SCIENTIFIC WORKING GROUP ON IMAGING TECHNOLOGIES (SWGIT)

DRAFT RECOMMENDATIONS AND GUIDELINES FOR THE USE OF DIGITAL IMAGE PROCESSING IN THE CRIMINAL JUSTICE SYSTEM

(Version 1.1 – February 2001)

The purpose of this document is to provide recommendations and guidelines for the use of digital image processing in the criminal justice system. Our objective is to ensure the successful introduction of forensic imagery as evidence in a court of law. This document includes brief descriptions of advantages, disadvantages and potential limitations of each major process.

SWGIT POSITION ON DIGITAL IMAGE PROCESSING:

Digital image processing is an accepted practice in forensic science. It is the position of the Scientific Working Group on Imaging Technologies (SWGIT) that changes to an image made through digital image processing are acceptable in forensic applications provided the following criteria are met:

1. The original image is preserved.
2. The processing steps are logged when they include techniques other than those used in a traditional photographic darkroom.
3. The end result is presented as an enhanced image, which may be reproduced by applying the logged steps to the original image.
4. The recommendations of this document are followed.

Introduction

This section addresses digital image processing and related legal considerations in four categories. These are:

(1) Image enhancement
(2) Image restoration
(3) Image compression
(4) Image analysis

When using digital image processing techniques one should use caution to avoid (1) introduction of unexplainable artifacts that add misleading information to the image and (2) loss of image detail that could lead to an erroneous interpretation. Any processing techniques should be applied only to the working image.

The successful introduction of forensic imagery as evidence in a court of law is dependant upon the following four legal tests:

(1) Reliability
(2) Reproducibility
(3) Security
(4) Discovery

DEFINITIONS

Forensic- relating to or dealing with the application of scientific knowledge to legal problems, especially in relation to the detection of crime.

Reliability- the extent to which information can be depended upon.

Reproducibility- the extent to which a process yields the same results on repeated trials.

Security- the extent to which the evidence has been preserved and safeguarded.

Discovery- the criminal defendant's right to confront and challenge the evidence.

Image Processing – any activity that transforms an input image into an output image. Note: image processing does not mean that the input image is overwritten during the process. Forensic image processing should only be performed on working images.

Image Enhancement- any process intended to improve the visual appearance of an image.

Image Restoration - any process applied to an image that has been degraded by a known cause (such as defocus or motion blur) so the effects of that degradation are partially or totally removed.

Image Compression- the process of reducing the size of a data file.

Image Analysis- the extraction of quantitative information from an image beyond which is readily apparent through visual examination.

Copy Image- A reproduction of information contained in a primary or original image.

Working Image- Any image subjected to processing.

Primary Image- Refers to the first instance in which an image is recorded onto any media that is a separate, identifiable object or objects. Examples include a digital image recorded on a flash card or a digital image downloaded from the Internet.

Original Image- An accurate and complete replica of the primary image, irrespective of media. For film and analog video, the primary image is the original image.

Image Synthesis- any process that renders an image through the use of computer graphics techniques for illustrative purposes (i.e. age progression, facial reconstruction, accident/crime scene reconstruction). This subject is beyond the scope of this document.

Artifact – Any visible feature or distortion in a recorded image or output image that is not present in the corresponding imaged object or input image. Image artifacts can be introduced inadvertently by hardware or software, or intentionally by an operator. The latter type includes annotation or other direct alteration of an image in order to clarify or call attention to some particular image content. Artifacts introduced by hardware and software generally degrade an

image, and, if severe enough, can impair interpretation. (See SWGIT's "Definitions and Guidelines for Digital Image Processing" document for further information.)

Compression ratio- the size of an image data file before compression divided by the file size after compression.

JPEG- (Joint Photographic Experts Group). A Lossy image compression process. Users can set their own quality settings on a sliding scale within the application software.

JPEG 2000- an image compression process currently under development

LZW- (Lempel-Ziv-Welch). A Lossless compression process used by the TIFF and GIF file format.

