

## Publication

Unsupervised footwear impression analysis and retrieval from crime scene data

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Footwear impressions are one of the most frequently securedtypes of evidence at crime scenes. For the investigation of crime seriesthey are among the major investigative notes. In this paper, we introducean unsupervised footwear retrieval algorithm that is able to cope withunconstrained noise conditions and is invariant to rigid transformations. A main challenge for the automated impression analysis is the separationof the actual shoe sole information from the structured backgroundnoise. We approach this issue by the analysis of periodic patterns. Givenunconstrained noise conditions, the redundancy within periodic patternsmakes them the most reliable information source in the image. In thiswork, we present four main contributions: First, we robustly measurelocal periodicity by fitting a periodic pattern model to the image. Second, based on the model, we normalize the orientation of the image and compute the window size for a local Fourier transformation. In this way, we avoid distortions of the frequency spectrum through other structuresor boundary artefacts. Third, we segment the pattern through robustpoint-wise classification, making use of the property that the amplitudes of the frequency spectrum are constant for each position in a periodicpattern. Finally, the similarity between footwear impressions is measured by comparing the Fourier representations of the periodic patterns. Wedemonstrate robustness against severe noise distortions as well as rigidtransformations on a database with real crime scene impressions. Moreover, we make our database available to the public, thus enabling standardizedbenchmarking for the first time. edoc-URL http://edoc.unibas.ch/dok/A6328777

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