

Slap Fingerprint Segmentation Evaluation 2004

Appendix A Announcements and Website Documents

28 February 2005

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A.1 Biometric Consortium Listserv Announcement

Date: Wed, 7 Jul 2004 14:01:06 -0400
Reply-To: The Biometric Consortium's Discussion List
<BIOMETRICS@PEACH.EASE.LSOFT.COM>
Sender: The Biometric Consortium's Discussion List
<BIOMETRICS@PEACH.EASE.LSOFT.COM>
From: "R.M. McCabe" <mccabe@NIST.GOV>
Subject: SlapSeg04
Content-Type: multipart/alternative;

The Slap Fingerprint Segmentation Evaluation 2004 (SlapSeg04) is an assessment of the accuracy of algorithms used to segment slap fingerprint images into individual searchable images.

- Slap fingerprints (slaps) are also known as four-finger simultaneous plain impressions. Slaps are taken by simultaneously pressing the four fingers of each hand onto a scanner or fingerprint card.
- Slap segmentation is the process by which a single image containing four fingerprint images is divided into four images of the individual fingers.

SlapSeg04 is being conducted by the National Institute of Standards and Technology (NIST) on behalf of the Department of Justice (DOJ) Justice Management Division (JMD), IDENT/IAFIS Integration Project. A variety of U.S. Government fingerprint systems (including U.S.VISIT and IAFIS) are considering the use of slap fingerprints for searches for background checks. The segmentation of slap fingerprints is known to have a finite error rate, but no rigorous evaluation of current slap segmentation algorithms has ever been conducted. Knowing whether existing segmentation software is feasible for operational use will be of practical interest and value to policymakers.

The SlapSeg04 schedule will be announced shortly. Additional information about SlapSeg04 will be posted at (<http://fingerprint.nist.gov/slapseg04>) as soon as it becomes available. Interested parties should send contact information (name, email, telephone, and address) to: slapseg04@nist.gov.

The preceding was forwarded by the Biometric Consortium's Electronic Discussion Group. Any opinions expressed here do not necessarily reflect those of the Biometric Consortium. Further distribution is prohibited.

LISTSERV members may access the BIOMETRICS mailing list archives or change their subscription settings (including removing your name from the list) at: <http://peach.ease.lsoft.com/archives/biometrics.html>.

A.2 FedBizOpps Announcement

Vendors
Federal Business Opportunities



70 -- Slap Fingerprint Segmentation Software Sources Sought

General Information

Document Type: Sources Sought Notice
Solicitation Number: Reference-Number-Sources-Sought-for-Slap-Fingerprint-Segmentation-Software
Posted Date: Aug 06, 2004
Original Response Date: Sep 01, 2004
Current Response Date: Sep 01, 2004
Original Archive Date: Sep 02, 2004
Current Archive Date: Sep 02, 2004
Classification Code: 70 -- General purpose information technology equipment
Naics Code: 511210 -- Software Publishers

Contracting Office Address

Department of Commerce, National Institute of Standards and Technology
(NIST), Acquisition and Logistics Division, 100 Bureau Drive, Building 301,
Room B129, Mail Stop 3571, Gaithersburg, MD, 20899-3571

Description

THIS FEDBIZOPPS POSTING IS STRICTLY A SOURCES SOUGHT NOTICE THAT IS PART OF A TECHNOLOGY RESEARCH SURVEY THAT IS BEING CONDUCTED FOR PLANNING PURPOSES ONLY; IT IS NOT TO BE CONSTRUED AS A SOLICITATION OR A REQUEST FOR QUOTATIONS OR PROPOSALS.

THIS IS A 3RD POSTING OF A NOTICE THAT WAS PREVIOUSLY POSTED ON JULY 8, 2004. IT CONTAINS THE SAME INFORMATION AS THE 2ND POSTING, BUT CORRECTS A TYPOGRAPHICAL ERROR IN THE REFERENCE NUMBER BLOCK.

The U. S. Department of Commerce, National Institute of Standards and Technology (NIST) in Gaithersburg, Maryland seeks to identify potential sources that currently can provide, or will soon be able to provide, commercially available, or soon-to-be commercially available, slap fingerprint segmentation software. Such software may be selected by the Government to participate in the Slap Fingerprint Segmentation Evaluation 2004 (SlapSeg04), a government-sponsored technology evaluation of algorithms used to segment slap fingerprint images.

Note: Slap fingerprints (slaps) are also known as four-finger simultaneous plain impressions; slaps are taken by simultaneously pressing the four fingers of each hand onto a scanner or fingerprint card. Slap segmentation is the process by which a single image containing four fingerprint images is divided into four images of the individual fingers.

Potential sources of such software will neither be funded by NIST, nor charged by NIST, to participate in SlapSeg04. Rules for SlapSeg04 participants are outlined in the HOW TO PARTICIPATE page at <http://fingerprint.nist.gov/slapseg04>. A deadline for submission is shown on the CALENDAR page of <http://fingerprint.nist.gov/slapseg04>. INTERESTED PARTIES MUST SUBMIT INFORMATION TO slapseg04@nist.gov, AND CONTACT THAT SAME EMAIL ADDRESS WITH ANY QUESTIONS REGARDING THIS SOURCES SOUGHT NOTICE.

Original Point of Contact

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A.3 About SlapSeg04

About SlapSeg04

Last updated 19 October 2004

The Slap Fingerprint Segmentation Evaluation 2004 (SlapSeg04) is an assessment of the accuracy of algorithms used to segment slap fingerprint images into individual fingerprint images.

- **Slap fingerprints (slaps)** are taken by simultaneously pressing the four fingers of one hand onto a scanner or fingerprint card. Slaps are also known as four-finger simultaneous plain impressions.
- **Slap segmentation** is the process by which a single image containing four fingerprint images is divided into four images of the individual fingers.

SlapSeg04 is being conducted by the National Institute of Standards and Technology (NIST) on behalf of the Department of Justice (DOJ) Justice Management Division (JMD), IDENT/IAFIS Integration Project.

NEW Thirteen segmentation applications from ten organizations are being evaluated in SlapSeg04:

- 123ID
- Aware
- Cogent
- IAFIS
- NEC
- NIST
- Sagem Morpho
- Smiths-Heimann (SHB)
- Sonda
- UltraScan

The deadline to register for SlapSeg04 was closed on 8 September 2004. The deadline for software was closed on 4 October 2004.

SlapSeg04 will serve as part of NIST's statutory mandate under section 403c of the USA PATRIOT Act to certify those biometric technologies that may be used in U.S. VISIT.

The use of slap fingerprints for background checks is being considered in a variety of U.S. Government fingerprint systems (including U.S.VISIT and IAFIS). The segmentation of slap fingerprints is known to have an associated error rate, but no rigorous evaluation of current slap segmentation algorithms has ever been conducted. Knowing whether existing segmentation software is feasible for operational use will be of practical interest and value to policymakers.

SlapSeg04 was announced on FedBizOpps.gov ([Listing](#); [cached](#)), and in postings to the [Biometric Consortium Listserv](#).

Interested parties should send contact information (name, email, telephone, address) to: slapseg04@nist.gov.

A.4 Test Plan

Slap Fingerprint Segmentation Evaluation 2004 (SlapSeg04) Test Plan

Last updated 28 July 2004

Introduction

The Slap Fingerprint Segmentation Evaluation 2004 (SlapSeg04) is an assessment of the accuracy of algorithms used to segment slap fingerprint images into individual fingerprint images.

- **Slap fingerprints (slaps)** are taken by simultaneously pressing the four fingers of one hand onto a scanner or fingerprint card. Slaps are also known as four-finger simultaneous plain impressions.
- **Slap segmentation** is the process by which a single image containing four fingerprint images is divided into four images of the individual fingers.

SlapSeg04 is being conducted by the National Institute of Standards and Technology (NIST) on behalf of the Department of Justice (DOJ) Justice Management Division (JMD), IDENT/IAFIS Integration Project.

The use of slap fingerprints for background checks is being considered in a variety of U.S. Government fingerprint systems (including U.S.VISIT and IAFIS). The segmentation of slap fingerprints is known to have an associated error rate, but no rigorous evaluation of current slap segmentation algorithms has ever been conducted. Knowing whether existing segmentation software is feasible for operational use will be of practical interest and value to policymakers.

