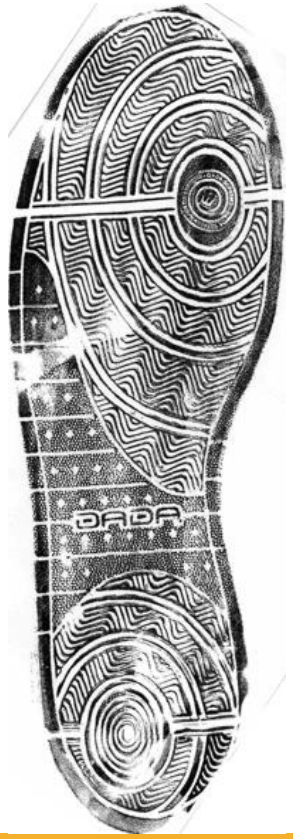
NIST
National Institute of Standards and Technology
U.S. Department of Commerce

FORENSICS @ NIST | #NISTForensics

Image Alignment and Feature Extraction for Shoeprint Matching

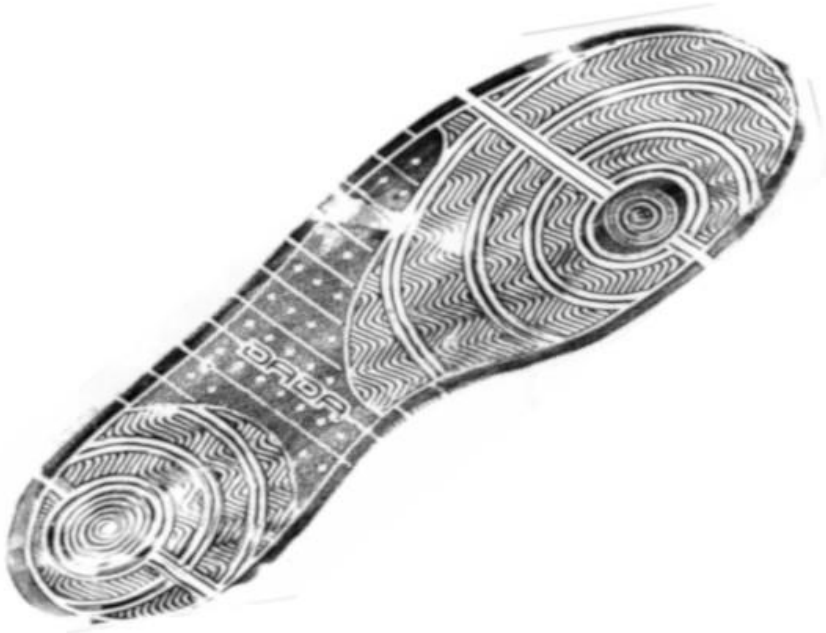
Gautham Venkatasubramanian

Variability of Crime Scene Impressions



Creative Visualization

Variability of Crime Scene Impressions



Creative Visualization

Variability of Crime Scene Impressions

Creative Visualization

Variability of Crime Scene Impressions

Creative Visualization

Variability of Crime Scene Impressions

Creative Visualization

Ideal Comparison Method

- Account for the below factors while computing similarity:
  - Alignment
  - Feature Comparison

What is Alignment?

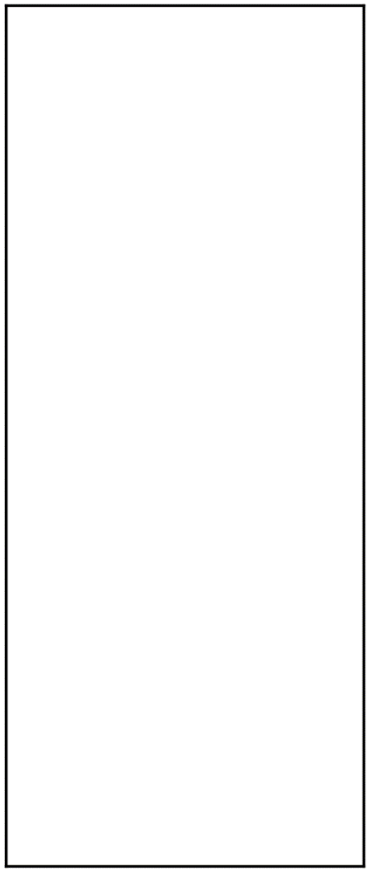
- Process by which effects of translation, rotation, scaling, and shearing are minimized
- Current Approaches:

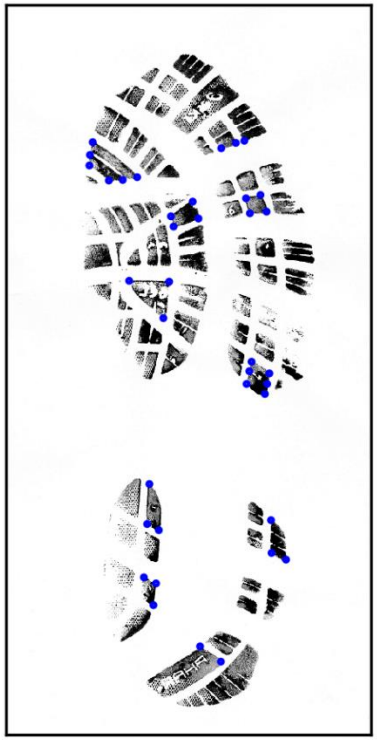
Why Align?

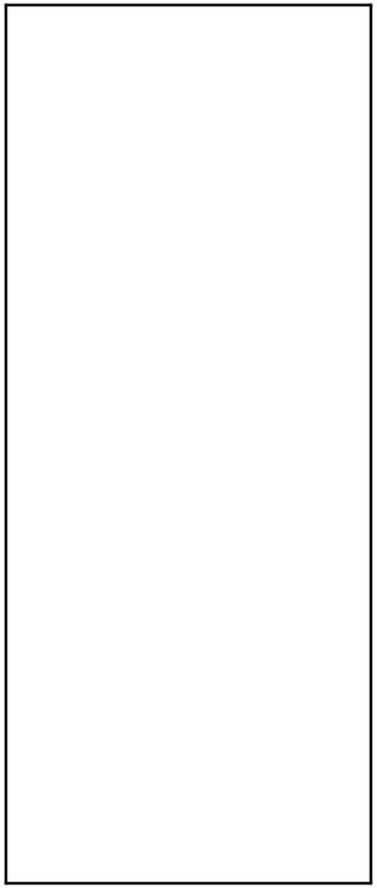
- Reduce complexity of similarity computation
  - Reduce comparisons between unrelated features
  - Eliminate some cases altogether
- Allow comparison of localized features
- Present information that would agree with examiner's intuition

