

Overview / Introduction

- 1) Unlock the power of handwriting analysis with handwriter. This tool is designed to assist forensic examiners by analyzing handwritten documents. Whether you are a forensic document examiner, legal professional, academic, or simply curious about how statistics are applied to handwriting, handwriter provides an automated way to evaluate handwriting samples.
- 2) How it works
 - a) Inputs scanned handwriting samples saved as JPEG files
 - b) Handwriter splits the scanned handwriting into component shapes called **graphs**. Graphs capture shapes, not necessarily individual letters. They might be a part of a letter or contain parts of multiple letters.
 - c) Handwriter analyzed handwriting samples from 100 writers, grouping the tens of thousands of graphs into 40 forty clusters of similar shapes with a K-Means clustering algorithm. The result is a **cluster template** of 40 exemplar handwriting shapes. These shapes might be part of a letter or contain parts of multiple letters. The cluster template is used to estimate writer profiles.
 - d) Each graph in a handwriting sample is matched to its most similar shape in the cluster template. By counting how often a writer uses graphs from each cluster, handwriter creates a profile of a writer's handwriting style. This profile shows the writer's tendency to form shapes in particular ways.
 - e) Handwriter uses statistical models to compare writer profiles. Handwriter addresses two forensic scenarios and uses a different statistical model for each scenario
 - f) Scenario 1 - In this scenario, a document examiner has two handwritten documents. They might know who wrote one of the documents, or they might not know who wrote either document. The examiner wants to know whether the documents were written by the same person. We call this scenario the **open set problem**.
 - g) Scenario 2 - In this scenario, a document examiner has a handwriting document from an unknown writer and a **closed set** of potential writers, where the document must have been written by one of the potential writers. For example, if a handwritten threat letter is found in a prison, the closed-set of potential writers is people who had access to the prison. We call this scenario the **closed set problem**.

Quick Start Guide

- Installation instructions
- Launch the app
- Follow the instructions in the app

Learn More (Theory)

- A one-page summary of the Scenario 1 method
- A one-page summary of the Scenario 2 method
- A longer explanation of the Scenario 1 method
 - Model name, date, version
 - Intended Use (cross-reference Permitted Use Statement)
 - Training and Evaluation Data
 - Training the Model
 - Comparing Two Handwriting Samples
 - Factors
 - Metrics
 - Quantitative Analyses
 - References
- A longer explanation of the Scenario 2 method
 - Model name, date, version
 - Intended Use (cross-reference Permitted Use Statement)
 - Training and Evaluation Data
 - Training the Model on known writing samples from a closed-set of potential writers
 - Analyzing a Questioned Document
 - Factors
 - Metrics
 - Quantitative Analyses
 - References

Advanced R Users (Programming)

- The handwriterSuite consists of three R packages: handwriter, handwriterRF, handwriterApp.
- Handwriter
 - Cross-reference installation

- Core handwriting processing
 - Read a PNG image
 - Convert the image to black and white
 - Thin the image to a single pixel in width
 - Split the handwriting into component shapes called graphs
- Estimating writer profiles
 - Show how to view and plot the cluster template
 - Estimate writer profiles from handwriting samples using the cluster template
 - Plot writer profiles
- How to fit a Bayesian hierarchical model. Cross-reference model requirements and limitations.
- How to analyze a questioned document using the model. Explain the posterior probability of writership.
- HandwriterRF
 - Cross-reference installation
 - Cross reference core handwriting processing and estimating writer profiles from handwriter section.
 - Cross-reference score-based likelihood ratio (SLR) model requirements and limitations.
 - How to use the built-in random forest and reference similarity scores to compare two handwriting samples.
 - Step 1: Estimate writer profiles from each sample
 - Step 2: Calculate the absolute and Euclidean distances (cross-reference definitions of these distances) between the two writer profiles. Use the trained random forest to calculate a similarity score from the distance.
 - Step 3: Compare the similarity score to reference “same writer” and “different writer” similarity scores. Calculate an SLR to quantify the comparison.
 - How to create your own random forest and reference similarity scores
- handwriterApp
 - Cross-reference installation
 - Launch the app
 - More info?

Publicly Available Handwriting Datasets

- The CSAFE Handwriting Database
- The IAM Handwriting Database
- The CVL Handwriting Database

Permitted Use Statement

License

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