TIFF –(Tagged Image File Format). A standardized image file exchange format. It is widely supported by both hardware and software manufacturers and is platform independent. Can be lossless or lossey

GIF-(Graphical Interchange Format). A Lossless compression file format commonly used for graphics images.

MPEG- (Motion Pictures Experts Group)-Similar to JPEG a standard compression algorithm used to compress video and audio sequences.

AVI-(Audio/Video Interlaced)- Microsoft file format for storing and displaying compressed video sequences.

Apple QuickTime™ Movie Format-(MOV file format) Apple file format for storing and displaying compressed video sequences.

Deinterlacing-Any technique that converts interlaced scanned video into progressively scanned video. This process requires interpolation or replication to replace missing image lines in individual frames.

Image Averaging The process of averaging together similar images, such as sequential video frames, to reduce noise in stationary scenes.

Interpolation- A process by which the *apparent* resolution of an image is increased. In most cases the software mathematically averages adjacent pixel densities and places a pixel of that density between the two.

Interlaced Scan Video in which each field frame does not contain information from every horizontal scan line of the imaging sensor. This is commonly performed by storing video sequentially as field frame A, field frame B, field frame A, field frame B, …, in which field frame A contains only even-numbered horizontal scan lines, and field frame B contains only odd-numbered scan lines.

Progressive Scan-(Non interlace) Video in which each image frame contains information from every horizontal scan line of the imaging sensor.

Image Enhancement

Purpose:

Image enhancement is any process intended to improve the visual appearance of an image. This includes processes that have a direct counterpart in the conventional silver-based photographic laboratory, and those that can only be accomplished using a computer.

Enhancement Techniques

Traditional Enhancement Techniques:

Those enhancement techniques that have direct counterparts in traditional darkrooms. These include; brightness and contrast adjustment, dodging and burning, color balancing, cropping. They are used to achieve an accurate recording of an event or object. These are considered to be traditional and acceptable forensic techniques.

Brightness adjustment is used when the image is too bright or too dark. If the image is made too bright there is a risk of loss of detail in light areas. If the image is made too dark there is a risk of loss of detail in the dark areas.

Contrast adjustment is used when the image lacks sufficient contrast. If the image contrast is increased too much there is a risk of loss of detail in both light and dark areas.

Dodging and burning have the same effect as brightness adjustment, but is used in a localized area.

Color balancing is the adjustment of the color components of an image. The purpose of color balancing is to render the colors in the scene faithfully. Improper color balance adjustment can render colors inaccurately and objects will appear to have the wrong color when compared to the actual subject.

Cropping is used to remove that portion of the image that is outside the area of interest.

Spotting has been used traditionally to remove artifacts due to dust and scratches on the negatives. Spotting is not considered to be an acceptable practice on any forensic image.

Note: The use of spotting and cropping techniques may come under additional scrutiny. Specific agency policies should address the use of these techniques.

Non-Traditional Enhancement Techniques:

The following examples of non-traditional image enhancement processes are used and accepted by a variety of scientific fields such as medicine, aerospace, and cartography. These processes have no direct counterpart within traditional silver based photography; they have only recently been applied within the forensic environment and their general acceptance may be subject to challenge.

Linear filtering techniques include sharpening, deblurring, edge enhancement and deconvolution. They are used to increase the contrast of small detail in an image. If a low degree of enhancement is used, the image will remain an accurate representation of the scene. If a high degree of enhancement is used, the image may no longer be an accurate representation of the overall scene, but still may be useful as an adjunct for interpretation of small details. Caution: A high degree of enhancement can also increase the visibility of existing noise and artifacts. (Examples of noise include: "film grain," "Snow appearing on a TV screen," or "random color dots.) (See Figure 1).

Figure 1. This example illustrates the effects of linear filtering. Left: original, Middle: blurred image, Right: sharpened image.