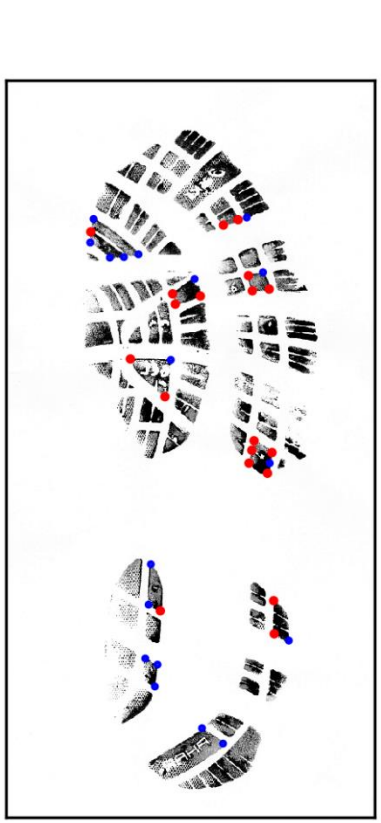
Align using Interest Points

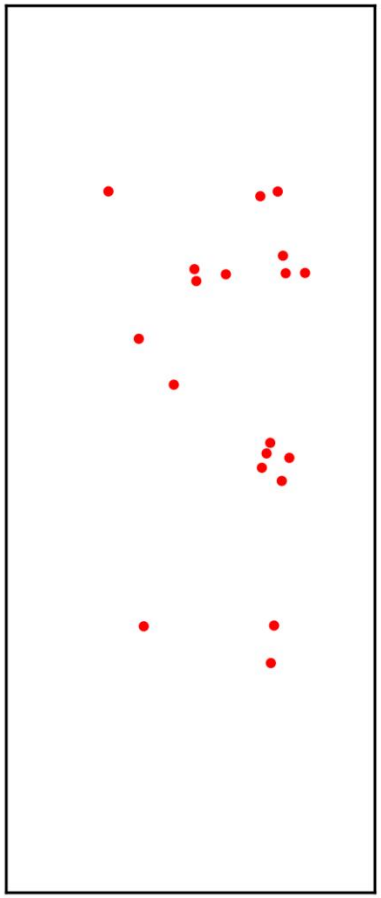
- Interest points in an image are any points resistant to the rotation, translation, scaling, shearing, and noise
  - Corners
  - Edge points
  - Centers of Circles
  - Points from SIFT, SURF etc.
- **Impressions that match** (i.e. from the same shoe) **will have many common interest points.**

