Interactive Visualization Framework for Forensic Bullet Comparisons

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1. Introduction

Impressions left on fired bullets, known as Land Engraved Areas (LEAs), are crucial in forensic analyses to establish whether two discharged bullets originated from the same firearm barrel. Current practices rely on forensic examiners to manually assess similarity based on visual comparisons. This analysis can be aided through algorithmic comparisons, which rely on 3D topographic imaging to evaluate matching bullets. This presented work adds to that algorithmic framework by creating a visualization diagnostic tool to assess how accurate the predictions are. The framework is used to analyze a real-world case of mislabeled bullet scans.

1.1. Houston Persistence Data

The data used for this study comes from a set of 40 fired bullets in a Houston lab. 13 different firearms were used for the study, each being the same make and model. The first ten (firearms A-J) were produced consecutively, while the other three (firearms 1-3) were selectived randomly. For each firearm, 40 bullets were fired and collected. For each of the 40 bullets, there were six LEAs captured via topographic imaging. These LEAs are what are used for the analysis.

Therefore, the structure of the data is as follows:

- 13 firearms
  - For each firearm, 40 bullets
    - For each bullet, 6 images of Land Engraved Areas

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