recognition program can "link" crimes recorded as having different *modus operandi* (m.o.) and crime types, since the outsole's patterns are systematically and impartially coded and because the search for matching impressions is scored based upon the number of matching features. This "cold searching" benefit of computerized database programs has already proved its worth in AFIS, IBIS, and CODIS systems.

Clearly, the primary benefit of outsole recognition programs occurs when agencies from different jurisdictions become networked across jurisdictional lines.

These "linked" agencies are able to search each other's "Active Crimes" and "Suspects" databases in order to detect crimes committed by the same persons in both jurisdictions. Investigators can then contact their counterparts in the other jurisdiction(s) to share information that can lead to the closure of their cases.

A "Footwear Loophole" currently exists because (without networked outsole recognition programs) images of "wanted" shoe prints investigated by one police agency are not compiled in a computer database accessible by other police agencies. Nor do these agencies have the means to easily determine if the footwear they seek has already been seized. Without a linked network of outsole recognition programs, perpetrators can go on leaving their incriminating shoe prints at crime scenes without fear of being associated (i.e., linked) to all their crimes. Thus, perpetrators escape apprehension and prosecution simply because (unlike fingerprints) a shared network of "wanted" and "known" shoe print information is not currently available. The networking of outsole recognition installations is a solution designed to close this "Footwear Loophole."

The Current State of Outsole Recognition Programs

The collection of known footwear outsoles (unlike fingerprints, firearms, and DNA) is not mandated (in part or whole) by local, state, or federal law. The law enforcement community receives no assistance from any governmental or forensic organization that has been designated and funded to coordinate the collection of known footwear outsoles. There is no "centralized" database of outsoles to which outsole producers, footwear manufacturers, or retailers are required to submit their footwear products. Thus, no journal, publication, or software program can be purchased to provide a law enforcement agency with an updated collection of all the thousands of known shoe outsoles available throughout most first and second world countries. Unless an agency maintains its own database of outsoles, there are limited means to search footwear outsoles, including the unproductive method of going to shoe stores to flip over shoes in the hopes of stumbling upon the correct outsole.

"National" databases exist within certain countries [3],

but these are "stand-alone," non-commercial products. This nature prevents non-aligned law enforcement agencies from networking to these databases. Maryland State Police, for instance, cannot connect on-line with the FBI Laboratory's outsole database.

There are a few commercial systems available to law enforcement agencies; however, they are incompatible in terms of communicating with the other vendors. To date, no vendor has created a "national" central server to which numerous geographically dispersed law enforcement agencies can link. This is due in part to the cost of initial set up of a central server with its communication lines, and the yearly cost for maintaining the high-speed communication lines. The National Institute of Justice has recently passed on the opportunity to establish and fund such a network [4].

As of November 2002, Foster and Freeman, Ltd. lists fourteen (14) SICAR user sites in the states of Florida, Illinois, Maryland, Michigan, New York, North Carolina, Ohio, Oregon, Pennsylvania, and Texas.

The Effectiveness of SICAR at Maryland State Police

SICAR was originally installed at the MSP Crime Laboratory on June 23, 1999. Since then, two subsequent software upgrades have been delivered and installed. The MSP SICAR installation consists of approximately 5,000 outsoles in the "Reference" database, approximately 110 cases are kept in the "Active Crimes" database, over 100 cases in the "Archived Crimes" database, and the "Suspects" database is maintained around five seized outsoles at any given time.

In an effort to speed the search times, over 350 "older" outsoles from the software manufacturer's original "Reference" database were archived and removed from the "Reference" database. The MSP expects that, for continuing operations, the number of "Active Crimes" will be kept to around 120 cases, with cases older than nine months being automatically archived in the "Archived Crimes" database. Naturally, both the "Reference" and the "Archived

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Crimes” databases will continue to grow. Outsoles are kept in the “Suspects” database for eight months.

Since the MSP has investigative jurisdiction in the suburban and rural sections of the western, northeastern, and eastern shore regions of Maryland, SICAR has been tailored to reflect the “outdoors” environment of those regions. Thus, SICAR is weighted toward men’s outdoor boots (hiking, hunting, and work boots). Due to the prominence of the Chesapeake Bay in this region, an effort is also made to capture “nautical” footwear (sandals, moccasins, and water socks). Due to the presence of a number of military bases in this region, an effort is made to capture “service” footwear (combat, duty, military boots) as well.

Statistics kept for the calendar year 2001 revealed a “Hit” ratio of 66.6% on all unknown footwear impression searches launched against the “Reference” database. This means that over 66% of the unknown footwear impressions recovered from crime scenes were recognized for their brand/model names and this information was forwarded to the appropriate case investigators.