The sponsors of this study want to determine the practicality of these operational scenarios:

- Batch segmentation of large databases of livescan, paper, or mixed slap fingerprints
- Realtime segmentation of livescan slap fingerprints at the time of capture

This evaluation will determine the accuracy (and error rate) of existing slap segmentation algorithms on a variety of operational-quality slap fingerprints, as well as the ability of segmentation algorithms to detect when segmentation was successful.

Sponsors and Partners

Sponsors

- Department of Justice (DOJ) Justice Management Division (JMD), IDENT/IAFIS Integration Project
- National Institute of Standards and Technology (NIST)

Partners

- U.S. VISIT Program, U.S. Department of Homeland Security
 - Federal Bureau of Investigation
-

Participation Requirements

Makers of commercially available, mature prototype, or research slap segmentation software are invited to participate in SlapSeg04. SlapSeg04 is **not** evaluating image acquisition devices (fingerprint scanners) or fingerprint matching software. The [How to Participate](#) page explains what is required of participants.

Participants will submit a segmentation application that takes as input a slap image, and outputs (up to) four segmented images, each corresponding to one of the individual fingers pictured in the slap. It is recommended that the segmentation application return segmentation quality values, indicating the likelihood that each finger was correctly segmented. All testing will be conducted at NIST.

The [SlapSeg04 API Specification](#) defines the required interface to the segmentation application, including formats of input and output files.

Evaluation Objectives and Methods

The primary criteria for evaluating segmentation software will be :

- The ability to correctly segment all four fingerprint images from a slap image
- The ability to recognize and signal unsuccessful segmentation

The ability to correctly identify finger positions, especially when hand positions are unidentified, may also be evaluated. Rotation or bounding box information, if provided, is informational and will not be used for evaluation.

The primary method for evaluating segmentation accuracy will be to use multiple matchers to score the output segmented images against corresponding rolled images (which were captured at the same time, using the same device/method). Each of the four segmented images produced by a segmentation application from a slap image will be matched against a rolled fingerprint corresponding to the same finger. Multiple fingerprint matchers will be used. Manual validation of results will be used as necessary.

Slap Fingerprint Data

Evaluation Data

The fingerprints used for evaluation have been collected from a range of U.S. Government sources. Some of the fingerprints are representative of current operational data, others are representative of legacy data, and some are from non-operational (controlled) data. The majority of the fingerprints used come from the sources used in [FpVTE 2003](#). Since the fingerprints used for evaluation are considered Sensitive but

Unclassified data, none of the evaluation data can be made available for testing or training of software. The evaluation data includes a mix of slap images from livescan devices, scanned from inked paper cards, and unspecified sources. Segmentation of slaps from paper is usually more difficult, due to problems such as stray marks, printed text, overlapping thumb images, and background texture.

The livescan fingerprints were captured by the following devices:

- CrossMatch 442
- CrossMatch ID1000
- DBI 1133S5
- Identix TP2000
- Identix TP600
- Ricoh IS-510
- Smiths Heimann LS2 Check

Note: *The listing of makes and models does not imply a recommendation by NIST or SlapSeg04 personnel, but simply recognizes the actual devices used by the variety of agencies that contributed data to SlapSeg04.*

Inked cards were scanned using FBI EFTS Appendix F-certified flatbed scanners.

The type of scanner used to capture each fingerprint will **not** be provided in the tests.

Sample Data

A small amount of data (approximately 50 images) will be made available to registered participants to be used to test compliance with the API Specification:

- Participants will use the Sample Data to verify that they can read WSQ files as input.
- Participants must send the segmented images they created using the Sample Data to the SlapSeg04 Liaison for validation before submitting software for evaluation.
- When software is received by NIST, installation will be checked by running the Sample Data, and comparing those results to the sample results submitted earlier by the Participants.

The purpose for this sample data is to provide data representative of the format of the evaluation data. It **is not** representative of the evaluation data in terms of image quality or other characteristics. The Sample Data includes a disproportionate number of problem cases.

Practice Data

For Participants who want additional slap data for testing or training, [NIST Special Database 29 \(SD29\)](#) contains full sets of fingerprint that were scanned from paper cards. The slap images from SD29 are representative of the **paper** source slaps to be used in the evaluation. Unfortunately, no livescan data can be released as sample data. Registered Participants will be sent Practice Data CDs containing the slap images from SD29 in WSQ files, as well as the complete SD29.

A.5 Frequently Asked Questions (FAQ)**Frequently Asked Questions (FAQ)***Last updated 10 September 2004*

To ask a question, please [email us](#). All responses will be posted to this list: no individual responses will be sent. The newest Q&As are at the beginning of each section.

Note: a separate FAQ regarding test details will be available to registered test participants in the Participant Area.

On the paper source images, will the rolled fingers, which are normally above the slap boxes but sometimes overlap the edges of the slap boxes, be totally eliminated or at least minimized? NEW

If other fingerprints (such as rolls or plain thumbs) overlapped the margins of the slap image on the paper card, they will be included in the slap images used in the paper source evaluation data. In the [issues web page](#), see the "Thumb overlapping edge of image" example.

Will there be any laser jet print out cards in the paper source testing set? NEW

The overwhelming majority of the images labeled "paper" will be scanned from inked paper cards. However, in a few cases, agencies have taken livescan images, printed them onto paper fingerprint cards, and those cards were treated as if they were inked cards and rescanned. This process is not recommended, but it does occur in some operational systems. These rescanned cards are not differentiated from cards from inked sources in the operational databases. Since the SlapSeg04 evaluation data reflects the actual contents of the operational data, some small portion of the "paper" evaluation data in SlapSeg04 will be rescanned.

How is SlapSeg04 related to NIST's role under the PATRIOT Act?

SlapSeg04 will serve as part of NIST's statutory mandate under section 403c of the USA PATRIOT Act to certify those biometric technologies that may be used in U.S. VISIT.

The NIST WSQ code (with minor modification) requires almost 1.7 seconds to uncompress a slap image on a 1GHz CPU while [a commercial vendor] WSQ library requires 0.4 seconds. Although we would like to use NIST WSQ code, this time difference cannot be disregarded if the total processing time is one of SlapSeg04 evaluation. I understand that SlapSeg04 does not intend to evaluate WSQ performance. Is it possible for you to uncompress the test images and to feed uncompressed images to Segmentator? This preparation (WSQ uncompression) will shorten the total evaluation time because all participants can save WSQ uncompression time.

1. The API states "The segmentation application must be capable of taking as input either a Wavelet Scalar Quantization (WSQ) compressed slap image, **or** an uncompressed raw slap image." Participants may choose to use raw images, which are precisely the same as the uncompressed WSQs, in their applications. We do not encourage (or discourage) one format over the other.
2. We are not encouraging (or discouraging) use of the NIST WSQ code - it is available as an option.
3. Average processing time (total time, including WSQ decompression) will be noted in the final report but will not be used as a primary evaluation criterion.

Whether the processing time includes WSQ decompression will also be noted. The 10 second limit was imposed to control the amount of time required to run the tests at NIST. We believe this limit to provide ample processing time based on our use of multiple segmentation algorithms in the past.

Are the examples in the Issues and Examples documents selected from the evaluation data? From the sample data?

In the sample data, and in the Issues and Examples documents:

- The paper slaps in are from SD29 (AKA "Practice data"), which is reasonably representative of the paper evaluation data. SD29 will not be used as evaluation data.
- The livescan slaps are taken from volunteers, and attempt as much as possible to mimic characteristics seen in the operational/evaluation data. This is because all of the evaluation slaps we have are considered Sensitive data, and cannot be distributed.

Will there be test images in which the upper part of the palm (interdigital area) is visible on the slap image?

The slap images come from and are representative of operational government sources. The interdigital area is unlikely to appear except possibly in livescan images using a large (4 inch) platen. Most of the evaluation images will be no more than 2 inches tall. The Sample Dataset does not include any images of that type.

What assumptions can be made regarding the orientation of the slap? For example, +/-30° from vertical for most of the test images but can be up to +/-45° for some images.

The slap images come from and are representative of operational government sources. The orientation of slap images is affected by the dimensions of the rectangular space provided for image capture. These dimensions vary from source to source. Most slap images (except possibly those from large-platen livescans) are rotated. The amount of rotation varies, but typically averages 20-25 degrees. Fingers from the left hand are usually rotated clockwise, and those from the right hand are usually rotated counterclockwise. Few images are rotated more than 45 degrees, but this does occur. Please see the [Issues](#) page for more discussion of this.

