cartridgeInvestigatR

An Interactive App for Cartridge Case Identification

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csafe
Center for Statistics and Applications in Forensic Evidence

Acknowledgements

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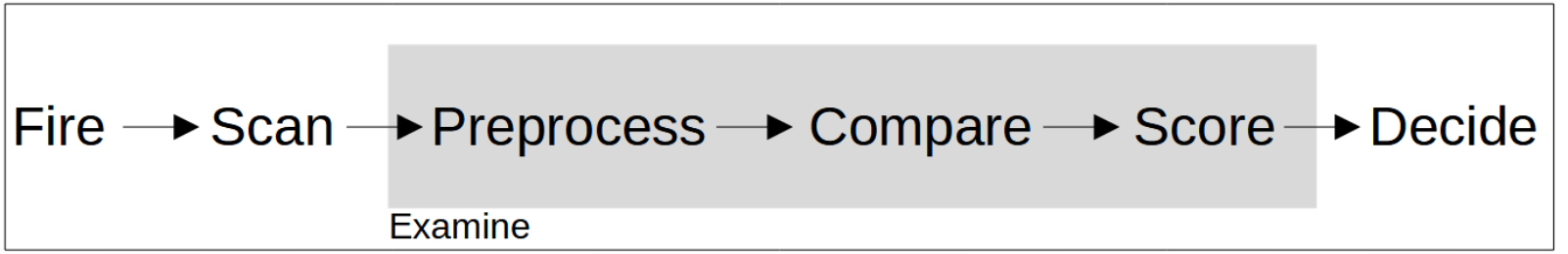


0) Data Collection: topographically scan fired cartridge cases

1) Preprocess: prepare cartridge case scans for comparison

2) Compare: compare two scans

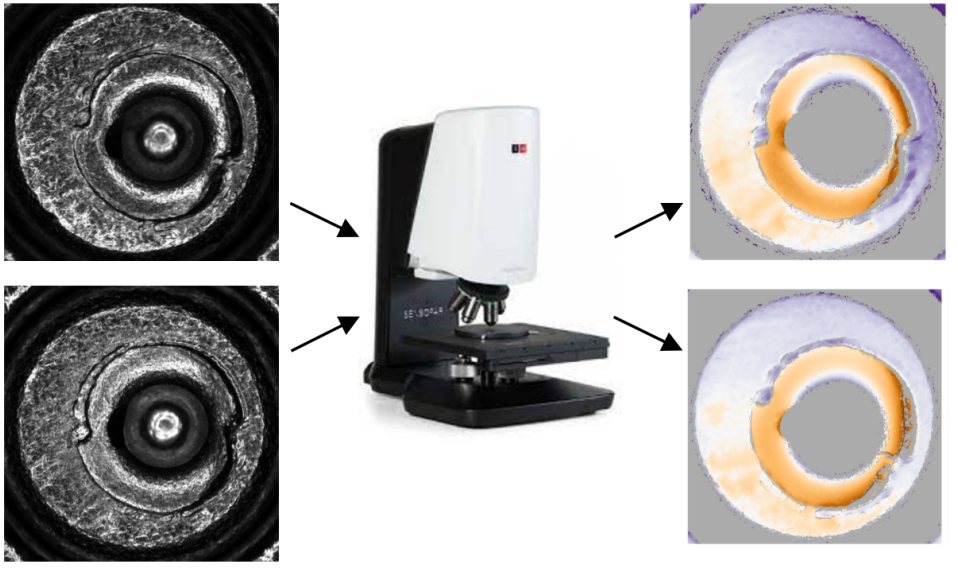
3) Score: calculate a similarity score based on comparison

Lastly, a conclusion is formed based on results of examination (e.g., identification, exclusion, inconclusive).

