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Capture and analysis of 3D footwear evidence: New horizons and opportunities

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Footwear impressions provide an important source of evidence within a range of criminal investigations, placing suspects at a crime scene or linking multiple crimes, helping to gather criminal intelligence. Despite rapid advances in other areas of forensic science, the techniques and tools used to capture and analyze footwear evidence have hardly changed in over a hundred years. Tracks are still cast in plaster, photographed and compared visually. This is beginning to change as 3D imaging now offers a superior approach to the capture and analysis of footwear impressions. Until now however, the prohibitive investment in terms of equipment, software and training meant that it could only be applied in serious cases. Recent algorithmic developments in digital photogrammetry have dramatically improved 3D imaging, allowing easy operational deployment. Bulky and expensive 3D scanners are no longer required and a good 3D model can be created by a crime scene photographer simply taking a few extra moments to collect additional oblique photographs of footwear impression. By translating academic research on ancient footprints and technical 'know-how' into a freeware software product (www.digtrace.co.uk) the authors have placed 3D imaging at the disposal of every police force or forensic agency, allowing its application to any footwear evidence regardless of crime severity. This project was supported by a UK NERC Innovation Award with project partners from the UK Home Office and National Crime Agency. This paper demonstrates how comparison of 3D images, either multiple tracks or a track with a shoe sole, can be achieved and illustrates the advantages over other methods. For example, given a line of multiple tracks made by one individual using DigTrace it is possible to compute an average 3D track from the population. Similarly, using the same technology you can compare a track to a 3D model of a suspect's sole.

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