What assumptions can be made regarding the rotation tolerance of the matching algorithm that will be used to test the segmentation?

The analysis methodology is being designed so that whether or not output images are rotated will not affect evaluation. Participants may assume that the matchers are tolerant of rotations. Segmenters may produce output images that preserve the original orientation, or they may rotate the images to the upright position. Multiple matchers will be used for scoring.

If the test image is identified with an unknown ("U") hand identifier, should the finger_pos code be set to unknown ("0") or is it expected that the application will attempt to "guess" as to the hand and therefore the finger position?

A segmenter capable of detecting switched hands has obvious operational advantages. One measure of interest is how often a segmenter can correctly segment all fingers in a slap from an unknown hand and correctly identify their position. An application should attempt to identify the finger positions if it is accurate at this task.

When the hand position is not specified, is there an advantage for a segmenter to specify the finger positions?

Part of the purpose of the subtest in which hands are not identified is to determine if segmenters can correctly identify which hand the image came from. Segmenters identify which hand the image came from by specifying the finger positions, if they can do so accurately.

How will the finger_pos values be evaluated and scored? In other words is it better for the algorithm to "guess" the correct finger position or to be more conservative and mark a finger image as unknown ("00") in the case that it is not clear?

An application should attempt to identify the finger positions if it can do so accurately. If finger positions cannot be accurately identified, the finger positions should be marked as unknown. In other words, correctly identifying the finger positions is better than leaving them unknown, but incorrectly identifying the finger positions is worse than leaving them unknown. Segmenters will be evaluated on this information.

When the hand position is specified, should the segmenter look for switched hands or assume that the specification was correct?

Segmenters may assume that hand position is correctly specified. Only when hand position is specified as "Unknown" should segmenters make a left/right determination.

Will segmenters be evaluated on the accuracy of the ORIGINAL_ROTATION value in the meta-information files? If not, why is this information requested?

Segmenters will NOT be evaluated on this information. We do not plan to manually verify rotational information over a large dataset. However, If enough segmenters provide the ORIGINAL_ROTATION value, consensus and selective manual verification will make it possible to report on the distribution of rotation angles in the data, and to analyze the effect of rotation on segmentation accuracy. Please provide rotation information if it is calculated by your application.

The API Specification states, "If the output images are rotated relative to the input, OUTPUT_ROTATED should be set to TRUE." Is this required or optional?

If the output images are rotated relative to the input (e.g. the original slap was rotated 45 degrees, but the output fingerprints are rotated to be upright), the application should set OUTPUT_ROTATED to TRUE.

Could you tell how much proportion of slap images are hand-type known and how much proportion of slap images are hand-type unknown?

The vast majority of the evaluation data (95%+) will have the hands identified. A smaller subtest, which will be run using livescan slaps, will not differentiate between right and left hands.

The Test plan says "The ability to correctly identify finger positions, especially when hand positions are unidentified, may also be evaluated." I assume this is only applicable to slap images with impression of four fingers (or less) mostly from Live Scanning. I mean that this is not applicable to slap images with "extra fingers" from Paper Card. The reason why I would like to make sure is because "hand type (left or right) recognition" becomes more difficult (or less accurate) and time consuming if we need to consider the case of extra fingers from Paper Card. I understand needs for "Left or Right hand recognition" capability on US Visit when "slap4 scanning" is introduced at port of entry. Illegal immigrants or terrorists may try to scan wrong hand. The good system needs to have ability to detect such illegal trial. However, I do not think this capability is necessary for

"Batch segmentation of large databases of paper slap fingerprints". Is my assumption correct?

Swapped hands are a problem (as you mention) with uncooperative subjects. This was true to a limited extent in the past even with paper cards. However, in cases in which rolled and slap fingerprints are collected at the same time, a sequence checking step can be used to verify that the slaps were not swapped at the same time the sequence of the rolls is verified. The bulk of the test will focus on the accuracy of segmentation applications when the hands are identified, but unidentified hand tests will be conducted using livescan slaps.

Is there a fee to participate in SlapSeg04?

There is no participation fee.

Can non-US companies participate?

Yes.

Can we participate anonymously?

No.

Do you evaluate based on time to complete as well as segmentation accuracy?

Processing speed will be noted but will not be a primary evaluation criterion.

What's the sampling resolution of the images?

All images are 500 pixels per inch, 8-bit grayscale images.

Do the images scanned from inked paper cards contain extraneous text, lines, or other marks?

Yes.

Are there any publicly-available or open-source examples of slap segmentation software?

A reference implementation of slap segmentation software will be included in the next update of [NIST Fingerprint Image Software \(NFIS\)](#). Note that this software uses a slightly different API than is defined for SlapSeg04. This can be made available to registered participants upon request.

We plan to use WSQ code in the NIST Public Domain for SlapSeg04 test. This WSQ code does not seem to have a copyright notice. I understand it is OK to use it for SlapSeg04 test. Is it OK to redistribute this WSQ code to other purpose under the same condition as the copyright of JPEG code?

The NIST WSQ code has no copyright restrictions of any kind and may be freely distributed.

A.6 Examples

Examples of Slap Fingerprint Segmentation

Last updated 30 July 2004

This document provides examples and illustrations of input and outputs, corresponding to the [SlapSeg04 API Specification](#).

1. Livescan Slap Images

Below is a typical livescan image.



Below are example output segmented images from the typical livescan image above. Note the filenames (which assume the input file was named "Example.wsq"), which indicate the segmented position (A-D) and finger position (02-05).



Example_A_02.raw Example_B_03.raw Example_C_04.raw Example_D_05.raw

It is permissible, but not required, to rotate the output images relative to the original, as shown below. See the Rotation section below for more information.



Example_A_02.raw Example_B_03.raw Example_C_04.raw Example_D_05.raw

Note that neighboring fingers should not be included in the segmented output, as shown by the highlights below:



2. Paper Slap Images

Below is a typical image from an inked paper source. Note the variation in background when compared to the livescan image, the handwritten and printed text, punched hole, and cropped

middle finger.



Below are example output segmented images from the typical inked paper image above. Note the filenames, which indicate the segmented position (A-D) and finger position (10-07).



Example_A_10.raw Example_B_09.raw Example_C_08.raw Example_D_07.raw

3. Missing Fingers

Not all images will include four fingers. In such cases, it is important that the application use the return codes (noted in section 2.3 of the [SlapSeg04 API Specification](#)) to indicate the number of fingers found:

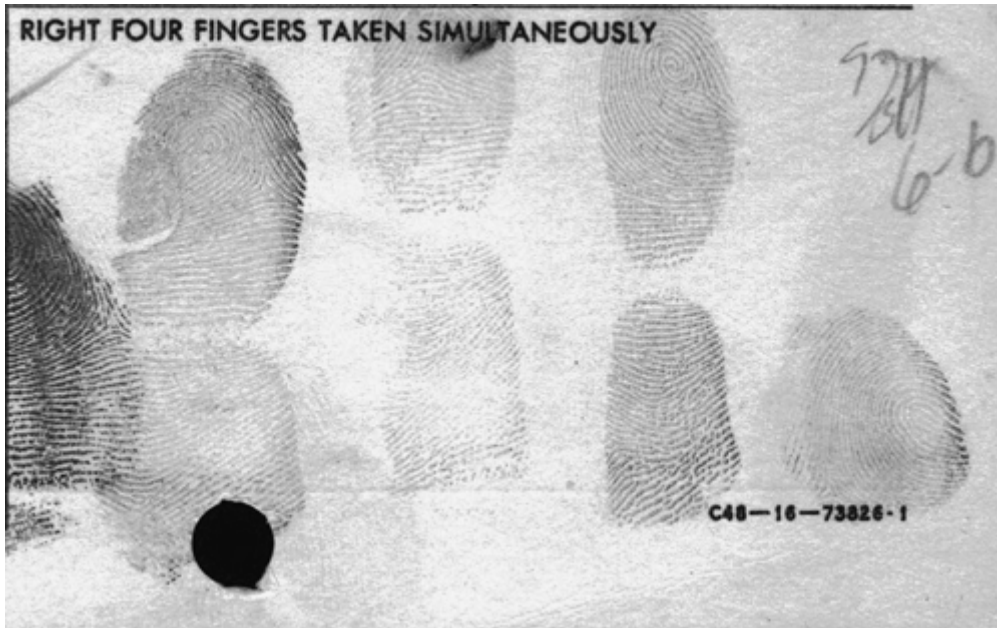
Return code	Explanation
10	0 fingers could be segmented
11	Only 1 finger could be segmented
12	Only 2 fingers could be segmented

13 Only 3 fingers could be segmented

In the example below, only 3 fingers can be segmented, and the finger positions probably cannot be determined. The three resulting image files should be named (left to right) *_A_00.raw, *_B_00.raw, and *_C_00.raw. The program should return a Return Code of 13 to indicate only 3 fingers could be processed.