Non-linear contrast adjustments include gamma correction, gray scale transformation, curves and look-up tables. They are an extension of traditional photographic sensitometric techniques. They are used to adjust the contrast in selected brightness ranges within the image. For example, details may be brought out in the shadow areas without affecting the highlight areas. Caution: A severe adjustment can cause loss of detail, color reversal and the introduction of artifacts. (See Figure 2).

Figure 2. This example shows nonlinear contrast adjustments. Left: original, Middle: enhancement of shadow and highlight areas, at the expense of midrange tones, Right: enhancement of midrange tones, at the expense of shadow and highlight areas.

Random-noise reduction techniques include filters such as low pass, blurring, median and despeckling. They are used to reduce the contrast of small detail in the image in order to suppress random noise. Caution: Overuse of this technique can cause loss of relevant detail.

Pattern noise reduction filters identify repeating patterns in the image and allow the user to selectively remove them. This type of filter can be used to remove patterns such as: fabric weaves, window screens, security patterns, and halftone dots. Caution: Overuse of this technique can cause selective removal of relevant image detail.

Color processing includes, color space transformations, pseudo-coloring and hue and saturation adjustments. These techniques can be used to modify the color characteristics of objects within an image. Caution: Application of these techniques can compromise the color fidelity of the image.

Considerations for the application of image enhancement techniques:

Q. What type of image shall not be enhanced?
A. A primary or original image.

Discussion: Because a primary or original image represents the first instance where the image is recorded onto any media, or is an accurate and complete replica of the primary

image, it must not be altered or modified. Enhancements will only be performed on working images. Copies of the working images may be enhanced.

Q. Is it necessary to document the enhancement process used to produce an enhanced image?
A. The need to document the enhancement process will be determined by the process used.

Discussion: Documentation of enhancement steps is not necessary when using traditional darkroom techniques. When using non-traditional image enhancement techniques, such as unsharp masking or random noise-reduction, enhancement steps should be documented in the case notes in sufficient detail to enable another comparatively trained individual to repeat these steps and produce the same output when the image is subjected to image analysis.

Q. In a legal setting, are enhanced images discoverable?
A. Yes

Discussion: All images may be discoverable. In cases where images are enhanced, both the original and the enhanced image, along with associated documentation, may be discoverable.

Q. Who is responsible for testifying about an enhanced image?
A. The person doing the enhancement or a person skilled and knowledgeable about the enhancement process utilized.

Discussion: The person who performed the enhancement is best qualified to testify as to the enhancement techniques used. However, there may be occasions where the court will require the additional assistance of subject matter experts.

Q. Are there legal ramifications associated with the software used specifically for image enhancement?
A. Yes.

Discussion: Some considerations may include:

- Have the particular functions within the software been accepted by the scientific community?
- Does the software perform as the manufacturer purports?
- Has the use of this software been reviewed by the judicial system?
- Does the software have “plug-ins” that are produced by another manufacturer?
- Is the enhancement process repeatable and reliable?

Image Restoration

Purpose:

Image restoration is any process applied to an image that has been degraded by a known cause (such as defocus or motion blur) so the effects of that degradation are partially or totally removed.

Limitations are imposed upon this technique by (1) noise in the image, and (2) the fact that information that has been totally lost cannot be replaced. Partial restoration can often be successful even when total restoration is impossible.

Restoration Techniques:

Grayscale linearization is the adjustment of brightness relationships among the objects in a scene. The purpose of grayscale linearization is to render the different brightness values in the scene faithfully. For example, a monochrome test target, having known gray values, can be placed in the scene prior to recording the image. Then a grayscale transformation (nonlinear contrast stretch) can be designed to place the different gray values on the test target in their proper relationship. It is commonly assumed that the other objects in the scene will be put in their proper brightness relationship as well. Improper grayscale linearization can render brightness values inaccurately, so that objects may appear brighter or darker than they actually appeared when the image was recorded.