Our app encompasses the Preprocess, Compare, and Score steps

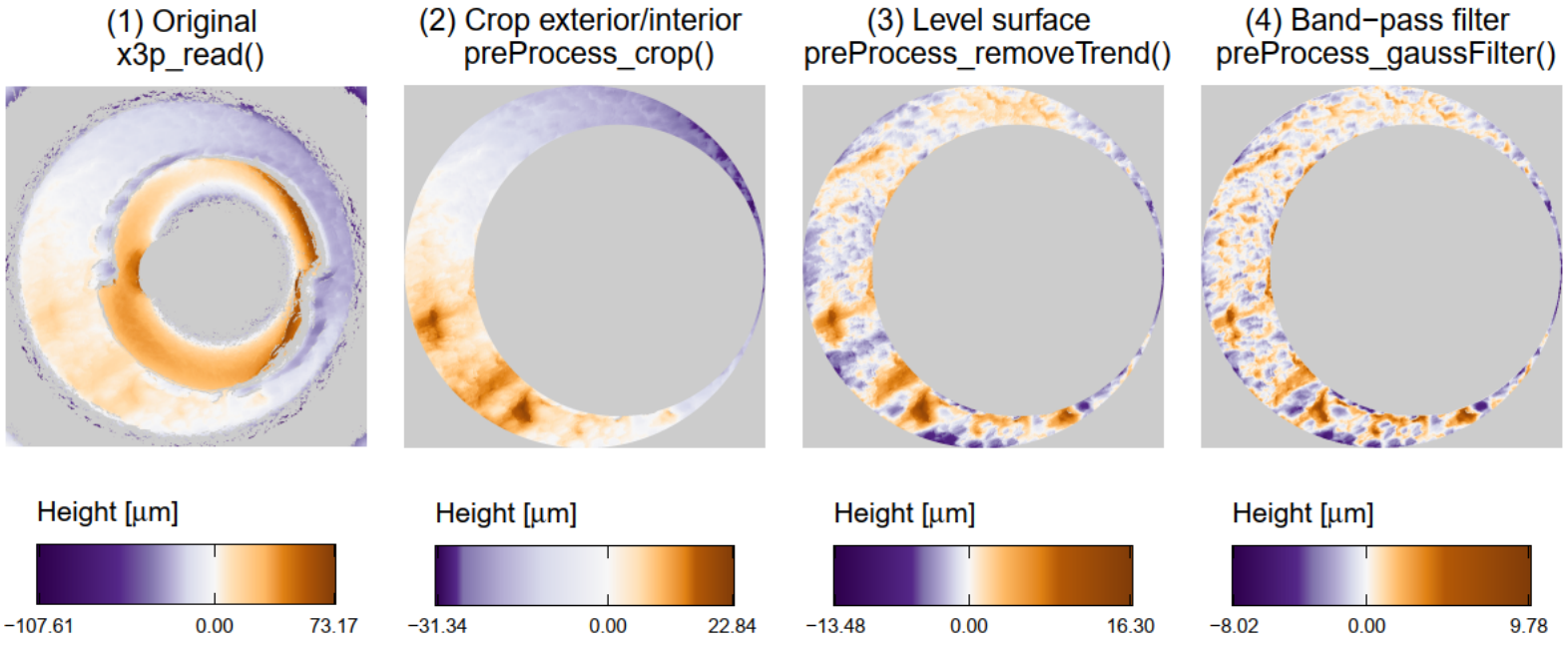
0) Data Collection

- Cartridge cases recovered from scene of shooting and from a suspect's firearm
    - Sufficient agreement between class characteristics
- Use 3D topographic scanner to scan cartridge cases
    - Scans are saved as x3p (XML 3D Surface Profile) files