SICAR has assisted numerous law enforcement agencies country-wide and world-wide to recognize footwear impressions at their crime scenes. SICAR has been able to recognize the brand/model of footwear in over 20 cases from soliciting agencies during the period of August 1999 to November 2002. These agencies have typically attached a jpeg or gif image of the questioned footwear impression to an e-mail addressed to the MSP Crime Laboratory [5]. Search results have been e-mailed back to the soliciting agency with an attached jpeg image of the matching outsole.

SICAR has also been successful in recognizing the brand/model of footwear impressions posted on the “Wanted Page” hosted by the Marks Working Group of the European Network of Forensic Science Institutes (ENFSI). This part of their website has been established to make it possible for an examiner to immediately reach a worldwide audience with a request for outsole recognition or with any other footwear-related question. This webpage is managed

by the National Bureau of Investigation in Vantaa, Finland. The “Wanted Page” website address is <http://194.89.205.4/wgm/wanted/htm>. Your submissions can be e-mailed to wanted@krp.poliisi.fi or sirkka.mikkonen@krp.poliisi.fi, or submitted through normal mail [6].

Conclusion

SICAR has been invaluable to this footwear examiner as a “known source” of footwear outsoles, both for its outsole recognition capabilities, and for its value in providing an unworn standard for the “true” appearance of outsoles minus any obstructing wear or foreign materials. More confidence has been gained in establishing conclusions for footwear examinations and in the statements issued in written laboratory reports. “SICAR Releases” provide a positive feedback mechanism to CSTs, further reinforcing their efforts in locating and recovering footwear impression evidence as a productive outcome of their crime scene processing.

With the ability to code, store, and search unknown footwear impressions from crime scenes, SICAR has given structure, focus, and closure to footwear impression casework. The MSP Crime Laboratory receives a comparatively small number of known footwear submitted for comparisons. Most footwear impression cases fall into the “evaluation only” category. SICAR provides a clear “end-point” for footwear impression casework upon the recognition of the brand and model of footwear corresponding to the unknown footwear impression. Case files are closed and courtroom testimony is rendered with brand and model names of the footwear impression recognized, rather than being simply declared as “made by unknown brand.”

As with any computerized database capable of “cold hit” searches, SICAR must be constantly updated and modified in order to remain highly effective. This entails regularly going to shoe stores to photograph outsoles and then scanning and coding them into the “Reference” database. Catalogs and sports magazines are constantly made to reflect any changes to the model names and styles of footwear under which the outsole may be retailed. This has indeed become a labor-intensive effort. What is needed is the

financial and manpower support that other database programs such as IBIS and CODIS enjoy. The management staff at law enforcement agencies think nothing of funding, contracting out, and hiring additional staff to perform data entry for IBIS and CODIS programs, yet they are slow to realize that this same commitment needs to be enacted with footwear outsole programs.

Should you have any further questions regarding the SICAR program at the Maryland State Police Crime Laboratory, please contact the author:

Alexander Mankevich
Maryland State Police, Crime Laboratory Division
Latent Print Unit
1201 Reisterstown Road
Pikesville, Maryland 21208-3899
Tel: 410-653-4518 Fax: 410-653-4509

References

[1] Foster & Freeman, Ltd., 25 Swan Lane, Evesham, Worcestershire, England, WR11 4PE. USA office: 133 Swan Drive, Annapolis, Maryland 21401-9528. Contact Mr. Carl Brooks Tel: 888-445-5048 or Fax: 888-445-5049. For more information

regarding the SICAR program consult the following: website: <http://www.fosterfreeman.co.uk>; e-mail: sales@fosterfreeman.com.uk; or ask for the SICAR brochure at the Foster & Freeman, Ltd. vendor booth at any professional conference.

- [2] SICAR Version 3.4 User Manual, Foster & Freeman, Ltd., August 2001. p. 3.
- [3] List of some "National" footwear outsole databases: "FBI Shoe Print Database" - Federal Bureau of Investigation, Washington, DC; "NBI Shoeprint Database" - National Bureau of Investigation, Vantaa, Finland; "REBEZO" - Ministry of Justice, Rijswijk, The Netherlands; "Footwear Index" - Metropolitan Police, London, England.
- [4] National Institute of Justice - Science and Technology Solicitation FY2002, "Shoepoint Image Capture and Retrieval (SICAR) East Coast Network," April, 2002.
- [5] Kindly address requests for outsole recognition to Maryland State Police, Crime Laboratory Division, Latent Print Unit at msplablp@qis.net. Attach your shoe print images as either jpeg or gif files.
- [6] Mailing address for sending submissions to the Wanted Page: National Bureau of Investigation, Attention: Sirkka Mikknen, Post Office Box 285, 01301, Vantaa, Finland.