Color balancing is the extension of grayscale linearization to a color image. It is the adjustment of the color components of an image. The purpose of color balancing is to render the colors in the scene faithfully. For example, a color test target, having known colors, can be placed in the scene prior to recording the image. Then a grayscale transformation (nonlinear contrast stretch) can be designed for each color channel (red, green, and blue) to place the different colors on the test target in their proper relationship. It is commonly assumed that the color of other objects in the scene will be rendered accurately as well. Improper color balance can render colors inaccurately, so that objects may appear to have the wrong color.

Blur removal is a filtering technique designed to remove, partially or completely, image blurring by a known cause. It differs from image enhancement filtering processes in that the filter is designed specifically for the process that blurred the particular image under examination. Examples include defocus and motion blur since these blurring phenomena can be described mathematically. A filter is then designed to compensate for the effects of the blurring. The degree to which blur removal can be successfully accomplished is limited by (1) noise in the image, (2) the accuracy with which the actual blurring process can be described mathematically, and (3) the fact that information that has been totally lost cannot be replaced. Partial deblurring can often be successful even when total deblurring is impossible.

Geometric restoration is the removal of geometric distortion from an image. The purpose of geometric restoration is to restore the proper spatial relationships among the objects in the scene. It can be used for the removal of geometric distortion, such as that introduced by a curved mirror or a fish-eye lens. It differs from image warping in that the geometric transformation is designed specifically for the process that distorted the particular image under examination. The degree to which geometric restoration can be successfully accomplished is limited by (1) the accuracy with

which the actual distortion process can be described mathematically, and (2) the fact that information that has been totally lost (e.g., hidden behind another object or obscured from the camera) cannot be replaced. Partial geometric restoration can often be successful even when exact geometric restoration is impossible.

Warping, unlike other image enhancement processes, changes the spatial relationships among the objects in an image. It is analogous to printing a photograph on a rubber sheet and then stretching the sheet in different directions and tacking it down. Warping can be used, for example, to remove perspective from an image or to "unroll" a poster that was wrapped around a pole. Used improperly, it can distort the natural appearance of the objects in a scene.

Considerations for the application of image restoration techniques:

Q. What type of image shall not be restored?
A. A primary or original image.

Discussion: Because a primary or original image represents the first instance where the image is recorded onto any media, or is an accurate and complete replica of the primary image, it must not be altered or modified.

Q. Is it necessary to document the restoration process?
A. Yes.

Discussion: Documentation of restoration steps is always required.

Q. Are restored images discoverable in legal proceedings?
A. Yes

Discussion: All images may be discoverable. In cases where images are restored, both the original and the restored image, along with associated documentation, may be discoverable.

Q. Who is responsible for testifying about a restored image?
A. The person doing the restoration or a person skilled and knowledgeable about the restoration process utilized.

Discussion: The person who performed the restoration is best qualified to testify as to the restoration techniques used. However, there may be occasions where the court will require the additional assistance of subject matter experts.

Q. Are there legal ramifications associated with the software used specifically for image restoration?
A. Yes.

Discussion: Some considerations may include:

- Have the particular functions within the software been accepted by the scientific community?
- Does the software perform as the manufacturer purports?

- Has the use of this software been reviewed by the judicial system?
- Does the software have “plug-ins” that are produced by another manufacturer?
- Is the restoration process repeatable and reliable?
- Has the degradation process been accurately modeled?

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Image Compression

Purpose:

Digital images produce large amounts of data to be stored. Image compression techniques reduce the storage requirements by making image data files smaller.

Compression Processes:

Lossless compression reduces file size by removing redundant information. Since the redundant information can be replaced in order to display the image, *lossless* compression results in no loss of information. *Lossless* compression does not alter the content of an image when it is decompressed. An example of a file format that uses *lossless* compression is GIF.

