Comparison of three similarity scores for bullet LEA matching

Lead Researchers: Susan Vanderplas, Melissa Nally, Tylor Klep, Christina Cadevall and Heike Hofmann
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OVERVIEW
As technology advances in the forensic sciences, it is important to evaluate the performance of recent innovations. Researchers funded by CSAFE judged the efficacy of different scoring methods for comparing land engraved areas (LEAs) found on bullets.

GOALS
- Evaluate the performance of scoring measures at a land-to-land level, using random forest scoring, cross correlation and consecutive matching striae (CMS).
- Consider the efficacy of these scoring measures on a bullet-to-bullet level.

THE STUDY
- Data was taken from three separate studies, each using similar firearms from the same manufacturer, Ruger, to compare land engraved areas (LEAs), areas on a bullet marked by a gun barrel’s lands — the sections in between the grooves on the barrel's rifling.
- Examiners processed the LEA data through a matching algorithm and scored it using these three methods:
  1. **Random Forest (RF):** A form of machine-learning that utilizes a series of decision trees to reach a single result.
  2. **Cross-Correlation (CC):** A measure of similarity between two series of data.
  3. **Consecutive Matching Striae (CMS):** Identifying the similarities between the peaks and valleys of LEAs.
CSAFE is a publicly funded organization headquartered at Iowa State University. The National Institute of Standards and Technology (NIST) is one of the center’s providers, supporting CSAFE as a nationally recognized Center of Excellence in Forensic Sciences, NIST Award # 70NANB15H176.

**RESULTS**

- The random forest algorithm struggled to identify damage to bullets that obscured LEAs caused by deficiencies in the gun barrel such as pitting from gunpowder or “tank rash” from expended bullets.
  - In future studies, examiners could pair the RF algorithm with another algorithm to assess the quality of the data and determine which portions can be used for comparison.
- All the studies used firearms from Ruger, a manufacturer picked because their firearms mark very well on bullets. Future studies can assess the performance of these scoring methods on firearms from different manufacturers with differing quality marks.

**FOCUS ON THE FUTURE**

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**LEARN MORE**

Access the full research study to learn more. [forensicstats.link/LEAMatching](https://forensicstats.link/LEAMatching)

*Additionally, explore relevant publications:*
- [forensicstats.link/Reproducibility-of-Automated-Bullet-Scores](https://forensicstats.link/Reproducibility-of-Automated-Bullet-Scores)
- [forensicstats.link/ChumbleyScore-and-Striae-on-BulletLEAs](https://forensicstats.link/ChumbleyScore-and-Striae-on-BulletLEAs)

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