**4. Extra Fingers**

In some cases, images from paper cards may include fingerprints overlapped from the plain thumb impressions, which border the slap areas on the cards. Segmentation applications should never return more than 4 segmented images as output. If the finger positions cannot be determined, all fingers should be noted as undefined, with a 00 finger code in the filenames.



5. Segmentation Quality

Segmentation Quality is a user-defined numeric value. It is requested, but not required. A higher segmentation value must correspond to a higher likelihood that that image was correctly segmented. The values can be integers or decimals.

In an operational environment, a measure of segmentation quality is necessary to indicate those problem cases that may require special processing. Below are examples of some images for which it may be difficult to obtain an optimal segmentation of all fingers. In such cases, it is recommended that the segmentation application return segmentation quality values that would indicate that the segmentation was not definitive.





6. Rotation

Applications may optionally return rotation information. The study is being designed so that rotating the output does not affect the evaluation. Applications are not evaluated based on rotation information, but it greatly assists in analysis.

The Meta-information file provides for two fields, ORIGINAL_ROTATION and OUTPUT_ROTATED.

ORIGINAL_ROTATION is the amount of rotation of the original (input) finger from vertical, in degrees. Positive values are clockwise rotation, and negative values are counter-clockwise. The

values can be integers or decimals. OUTPUT_ROTATED should be set to TRUE if the output images are rotated relative to the input.

In the example below, each finger is rotated about 45 degrees clockwise, so ORIGINAL_ROTATION should be set to 45. If the output segmented images are rotated to upright, OUTPUT_ROTATED should be set to TRUE.



Rotation is reported for each finger in the slap image. If rotation is only measured for the entire slap image, the rotation values should be set to that value for each finger.

7. Bounding Boxes

Applications may optionally return bounding box coordinates. These define the four corners of a rectangle bounding the individual segmented finger, measured in pixels from the top left corner of the input image. Applications are not evaluated based on bounding box information, but it greatly assists in analysis.

The example below shows bounding boxes when the output is not rotated relative to the original. Note that the bounding boxes may overlap.



The example below shows bounding boxes when the output is rotated relative to the original.



A.7 Issues

Slap Fingerprint Segmentation Issues

Last updated 9 August 2004

This document is a brief overview of slap fingerprinting, including a summary of the characteristics of those operational slap images that are potentially difficult to segment.

1 Slap Fingerprint Overview

Slap fingerprints, or "simultaneous plain impressions," are simply multiple flat fingerprints captured at the same time. They have been collected on paper fingerprint cards for decades, when their primary purpose was to allow sequence checking: verification that the rolled fingerprints on the card were in the correct order.

The examples below show slap fingerprints from paper and livescan sources.



Slap fingerprints have received increasing attention for possible use in large-scale fingerprint identification systems for non-criminal background checks, as a possible compromise between the use of rolled fingerprints and single finger flat fingerprints.

Rolled fingerprints

Sets of rolled fingerprints have been used for identification for decades, and provide a very accurate means of identification. However, operators must be well trained to collect good quality rolled fingerprints; the process is slow and requires physical manipulation of each of the subject's fingers by the operator. The use of slaps offers operational improvements over the use of rolled fingerprints, since collecting slap fingerprints is a rapid process that does not require the same degree of operator training and "manhandling" of the subject. However, each slap fingerprint averages less than half of the area of a good-quality rolled fingerprint: slaps therefore have fewer minutiae, and are harder to classify.

Single-finger flat fingerprints

Single-finger flats are frequently used for verification systems or small to medium-sized identification systems. Several studies, including the recent [FpVTE 2003](#), have shown that identification accuracy increases substantially as the number of fingers used increases, indicating that at least four fingers should be used for large-scale identification systems. Although single-finger scanners can be used to collect multiple fingers, sequence errors (in which fingerprints are taken out of order) are expected to be a substantial source of error when multiple fingers are taken on single-finger scanners. For these reasons, the use of slaps offers improvements in performance accuracy and efficiency over the use of single-finger flats, especially since four fingerprints can be collected in each image. Operationally, however, slap fingerprint scanners are larger and more expensive than single-finger fingerprint scanners.

A number of issues must be addressed in order to use slap fingerprints in an operational system. Key among these is the problem of segmentation error: segmentation can introduce errors, which could result in failures to enroll (FTE), or, if undetected, the enrolling of fingerprints into the database in the wrong order.

2 Problem Cases

Most livescan slap fingerprints are straightforward to segment. However, some livescan slaps, and a larger proportion of slaps from paper sources, are difficult to segment accurately. This document briefly describes some of the characteristics of hard-to-segment images.

Please note that the following examples are unusual cases; while they do occur, they are not typical of most images used in SlapSeg04.

Rotation

Most slap images (except possibly those from large-platen livescans) are rotated. The amount of rotation varies, but averages 20-25 degrees. Few images are rotated more than 45 degrees. Fingers from the left hand are usually rotated clockwise, and those from the right hand are usually rotated counterclockwise.

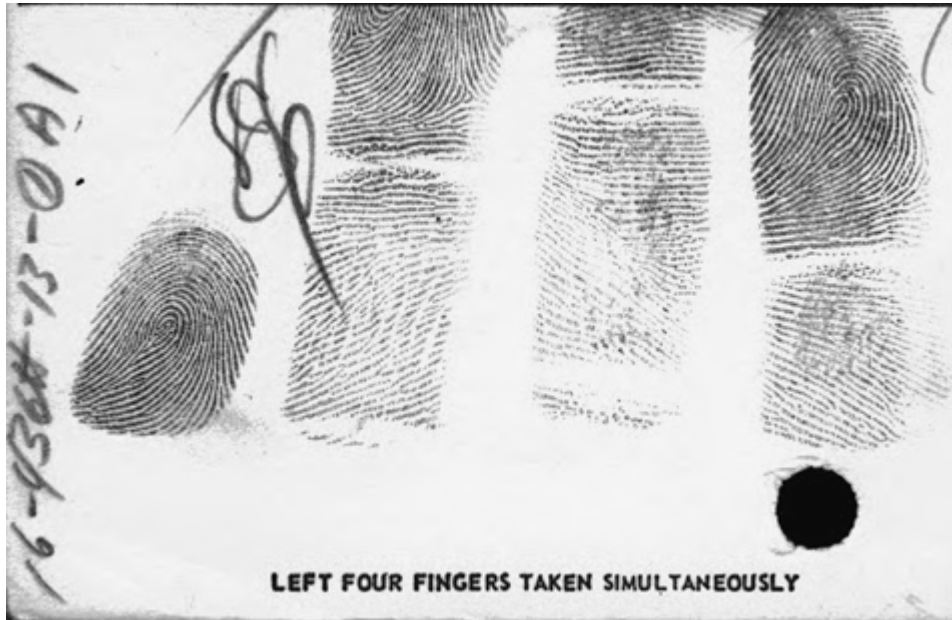


e.

When slaps are rotated more than usual, it may be more difficult to find the pads of all fingers, such as the index finger in this example.

