



# WHAT MAKES A GOOD PRINT?

As a result of popular television shows, many people have misperceptions about fingerprint quality. The Hollywood portrayal of fingerprints – with perfectly formed continuous ridges – while aesthetically pleasing does not reflect the reality of fingerprint capture by today’s advanced biometric systems.

Many of the fingerprint characteristics required to enroll, identify and verify individuals by their unique prints are not distinguishable to the naked eye. Processes that enhance the visual appearance of a print can also invalidate the image for matching against key databases.

These manipulated, retouched, or altered images may subjectively seem to be of higher quality, but such ‘Hollywood’ fingerprints increase risk and can reduce confidence in your organization’s biometric system.



## How to Measure Fingerprint Image Quality

The US National Institute of Science and Technology (NIST), has established the global standard for objectively measuring fingerprint image quality. Two algorithms, NIST Fingerprint Image Quality (NFIQ) 1 and [NIST Fingerprint Image Quality \(NFIQ\) 2](#), evaluate the suitability of a fingerprint image for automated matching. NFIQ 2 quality features are formally standardized as part of [ISO/IEC 29794-4](#) (Information technology – Biometric sample quality – Part 4: Finger image data) and serve as the reference implementation of the standard.

These algorithms do not use the visual or aesthetic merits of a fingerprint image. The NFIQ algorithm works by receiving a fingerprint image and extracting all relevant features – many of which are not discernible to the naked eye. This includes minutiae such as ridge frequency, ridge detail, and sweat pores.

The NFIQ does not use subjective aesthetic factors such as perceived grayscale distribution, observed contrast, and ridge continuity. Therefore, a lighter image, which could be perceived by a layperson to be of lower quality, may still rank high on the NFIQ.

## Scoring the Image

Once the features are extracted, they are processed through a neural network, and the print receives a score representing the quality of the print. The quality score is a representation of the fingerprints' ability to match against a database such as IAFIS. NFIQ 1 ranks the image from 1 to 5 with 1 being the best quality, and 5 being the worst quality.

NFIQ 2 ranks the image from 100 to 1 with 100 being the best quality, and 1 being the worst quality.

- NFIQ 1
  - 1 = Excellent
  - 2 = Very Good
  - 3 = Good
  - 4 = Fair
  - 5 = Poor
- NFIQ 2
  - 100 = Excellent
  - 75 = Very Good
  - 50 = Good
  - 25 = Fair
  - 1 = Poor





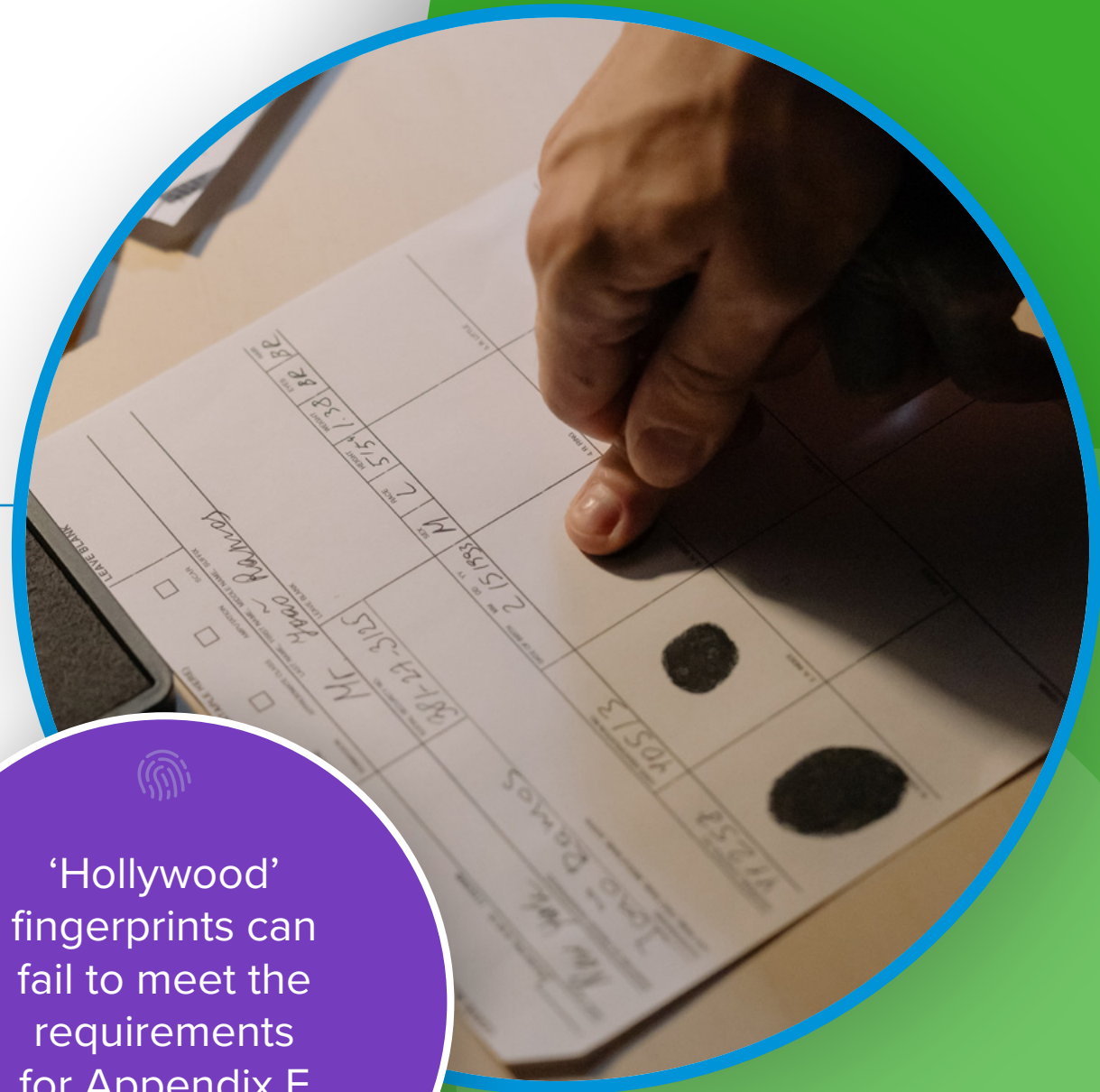
## What Makes a Good Print?