Lossy compression achieves greater reduction in file size by removing both redundant and "irrelevant" information. Since the irrelevant information (as determined by the compression algorithm) cannot be replaced upon reconstruction of an image for display, *lossy* compression results in some loss of image content and introduction of artifacts. The degradation occurs each time the image is saved in a *lossy* file format. Higher compression ratios result in more loss of information. Normally one can specify the degree of compression. Depending upon the application, *lossy* compression may render an image less useful.
Caution *lossy* compression should be used with care so as to avoid material degradation of the image. Additionally, the compression settings used by one camera or software program may not be the same as the compression settings used by another camera or software program.

The commonly used **JPEG** image storage format employs *lossy* image compression. It is applied to the image in 8-pixel by 8-pixel "blocks." Normally the degree of compression can be specified prior to storing the image. At high compression ratios, JPEG can remove important image detail and introduce "blocking artifacts" as the block boundaries become visible (see Figure 3). Modern digital cameras often create digital images in JPEG format, so that some *lossy* compression is unavoidable. One should set the degree of compression low enough that important image content is not lost or obscured by artifacts.

Figure 3. Left: original image. Middle: the result of JPEG compression (compression ratio = 15:1). Right: the result of edge enhancement after compression.

Considerations for the application of image compression techniques:

Q. What type of image shall not be compressed?
A. It depends on the end use and need.

Discussion: In instances where the primary or original image is already compressed, it should not be further compressed using *lossy* compression processes. Additional data loss will occur when re-saving an already compressed image using *lossy* compression. Sources of compressed primary images may include: electronic booking photos, some types of digital camera images, images downloaded from the Internet or e-mail. The file format is not an indicator of the compression history for an image. For example, a TIFF file may have been previously compressed in a *lossy* file format (JPEG). Be aware that the end use of any image may change over time, and the use of compression may become problematic. Images intended for laboratory analysis should not be compressed using a *lossy* process.

Q. Is it necessary to document the compression history of an image?
A. It depends on the intended use of the image.

Discussion: The type and degree of compression may become an issue in a judicial proceeding. Documentation may be necessary, as it could be argued that compression might have introduced artifacts or relevant information was lost.

Q. Who is responsible for testifying about a compressed image?

A. The person doing the compression can testify about the settings used to compress an image. Questions concerning the actual compression process should be referred to individuals who possess sufficient technical expertise to explain the specific process.

Quantitative Image Analysis

Purpose**:**

Quantitative Image Analysis is the process used to extract quantitative (measurable) data from an image. Cognitive image analysis is the process by which visual information is extracted from and image.

Quantitative Image analysis requires proper calibration of the image. The pixel spacing must be known in order to extract accurate size measurements. Objects that are different distances from the camera will have different pixel spacings. The accuracy of the extracted measurements will depend upon the accuracy of calibration. Caution: The use of image compression can degrade the accuracy of subsequent quantitative image analysis.

For example, if a circular object in an image includes 314 pixels, and the area covered by a single pixel is one square millimeter, then one can conclude that the area of the object is 314 square millimeters. Similarly, if the distance between the adjacent pixels in an image of a document is 0.02 inches, and the length of the document is 340 pixels, then it must be 340 times 0.02, or 6.8 inches long. These examples do not consider perspective distortion.

Quantitative Image Analysis Techniques

Photogrammetry is the science involving methods, techniques, and analytical procedures used to make accurate measurements of distances and/or sizes of objects from photographic images.

Photometry is the measurement of light values of objects in an image.

Image authentication verifies that the original image has not been altered.

Colorimetry is the quantification of the color of an object.

Considerations for the application of image analysis techniques:

Q. Which types of image should be subjected to quantitative image analysis?
A. A working image.

Discussion: Because a primary or original image represents the first instance where the image is recorded onto any media, or is an accurate and complete replica of the primary image, it must not be altered or modified.

Q. Is it necessary to document quantitative image analysis?
A. Yes.

Discussion: Documentation of quantitative image analysis steps is required in sufficient detail to enable another comparably trained individual to repeat these steps and produce the same conclusions.

Q. Are analyzed images discoverable?
A. Yes

Discussion: All analyzed images, documentation and conclusions may be discoverable.