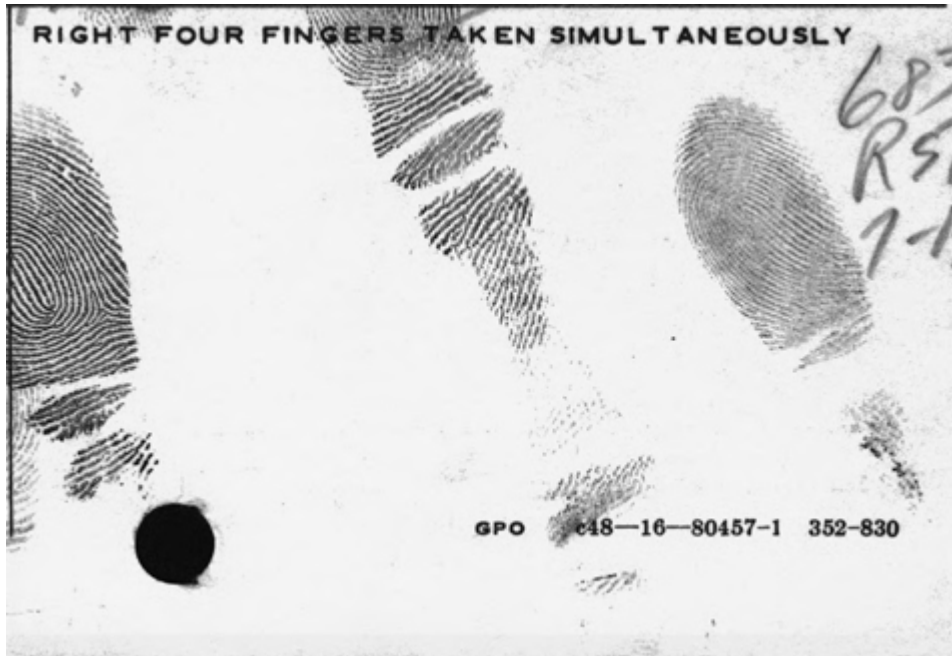
Cropped Fingers

Fingerprints frequently overlap the edges of slap images. Cropped fingers may affect the quality of the resulting fingerprints and/or the accuracy of segmentation.



Missing Fingers

Missing fingers are rare, but do occur.



Compressed Fingers

Fingers are occasionally pressed together unnaturally to force them on the platen, or into the box on the fingerprint card.



Paper Background Noise

Images from paper cards include the paper texture, unlike livescan images, which generally have pure white backgrounds.



Latent fingerprints

Most slap livescan devices employ a background removal algorithm that results in a pure white background. On occasion, this background removal is not successful, and the backgrounds contain latent fingerprint detail, so the feature extraction process will find minutiae in these backgrounds.



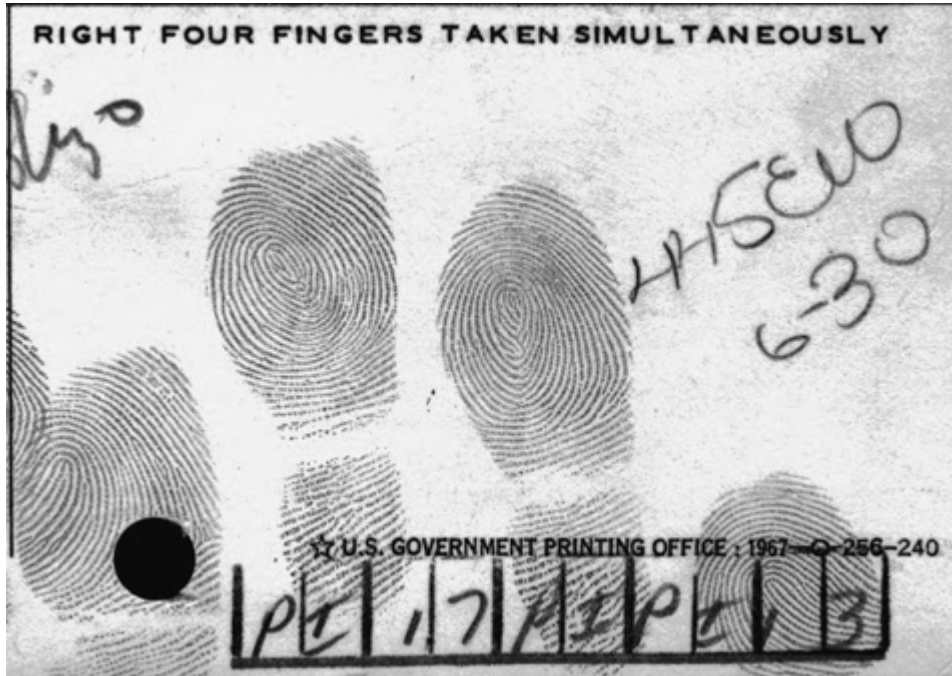
Haloing around fingers

Some livescan images have gray haloes around the fingers, apparently due to temperature or moisture.



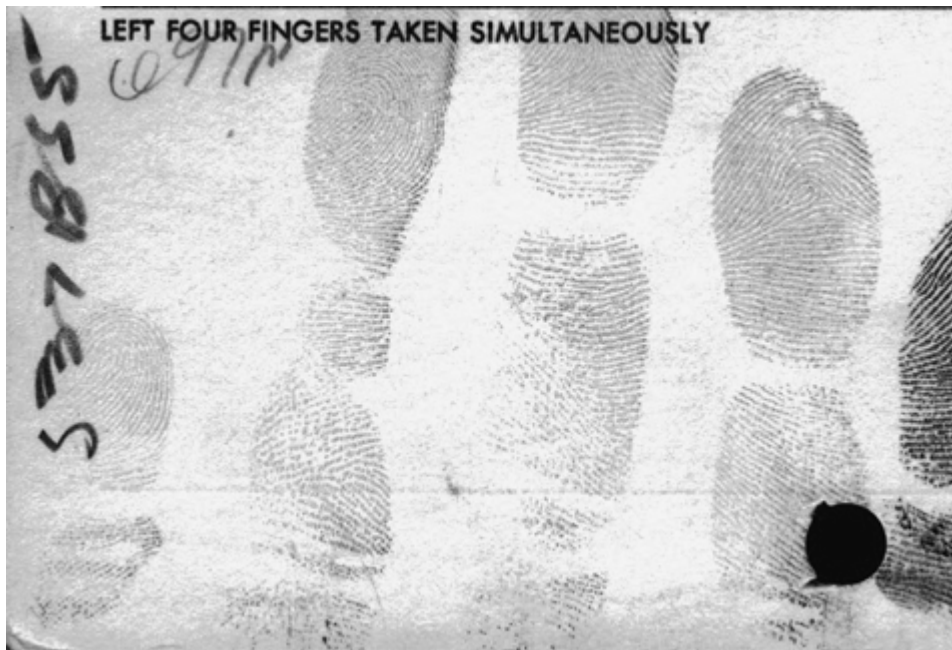
Handwritten and printed text, lines, punch holes, and marks

Paper fingerprint cards have preprinted text and lines. In addition, handwritten and printed text may be added to the card, and holes may be punched in it.



Thumb overlapping edge of image

In some cases, fingerprints in the neighboring boxes on a paper fingerprint card may overlap the edge of the slap.



A.8 How to Participate

How To Participate in SlapSeg04

Last updated 5 October 2004

NEW **The deadline to register for SlapSeg04 was closed on 8 September 2004. The deadline for software was closed on 4 October 2004.**

Application

- Complete the [Application to Participate in SlapSeg04](#)
- Print and sign the form, and mail or FAX to the location designated on the form.
- The signed *Application* must be received by **8 September 2004**, but would be welcomed before that date.
- Anonymous participation will not be permitted.

Slap Segmentation Software

- The Participants' Slap Segmentation software must comply with the [SlapSeg04 API Specification](#).
- All software to be evaluated must be received by **4 October 2004**, but would be welcomed before that date.
- Software is assumed to run on Windows 2000 or Red Hat Linux 7.2, on x86 platforms. Other options must be approved by the Test Liaison.
- **After** Sample Data results have been validated (see below), Participants should send the software to be evaluated to NIST. Software can be sent by email to slapseg04@nist.gov, or on CDROM to:

Slap Segmentation Evaluation 2004 Liaison
National Institute of Standards and Technology
Information Access Division (894)
100 Bureau Drive, Stop 8940
Gaithersburg, MD 20899-8940

Sample Data

- Participants must test their software using Sample data, and email these results to the Test Liaison (at slapseg04@nist.gov) for validation before sending software to NIST.
- Results from the Sample Data are requested by 27 September 2004, to provide time to resolve any issues before the software deadline.
- Sample data shall be made available to all registered Participants beginning in August 2004, on a Participant-only section of this website.
- Only a limited amount of sample data will be made available. The purpose for this sample data is to provide data representative of the format of the evaluation data, and may not be representative of the evaluation data in terms of image quality or other characteristics.
- Since the fingerprints used for evaluation are considered Sensitive but Unclassified data, none of the evaluation data can be made available for testing or training of software.
- A separate set of "Practice Data" will be made available for Participants who want additional slap data for testing or training. The Practice Data set is simply

[NIST Special Database 29 \(SD29\)](#), which contains full sets of fingerprint that were scanned from paper cards. The slap images from SD29 are representative of the **paper** source slaps to be used in the evaluation. Unfortunately, no liveness data can be released as sample or practice data.

