**A Robust Approach to Automatic Groove Identification in 3D Bullet Land Scans**

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**Abstract**

Land engraved areas (LEAs) provide evidence to address the same source-different source problem in forensic firearms examination. Advances in technology have led to new research on applying image-analysis algorithms to the automated, quantitative analysis of bullet evidence. One prominent example is an algorithm developed by Hare et. al ([1](#_bookmark1)) based on 3D imaging data of LEAs. Currently accepted best practice for collecting 3D images of bullet LEAs requires capturing portions of the neigh- boring groove engraved areas (GEAs). Analyzing LEA and GEA data separately is imperative to achieve high accuracy and precision in subsequent feature comparisons. However, existing standard statistical modeling techniques fall short when applied to the atypical structure of 3D bullet data, often failing to adequately separate LEA and GEA data. We developed a method for automated removal of GEA data based on robust locally weighted regression. This automated method was tested on high-resolution 3D scans of LEAs from Hamby set 44. This separation method outperforms current methods at separating LEA and GEA data.

*Keywords:* land engraved areas (LEAs), groove engraved areas (GEAs), 3D scans, bullet identification, automatic matching

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