Below are examples of finger images from the NFIQ 2 conformance test set, with their scores.



### Appendix F / PIV Fingerprint Image Quality

The US Federal Bureau of Investigation's Appendix F assesses image quality based on the [Next Generation Identification \(NGI\) Image Quality Specifications \(IQS\)](#). 'Hollywood' fingerprints can fail to meet the requirements for Appendix F certification.



  
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## What Makes a Good Print?

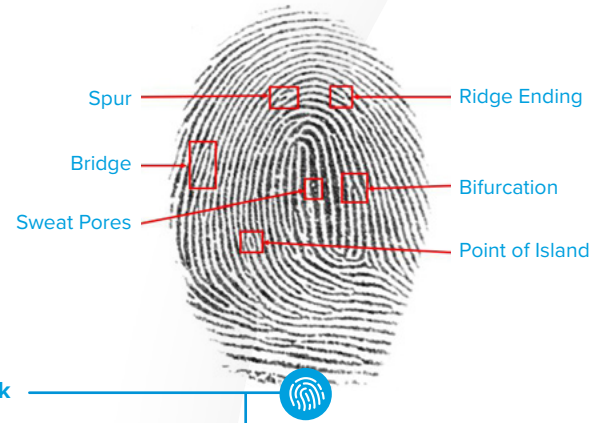


Image Captured on IB Kojak



A fingerprint image must have 80% of the captured fingerprint in the grayscale dynamic range of at least 200 gray levels, with 99% of the captured fingerprint having at least 128 gray levels. The fingerprint gray range is set so that a low contrast image can be avoided without adding false details.

In addition, no scanner or image processing algorithm may add information to the image.

### Minutiae Extraction and Matching

To meet the rigorous quality standards of NIST and the FBI there must be at least 10 distinct minutiae points for a 1:N match. Integrated Biometrics scanners far exceed that level, extracting on average 30 minutiae for a single scan.

Our ability to isolate features such as ridge islands, spurs, crossovers and sweat pores creates an image that can be used for enrollment, identification and verification.



## ABOUT INTEGRATED BIOMETRICS

Integrated Biometrics, LLC designs and manufactures FBI-certified fingerprint sensors for law enforcement, military operations, homeland security, national identity, election validation, social services, and a wide range of commercial applications. The company's patented light emitting sensor technology enables lightweight scanners that outperform traditional prism-based devices in size, power consumption, portability, and reliability. Identity management solutions providers, government agencies, and corporations around the world rely on Integrated Biometrics' products to enroll and verify individual identity quickly and accurately, even in remote locations.

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