Communication with SlapSeg04 Personnel

- All communication with SlapSeg04 personnel will be by sending email to the Test Liaison, at slapseg04@nist.gov.
- All responses to comments or questions from SlapSeg04 Participants will be in the Frequently Asked Questions (FAQ) pages of this website.

Evaluation

- Only slap segmentation software will be evaluated: no scanners, matchers or anything else.
- Evaluations will be conducted by SlapSeg04 personnel, using NIST computer hardware.
- Software that is not compliant with the [SlapSeg04 API Specification](#) cannot be evaluated.
- If the software being evaluated does not install and run easily, SlapSeg04 personnel will be very limited in their ability to work with the Participant to correct any problems. The Test Liaison will be the sole judge of what level of effort should be expended to install software.
- SlapSeg04 personnel may allow a Participant to enter more than one system in the evaluation if space is available. Please contact the Test Liaison if you are considering having more than one system evaluated.

Release of Evaluation Results

- Results will be published in the Slap Fingerprint Segmentation Evaluation 2004 Final Report, which should be released in early 2005.

A.9 Application to Participate

Application to Participate in the Slap Fingerprint Segmentation Evaluation 2004 (SlapSeg04)

1 Who Should Participate

- 1.1 Makers of commercially available slap fingerprint segmentation software are invited to participate in the Slap Fingerprint Segmentation Evaluation 2004.
 - 1.2 In addition, companies, research organizations, or universities that have developed mature prototype or research slap fingerprint segmentation software are invited to participate.
 - 1.3 Anonymous participation will not be permitted.
-

2 Evaluation Procedure

- 2.1 In order to request participation in SlapSeg04, potential participants must fill out this form (*Application to Participate in SlapSeg04*) identifying the Responsible Party and the Point of Contact, print and sign the form, and send to the location designated below.
 - The Responsible Party is an individual with the authority to commit the organization to the terms in this document.
 - The Point of Contact is an individual with detailed knowledge of the system to be considered for evaluation.
- 2.2 Upon receipt of the original signed form by the National Institute of Standards and Technology (NIST), the organization will be classified as a “Participant”. NIST must receive the form by the due date described in the SlapSeg04 Calendar, as posted on the SlapSeg04 website at <http://SlapSeg04.nist.gov/>.
- 2.3 Before sending software to NIST for evaluation, Participants must segment the SlapSeg04 Sample Data and send the results to NIST for validation. (See the Sample Data page on the SlapSeg04 website for more information.)
- 2.4 SlapSeg04 personnel may allow an organization to enter more than one system in the evaluation if space is available. Organizations interested in having more than one system evaluated should only fill out one copy of this form (*Application to Participate in SlapSeg04*).
- 2.5 Software to be evaluated must be compliant with the SlapSeg04 API Specification.
- 2.6 After Sample Data results have been validated, Participants should send the software to be evaluated to NIST. Software can be sent by email to SlapSeg04@nist.gov, or on CD to:

Slap Segmentation Evaluation 2004 Liaison
National Institute of Standards and Technology
Information Access Division (894)
100 Bureau Drive, Stop 8940

Gaithersburg, MD 20899-8940

3 Points of Contact

- 3.1 The SlapSeg04 Liaison is the government point of contact for SlapSeg04.
- 3.2 All correspondence should be directed to SlapSeg04@nist.gov, which will be received by the SlapSeg04 Liaison and other SlapSeg04 personnel.
- 3.3 All correspondences and responses to correspondence will be posted on the FAQ (Frequently Asked Questions) area of the SlapSeg04 website. Exceptions will be allowed only for extenuating circumstances (such as logistical issues for a specific Participant).
- 3.4 Interested parties and Participants should not contact any individual member of the SlapSeg04 staff.

4 Access to SlapSeg04 Sample Data

- 4.1 The SlapSeg04 Sample Dataset is supplied to Participants to assist in preparing for SlapSeg04.
- 4.2 The fingerprints in the SlapSeg04 Sample Data are representative of the SlapSeg04 Evaluation Data *only* in format. Image quality, collection device and other characteristics may vary between the Sample and Evaluation Datasets.

5 Access to SlapSeg04 Evaluation Data

- 5.1 SlapSeg04 Participants will have no access to SlapSeg04 Evaluation Data, either before or after the test.
- 5.2 The SlapSeg04 Evaluation Datasets will be protected under the Freedom of Information Act (5 U.S.C 552) and the Privacy Act (5 U.S.C. 552a) as applicable.

6 Release of Evaluation Results

- 6.1 After the completion of the evaluations, the Government will combine all results into a Final Report. The Slap Fingerprint Segmentation Evaluation 2004 Final Report will contain, at a minimum, descriptive information concerning SlapSeg04, descriptions of each experiment, and evaluation results.
- 6.2 Participants will be notified of the public release of the SlapSeg04 Final Report.
- 6.3 After the release of the SlapSeg04 Final Report, Participants may decide to use results of these evaluations for their own purposes. Such results shall be accompanied by the following phrase: "Results shown from the Slap Fingerprint Segmentation Evaluation 2004 do not constitute endorsement of any particular system by the Government." Such results shall also be accompanied by the Internet address (URL) of the SlapSeg04 Final Report on the SlapSeg04 website.

7 Additional Information

- 7.1 Any data obtained during these evaluations, as well as any documentation required by the Government from the participants, becomes the property of the Government. Participants will not possess a proprietary interest in the data and/or submitted documentation.
- 7.2 With the signing of this form, Participants attest that they will not file any SlapSeg04-related claim against SlapSeg04 Sponsors, Supporters, staff, contractors, or agency of the U.S. Government, or otherwise seek compensation for any equipment, materials, supplies, information, travel, labor and/or other participant provided services.
- 7.3 The Government is not bound or obligated to follow any recommendations that may be submitted by the Participant. The United States Government, or any individual agency, is not bound, nor is it obligated, in any way to give any special consideration to SlapSeg04 Participants on future contracts.
- 7.4 With the signing of this form, Participants realize that any test details and/or modifications that are provided in the SlapSeg04 website supersede the information on this form.
- 7.5 With the signing of this form, Participants realize that they can withdraw from the SlapSeg04 evaluations at any time before the software to be evaluated is received by NIST, without their participation and withdrawal being documented in the SlapSeg04 Evaluation Report.
- 7.6 Please send the completed and signed form to:
 Via Mail:
 Slap Segmentation Evaluation 2004 Liaison
 National Institute of Standards and Technology
 Information Access Division (894)
 100 Bureau Drive, Stop 8940
 Gaithersburg, MD 20899-8940
 Via Facsimile:
 (301) 975-5287

8 Request to Participate

Company / Organization Name

8.1 Responsible Party

Title	First Name	MI	Last Name	Suffix
Street/Mailing Address				
City		State	Zip Code	
Phone Number	Fax Number	Email Address		

--	--	--

8.2 Point of Contact Check if same as Responsible Party above

Title	First Name	MI	Last Name	Suffix
Street/Mailing Address				
City			State	Zip Code
Phone Number	Fax Number		Email Address	

With my signature, I hereby request consideration as a Tentative Participant and Participant in the Slap Fingerprint Segmentation Evaluation 2004, and I am authorizing my company or organization to participate in SlapSeg04 according to the rules and limitations listed in this document.

With my signature, I also state that I have the authority to accept the terms stated in this document.

SIGNATURE OF RESPONSIBLE PARTY

DATE

A.10 Calendar*Last updated 5 October 2004***Calendar**

SlapSeg04 API Specification available	14 July 2004
Sample Data available	6 August 2004
Last date to apply to participate	8 September 2004
Requested deadline for submission of sample data results	27 September 2004
Last date for NIST to receive software for evaluation	4 October 2004
Final Report made public	Early 2005

A.11 API Specification

Slap Fingerprint Segmentation Evaluation 2004 (SlapSeg04) API Specification

Last updated 28 July 2004

Overview

The Slap Fingerprint Segmentation Evaluation 2004 will investigate the accuracy of fingerprint image segmentation systems for use with multi-finger slap images.