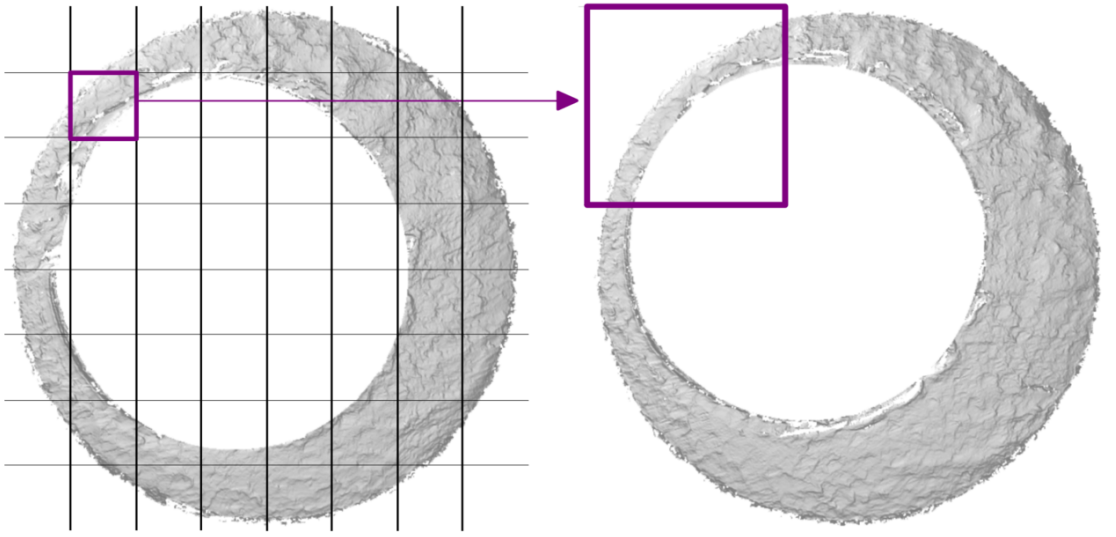
1) Preprocess

- Isolate: remove regions of cartridge case scan that do not contain breech face impressions.
- Emphasize: intensify BF impressions compared to other markings



2) Compare

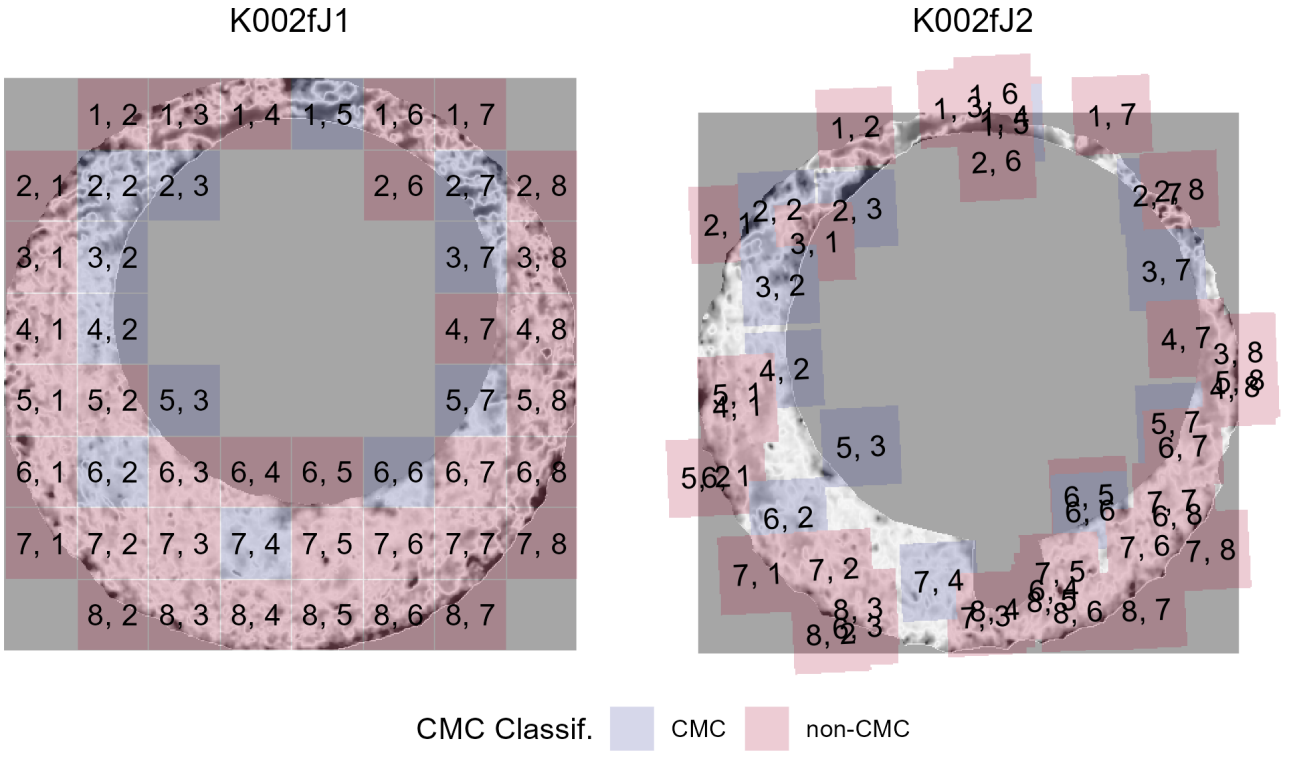
- Compare surfaces of two preprocessed cartridge case scans
- We use the cell-based procedure outlined in Song (2013):