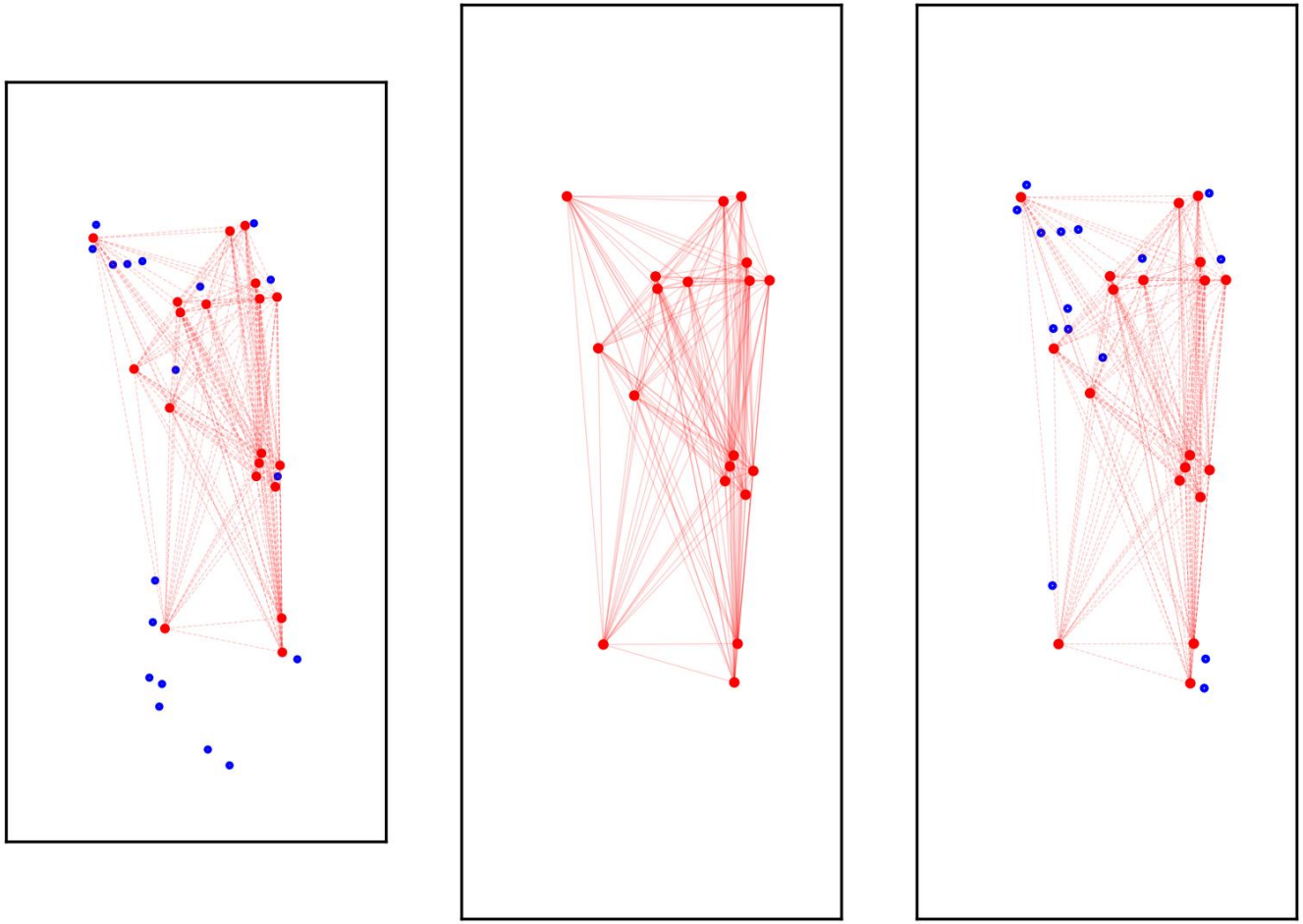


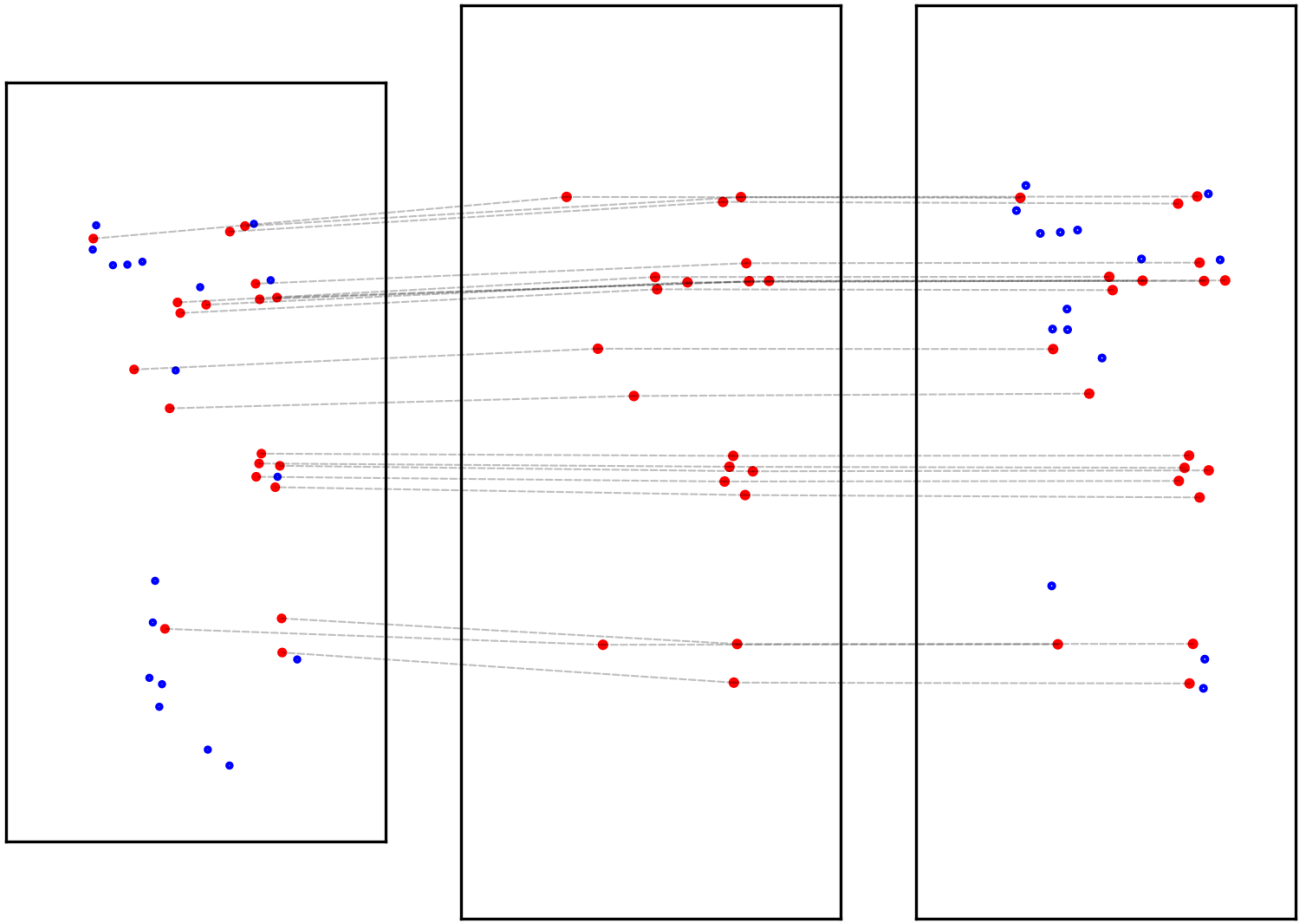


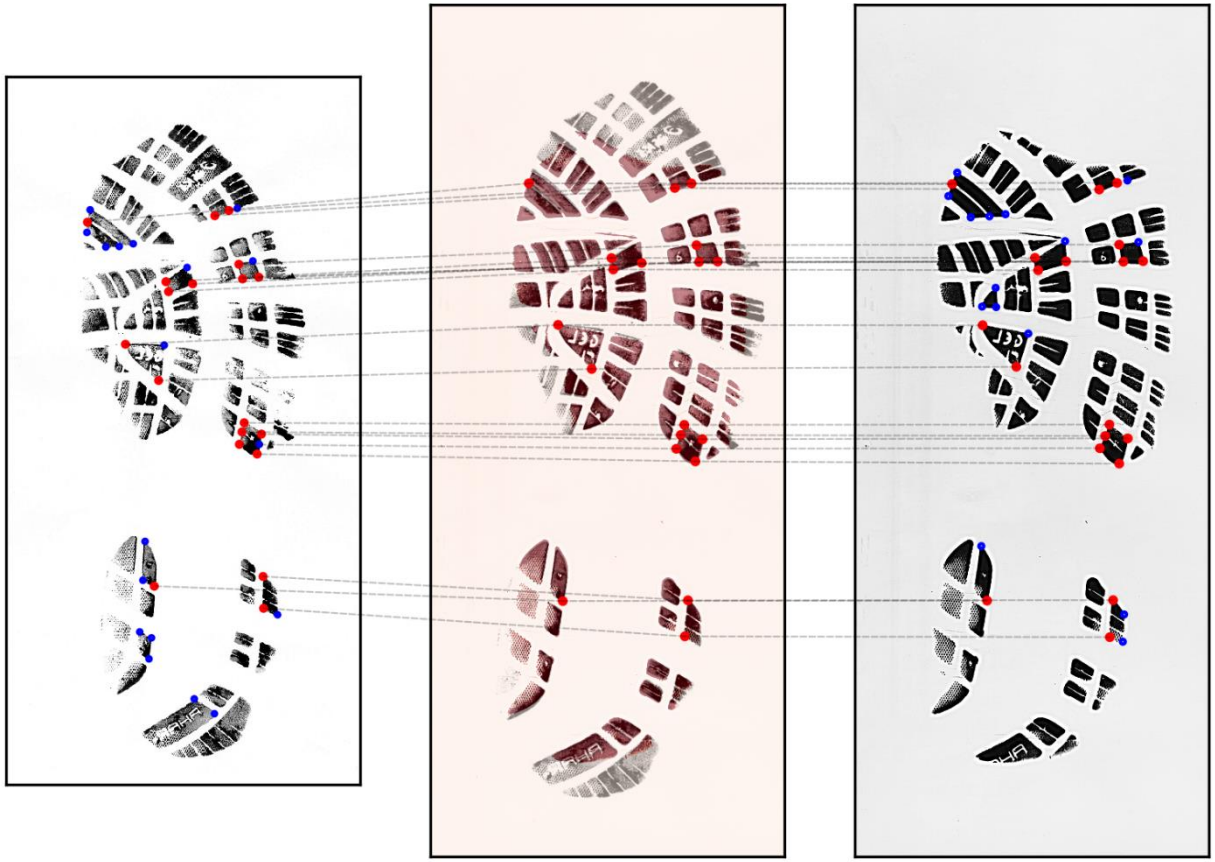