The segmentation application to be tested is assumed to run on Windows 2000 or Red Hat Linux 7.2, on x86 platforms. Other options must be approved by the Test Liaison. The application must have a command-line interface as specified in this document; no other user interface is permissible.

The segmentation application must be capable of taking as input either a Wavelet Scalar Quantization (WSQ) compressed slap image, or an uncompressed raw slap image, and outputting up to four uncompressed raw segmented images, each corresponding to one of the individual fingers pictured in the slap. It is recommended that the segmentation application return segmentation quality values, indicating the likelihood that that image was correctly segmented.

1 Application Inputs

1.1 Slap Image Files

The segmentation application must be capable of processing multi-finger slap images stored either in

- Wavelet Scalar Quantization (WSQ) compressed format, or
- Uncompressed raw 8-bit (one byte per pixel) grayscale format.

These formats are defined further below.

1.1.1 Resolution and Dimensions

All images for this test shall employ 500 PPI resolution (horizontal and vertical).

In almost all cases, the dimensions of slap images are within the maxima defined by ANSI/INCITS 381[2]: width less than 83.8 mm (3.3 in), and height less than 76.2 mm (3.0 in). In a few cases, the dimensions may exceed those values, up to a maximum of 101.6 mm (4.0 in), or 2000 pixels.

1.1.2 Slap Image Filenames

Multi-finger slap image files shall be specified in the command line either by relative pathnames, or fully-qualified pathnames. Unix-style forward slashes ("/") shall be used, not Windows-style backward slashes ("\"). For example,

`/share/data/slap999.wsq`

The *root* filename is defined as the filename without the path or extension. For example,

`slap999`

Filenames will be limited to alphanumeric characters and underscores (i.e. they will not contain blanks). Symbolic links or Windows shortcuts will not be used.

1.1.3 WSQ File Format

WSQ files are compliant with the document *WSQ Gray-Scale Fingerprint Image Compression Specification*.^[4]

NIST has public domain WSQ tools in NIST Fingerprint Image Software (NFIS). [1] A variety of commercial vendors of WSQ tools can easily be found by doing an Internet search, e.g. for "wsq compression software."

1.1.4 Raw File Format

Raw 8-bit grayscale image files are canonically encoded with black equal to 0, white equal to 255, etc.; stored left to right, top to bottom, with one 8-bit byte per pixel. The number of bytes in a file is exactly the image height * image width, as measured in pixels; there is no header.

1.2 Input Parameters

The following information shall be provided as parameters to the segmentation application:

Hand identifier[-h]

specifies R (right), L (left) or U (unknown) hand corresponding to the specified slap image.

Source [-s]

specifies the source of the fingerprint image: L (livescan), P (paper), or U (unspecified; could be livescan or paper).

Output path [-o]

optionally specifies the directory to which all output files shall be written. The default is the directory in which the application is currently executing.

Slap image filename

specifies a file containing either a WSQ compressed, or uncompressed 8-bit grayscale slap image to segment. In the latter case, the height and width of the image in pixels shall follow as additional parameters.

The parameters (if present) will always be in the stated order. Parameters will be separated by spaces or tabs.

1.3 Example Command-line Usage

The following are examples of how the input parameters may be specified to the segmentation application (using “Unix-like” command-line usage syntax). In the following examples, items within “[]” are optional.

The application should be named “segment” (Linux) or “segment.exe” (Windows).

Usage:

```
segment -h ID -s SOURCE [-o DIR] image.wsq
```

or

```
segment -h ID -s SOURCE [-o DIR] image.raw HEIGHT WIDTH
```

-h ID

Hand identifier (R=right, L=left, U=unknown) (no other cases; uppercase only)

-s SOURCE

fingerprint image source (L=livescan, P=paper, U=unspecified) (no other cases; uppercase only)

-o DIR

Output directory for segmented image files

image.wsq

WSQ compressed image filename

image.raw HEIGHT WIDTH

Raw image filename with height and width in pixels

2 Application Outputs

2.1 Segmented Image Files

For each slap image file that is input, up to four separate segmented image files may be produced, depending upon the number of individual fingers that the segmentation system is able to find in the slap image. Unless otherwise specified by the application input parameter, *Output Path*, the segmented image files shall be written to the current execution directory.

2.1.1 Segmented Image File Format

Segmented images shall be stored in uncompressed, raw 8-bit (one byte per pixel) grayscale format and shall preserve the original resolution (PPI) of the slap image. The segmented image shall be encoded canonically (black equal to 0, white equal to 255, etc.) and stored left to right, top to bottom.

2.1.2 Segmented Image Filenames

Segmented image files shall be written with the root filename (as defined in 1.1.2 Slap Image Filenames) concatenated with `_{seg_pos}` followed by `_{finger_pos}` and the extension `.raw`.

Seg_pos

The segmented position is defined to begin at the capital letter “A”, and increment for each additional segmented image created from the slap. The seg_pos letters must progress from left to right for the fingers in the slap image. For example, for a left slap, the little finger would be assigned a seg_pos of A, while for a right slap, the index finger would be assigned a seg_pos of A.

Finger_pos

The finger position is the position code defined in Table 6 of the standard ANSI/NIST-ITL 1-2000 [3]:

- 00 Unknown
- 01 Right thumb
- 02 Right index
- 03 Right middle
- 04 Right ring
- 05 Right little
- 06 Left thumb
- 07 Left index
- 08 Left middle
- 09 Left ring
- 10 Left little

Finger_pos shall be written as two digits with a leading zero (if necessary). For example,

```
slap999_A_10.raw  
slap999_B_09.raw  
slap999_C_08.raw  
slap999_D_07.raw
```

Note that if the position code cannot be determined by the segmentation application, it shall set *finger_pos* equal to 0, for example,

```
slap999_A_00.raw
```

2.1.3 Dimensions

It is assumed that the output files are unlikely to have width or height greater than 1.5 inches (750 pixels), but any width or height up to 4 inches (2000 pixels) is permissible.

Output files with width or height less than 0.1 inches (50 pixels) will be ignored during analysis.

2.2 Meta-information Files

Along with outputting a set of (up to four) segmented image files for a single slap image, the segmentation application shall also produce a single meta-information file for each segmented image. Unless otherwise specified by the application input parameter, *Output Path*, the meta-information files shall be written to the current execution directory. The meta-information file is stored with a filename equal to the segmented image filename (see 2.1.2 Segmented Image Filenames) with the extension .nsm replacing .raw. For example,

slap999_A_10.nsm
slap999_B_09.nsm
slap999_C_08.nsm
slap999_D_07.nsm

The meta-information file shall contain a series of attribute-value pairs, formatted one per line. Minimally it must contain the following attribute-value pairs:

PIX_HEIGHT=value

value is the segmented image height in pixels

PIX_WIDTH=value

value is the segmented image width in pixels

The following attribute-value pairs may be output by the segmentation system, but are not required. We request that these be output if practical.

SEG_QUAL=value

value is the quality of the segmentation, in a user-defined numeric scale. A higher segmentation value must correspond to a higher likelihood that that image was correctly segmented. The values can be integers or decimals.

ORIGINAL_ROTATION=value

value is the amount of rotation of the original (input) finger from vertical, in degrees. Positive values are clockwise rotation, and negative values are counter-clockwise. The values can be integers or decimals.

OUTPUT_ROTATED=(TRUE or FALSE)

If the output images are rotated relative to the input, OUTPUT_ROTATED should be set to TRUE.

BOUNDINGBOX=(X,Y)_{opleft} (X,Y)_{oprigh} (X,Y)_{bottomleft} (X,Y)_{bottomright}

The four corners of a rectangle bounding the individual segmented finger, measured in pixels from the top left corner of the input image.

For example,

```
PIX_HEIGHT=200
PIX_WIDTH=120
SEG_QUAL=0.82
ORIGINAL_ROTATION=-30
OUTPUT_ROTATED=FALSE
BOUNDINGBOX=(100,100),(400,100),(100,400),(400,400)
```

2.3 Error Codes and Handling

The segmentation application shall exit with a return code of zero on success. The participant must provide documentation of all (non-zero) error or warning codes (see section 3.3, Documentation).