1. Divide one scan into a grid of "cells"
2. Allow each cell to roam over the surface of the other scan
3. Determine where each cell aligns best by maximizing the cross-correlation

3) Score

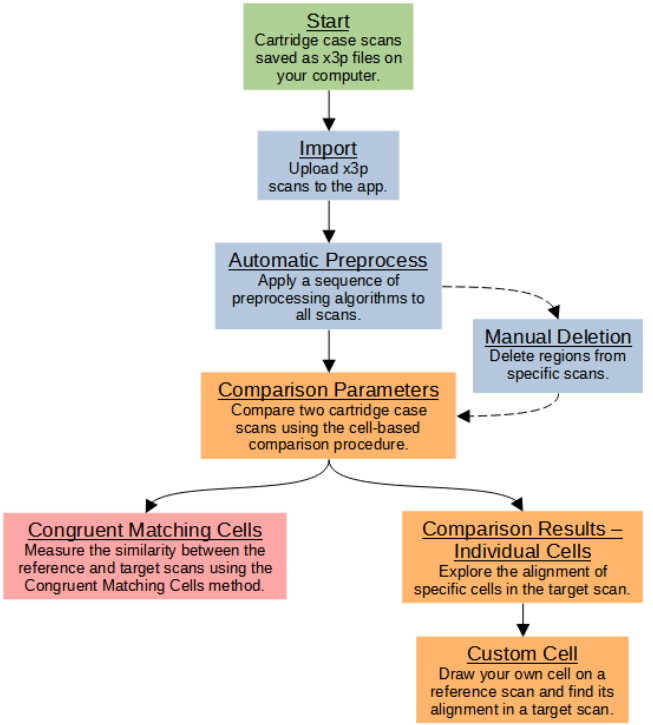
- Use comparison results to calculate a similarity "score."
- For example, Congruent Matching Cells method [Song, 2013]



- CMCs "agree" on where they align in the other scan

The `cartridgeInvestigatR` app

- We want non-programmers to engage with these algorithms
- Our app enables experimentation and learning



- csafe.shinyapps.io/cartridgeInvestigatR/

References

Zheng, X., Soons, J., Thompson, R., Singh, S., & Constantin, C. (2020). NIST Ballistics Toolmark Research Database. In Journal of Research of the National Institute of Standards and Technology (Vol. 125). National Institute of Standards and Technology (NIST). https://doi.org/10.6028/jres.125.004

J. Song. Proposed “NIST Ballistics Identification System (NBIS)” Based on 3D Topography Measurements on Correlation Cells. American Firearm and Tool Mark Examiners Journal, 45(2):11, 2013. URL https://tsapps.nist.gov/publication/get_pdf.cfm?pub_id=910868.