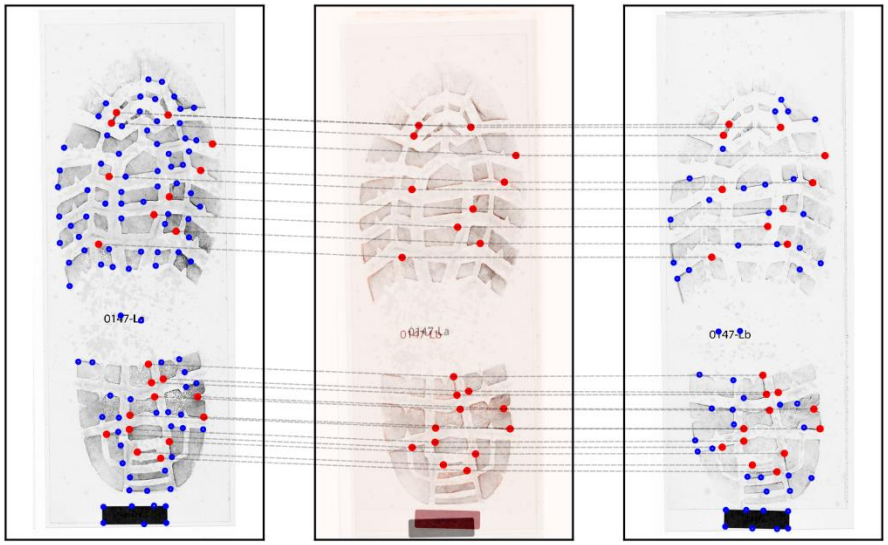


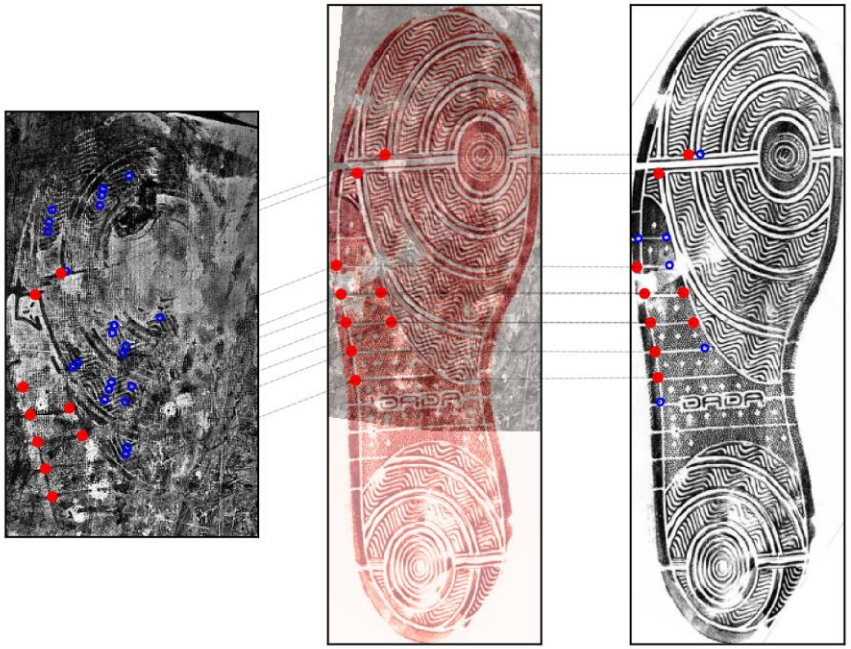






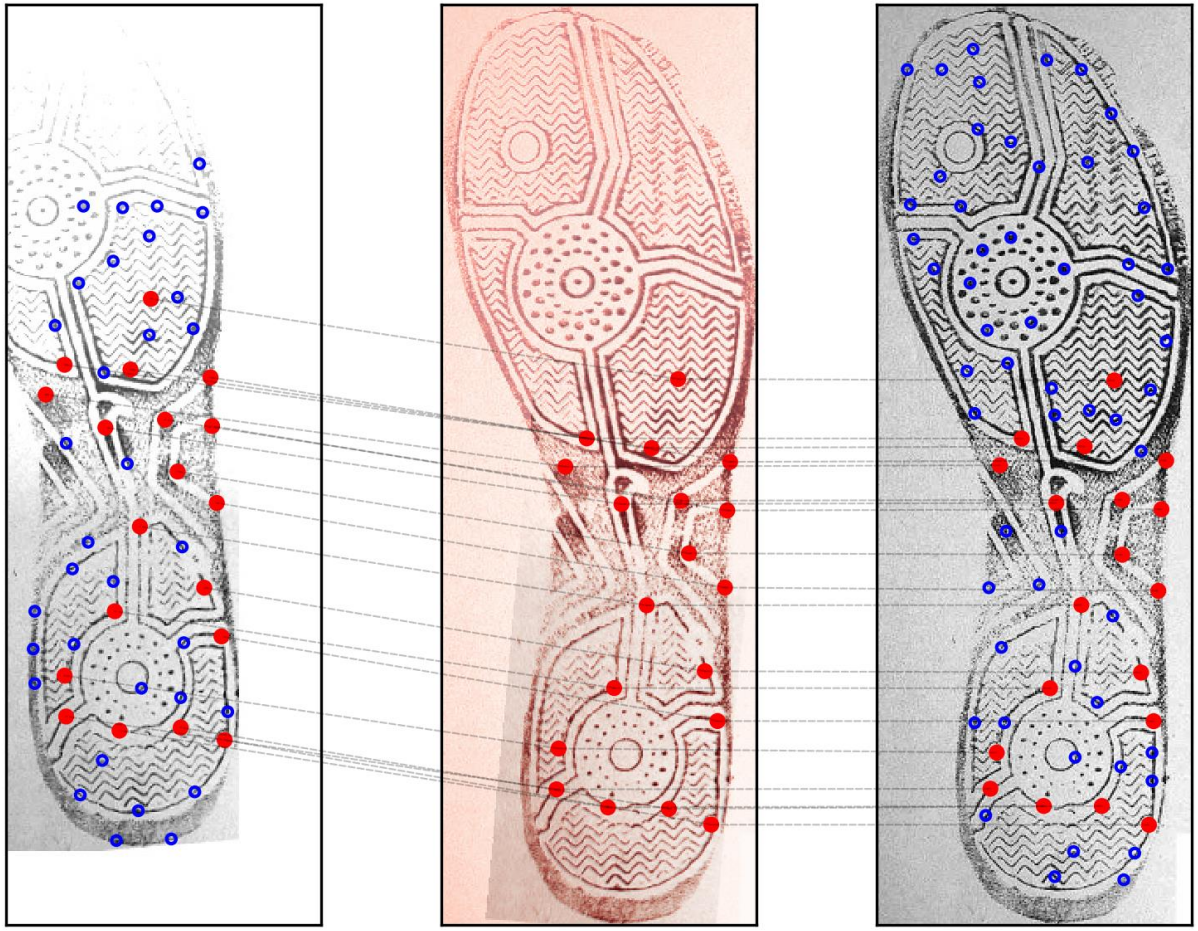


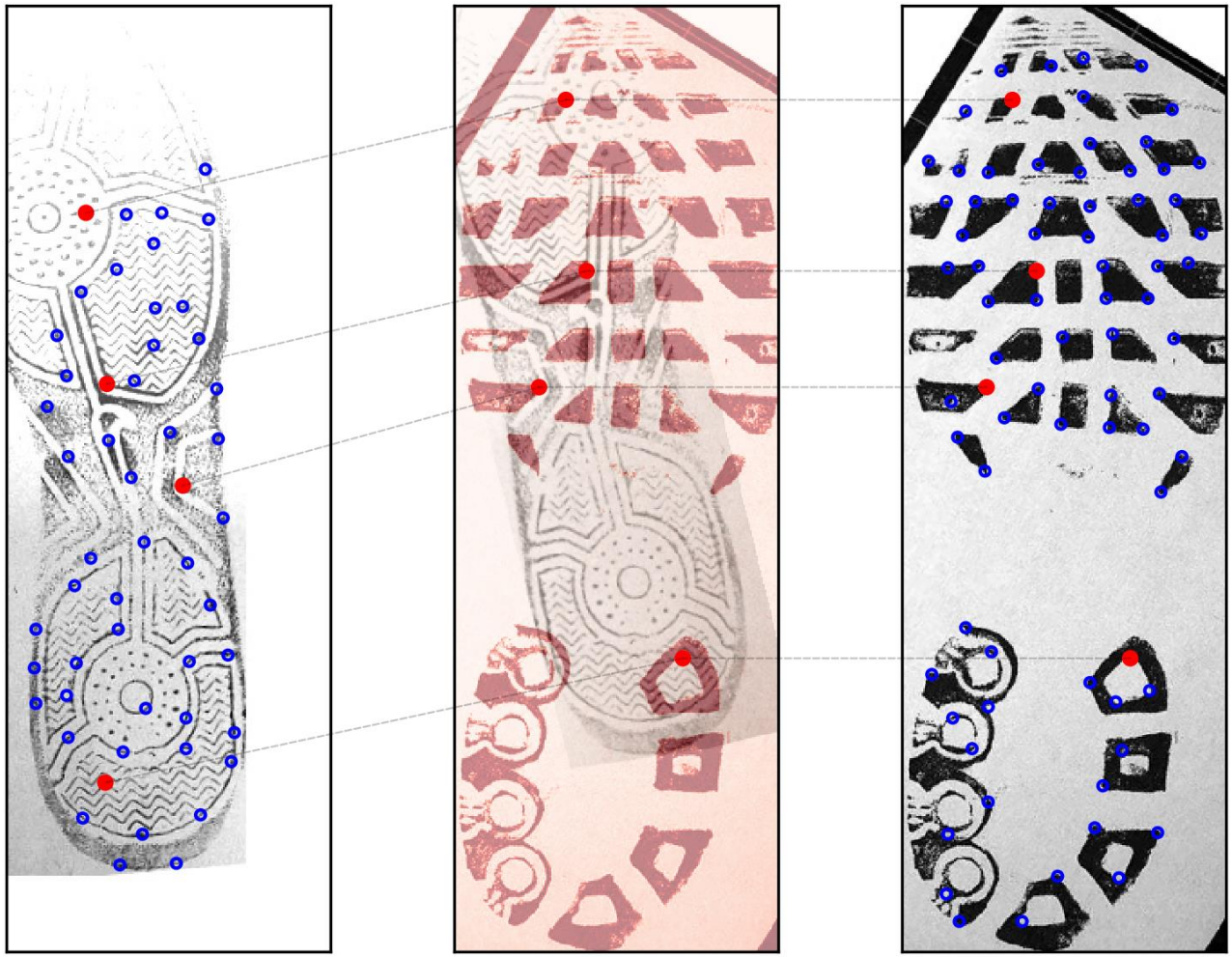

0147-La
0147-Lb



Distinguishing Power

- Can we use this alignment method to distinguish matches and non-matches?
- **Impressions that match** (i.e. from the same shoe) **will have many common interest points.**
  - The number of points in the common configuration is an indicator of similarity.
  - The spread of points in the configuration is an indicator of global correspondence





Feature Extraction after Alignment