The application should include error/exception handling so that in the case of a crash, the return code is still provided to the calling shell.

We request that the following return codes be used:

Return code	Explanation
--------------------	--------------------

0	Success
1	Unable to read input file
2	Unable to open/decompress input WSQ file
3	Unable to write output files
10	0 fingers could be segmented
11	Only 1 finger could be segmented
12	Only 2 fingers could be segmented
13	Only 3 fingers could be segmented
20 - 63	Application-specific fatal errors (explained in documentation)
64 - 127	Application-specific non-fatal warnings (explained in documentation)

All errors, warnings and informational messages shall be limited to output displayed via standard output or standard error. No GUI-type dialog windows are permitted.

3 Software and Documentation

3.1 Application type and platform

The application provided shall be command-line driven, and capable of being run in non-interactive "batch mode." No graphical user interface (GUI) is permitted.

Test participants shall provide NIST with binaries only (i.e. no source code) for their segmentation application. Testing of segmentation systems will be performed on commercial, off-the-shelf PCs. Applications running on Red Hat Linux 7.2 or Microsoft Windows 2000 are preferred; other operating systems must be approved by the Test Liaison.

3.2 Installation

Segmentation software must install and run easily to be evaluated.

It is recommended that the application shall be immediately executable without use of an installation program. Please contact the Test Liaison if an installation program is absolutely necessary.

The application shall be executable on any number of machines without requiring additional machine-specific license control procedures or activation.

It is preferred that the application be packaged as a single executable file. If external libraries (such as DLLs) are necessary, they should work from the application directory, and not require installation in another location.

3.3 Documentation

Complete documentation of application usage shall be provided, and shall detail any additional functionality or behavior beyond what is specified in this document.

The documentation must define all error and warning codes.

The documentation must define the range of segmentation quality values, at least to the extent of defining the minimum and maximum values. If thresholds are known, they should be documented: e.g. "values above 0.8 are almost always correctly segmented, and values below 0.2 are almost always incorrect".

3.4 Speed

Software that runs excessively slowly cannot be evaluated. On average, segmentation software should take *much* less than ten (10) seconds to segment a slap image (using a 1ghz Pentium III). Due to resource limitations, software that takes longer than that may not be evaluated.

Processing speed will be noted but will not be a primary evaluation criterion.

3.5 Sample Data and Results

Participants must test their software using the SlapSeg04 Sample data, and email these results to the Test Liaison for validation before sending software to NIST for evaluation.

References

- [1] *NIST Fingerprint Image Software (NFIS)*
http://www.itl.nist.gov/iaui/894.03/databases/defs/nist_nfis.html
- [2] *American National Standard for Information Technology - Finger Image-Based Data Interchange*, ANSI/INCITS 381-2004, May 13, 2004, www.incits.org
- [3] R. M. McCabe, "ANSI/NIST-ITL 1-2000 Data Format for the Interchange of Fingerprint, Facial, and Scar Mark & Tattoo (SMT) Information,"
ftp://sequoyah.nist.gov/pub/nist_internal_reports/sp500-245-a16.pdf
- [4] *WSQ Gray-Scale Fingerprint Image Compression Specification*, IAFIS-IC-0110 (V3)
Criminal Justice Information Services Division, Federal Bureau of Investigation, December 1997

A.12 Sample Data (from the Participant Area of the Website)

Sample Data

Last updated 17 September 2004

The Sample Data set includes 50 WSQ-compressed slap images, to be used to test compliance with the API Specification:

- Participants will use the Sample Data to test compliance with the API Specification.
- Participants must submit segmentation results from the Sample Data to the [Test Liaison](#) (by email) for validation before submitting software for evaluation.
 - Please do not email attachments larger than 10Mb.
 - If (as expected) the results are larger than 10Mb, please use multiple ZIP or TAR files, attached to different email messages, with subject lines indicating (for example) "1 of 2" or "2 of 2".
 - Alternatively, Participants may provide the address (URL) of an FTP or Web server from which the Test Liaison can download the results from the Sample Data.
- Results from the Sample Data are requested by 27 September 2004, to provide time to resolve any issues before the software deadline.
- Participants must use these command line statements to segment the Sample Data.:
 - [WSQ command line statements](#)
 - [Raw command line statements](#) **NEW**
 - All 50 of the Sample Data files are segmented with hand (right/left) and source (paper/live) specified
 - 4 of the Sample Data files are segmented a second time, with hand and source left unspecified
- The results from the Sample Data should be in one or more ZIP or TAR files, including:
 - The segmented image files (216, if all images can be segmented successfully)
 - The meta-information files (*.nsm)
 - A file named "RtnCodes.txt", containing the input filenames and return codes in a tab-separated format, one file per line
- When software is received by NIST, installation will be checked by running the Sample Data, and comparing those results to the sample results submitted earlier by the Participants.

The purpose for this sample data is to provide data representative of the format of the evaluation data. It is not representative of the evaluation data in terms of image quality or other characteristics. The Sample Data includes a disproportionate number of problem cases.

Please do not distribute the Sample Data.

Download

[WSQ Sample Data \(4.1 Mb ZIP file\)](#)

[Raw Sample Data \(42 Mb ZIP file\)](#) **NEW**

Practice Data

A separate set of "Practice Data" is available for Participants who want additional slap data for testing or training. The Practice Data set is simply the slap images from [NIST Special Database 29 \(SD29\)](#), which contains full sets of fingerprint that were scanned from paper cards. The slap images from SD29 are representative of the ***paper*** source slaps to be used in the evaluation. Unfortunately, no livescan data can be released as sample or practice data.

The Practice Data is too large for download. Please contact the [Test Liaison](#) if you would like a copy of the CD.

A.13 Participants' Frequently Asked Questions (from the Participant Area of the Website)**Participants' Frequently Asked Questions (FAQ)***Last updated 27 September 2004*

To ask a question, please [email us](#). All responses will be posted to this list: no individual responses will be sent. The newest Q&As are at the beginning of each section.

Note: a separate FAQ regarding questions of general interest is available in the main SlapSeg04 Website.

Is the test platform in reality a 1GHz PIII, as implied by section 3.4 of the API specification? I am extremely surprised such a dated (3+ years old) PC is being used to test state-of-the-art processing algorithms. If it is the case that a newer PC is actually being used, does that mean the speed requirement has also changed to reflect the newer PC speed? NEW

The test platforms are recent 2.8GHz Pentium 4s, and therefore much faster than 1GHz PIIIs. The API included the 1GHz PIII line as a point of reference for minimum throughput, before the test platform was determined. The minimum requirement still stands.

Will the image file's extension name ".wsq" or ".raw" always be lower case? Or they may be in capital or some kind of mixed?

The slap image file names will always have the lower-case extensions ".wsq" or ".raw".

Since there is one week between the submission of sample data results by 27 September and submission of the final application by 4 October there may be some evolution of the software during this time. If there are changes is it allowable and/or necessary to submit an additional set of test data results before the final application submission?

If software changes are made after the sample data results are submitted, please submit a new set of sample results. The first thing we will do when we receive the software will be to run the Sample Data and verify that we get exactly the same results as you sent us, to verify correct installation.

In the sample data command line statements: the commands "segment -h R -s L L001_13.wsq" and "segment -h U -s L L001_13.wsq" will produce exactly the same name output files, like L001_13_A_02.raw and L001_13_A_02.nsm.

This was an error in the Sample data command line page: there should have been 54 unique file names, so that no two commands would have identical names. This problem will not occur in the evaluation data.

In the [command line file](#), the last four lines have been replaced, appending "_HU" (hand unknown) or "_SU" (source unknown) to the filenames.

Old lines:

- segment -h U -s L L001_13.wsq
- segment -h U -s L L001_14.wsq
- segment -h R -s U P002_13.wsq
- segment -h L -s U P003_14.wsq

New lines:

- `copy L001_13.wsq L001_13_HU.wsq #use cp instead of copy for unix/linux`
- `copy L001_14.wsq L001_14_HU.wsq`
- `copy P002_13.wsq P002_13_SU.wsq`
- `copy P003_14.wsq P003_14_SU.wsq`
- `segment -h U -s L L001_13_HU.wsq`
- `segment -h U -s L L001_14_HU.wsq`
- `segment -h R -s U P002_13_SU.wsq`
- `segment -h L -s U P003_14_SU.wsq`