Q. Who is responsible for testifying about an analyzed image?
A. The person doing the analysis or a person skilled and knowledgeable about the analysis performed.

Discussion: The person who performed the analysis is best qualified to testify as to the techniques used. However, there may be occasions where the court will require the additional assistance of subject matter experts.

Q. Are there legal ramifications associated with the software used specifically for image analysis?
A. Yes.

Discussion: Some considerations may include:

- Have the particular functions within the software been accepted by the scientific community?
- Does the software perform as the manufacturer purports?
- Has the use of this software been reviewed by the judicial system?
- Does the software have "plug-ins" that are produced by another manufacturer?
- Is the analysis repeatable and reliable?

ADDITIONAL CONSIDERATIONS:

Q. Where does image processing take place, in the field or in a controlled environment?
A. Both.

Discussion: While most image processing takes place in a controlled environment, some image processing, such as photogrammetry and image compression, may take place in the field.

Q. Who performs image processing?
A. Photographers, analysts, and technicians.

Discussion: The person performing the processing must be properly trained.

Q. What are file management processes?
A. File management processes include the capture, storage, indexing, retrieval, and archiving of image files.

Discussion: Agencies/organizations should establish file management procedures for managing image files for use at a later date.

Q. Does image processing alter images?
A. Yes.

Discussion: The purpose of image processing is to alter the images in a controlled, repeatable, and predictable manner. Image processing does not mean that the input

image is overwritten during the process. Forensic image processing should only be performed on working images.

Guidelines for Image Processing Standard Operating Procedures (SOP)

Title: Digital Image Processing SOP

Purpose: To apply processing techniques intended to enhance, restore, compress, and/or analyze digital images. Caution: Successful processing of digital images should be made with regard to the four legal tests: reliability, reproducibility, security, and discovery. See sample SOP in Appendix.

Equipment: The agency should address the following minimum equipment requirements.

Hardware:
- Input/Capture Device
- Image Processing Systems
- Output Devices
- Storage/Archive

Software:
- Image Management
- Image Processing

Procedures: Agencies should establish specific step-by-step procedures for image processing in accordance with SWIGIT guidelines and agency requirements. These procedures should address the following as a minimum.

- Capture
- Processing
- Storage/Archive
- Image Management
- Security
- Output

Calibration: If necessary, agencies should develop procedures specific to their needs.

Calculations: If necessary, agencies should develop procedures specific to their needs.

Limitations: Agency-specific. Agencies should take into consideration budget, equipment, management, and accrediting agency requirements.

Safety: Agencies should develop procedures specific to their needs.

References: Agency-specific documentation, manufacturers' manuals, and SWIGIT guidelines.

Training: Agencies should document procedures to ensure sufficient training to afford competence and proficiency with applicable image processing. (See SWIGIT Training subcommittee document MAKE HYPERLINK).

Appendix A: Sample SOP for Latent Print Digital Imaging

Standard Operating Procedure for Latent Print Digital Imaging Latent Print Units Laboratory Division

1. Purpose:

1.1 This document sets forth Latent Print Units (LPU) specific procedures for latent print digital imaging.

2. Changes and Review:

2.1 The Section Chief and Unit Chiefs are the only persons who may authorize changes to this document.

2.2 The appropriate LPU personnel who handle evidence which may be digitally processed must review the LPU Standard Operating Procedure for Latent Print Digital Imaging (SOP-LPDI).

3. Responsibilities:

3.1 The Section Chief, Unit Chiefs, Team Supervisors and Program Managers are responsible for ensuring that LPU personnel adhere to the evidence handling procedures stated in the LPU Evidence Control Policy

3.2 LPU personnel are required to handle evidence slated for latent print digital imaging in accordance with the procedures set forth in the LPU Evidence Control Policy.

4. Sending Evidence to the Latent Photography & Digital Imaging Group:

4.1 LPU Specialists will determine if latent print digital image processing for enhancement purposes is needed after the appropriate silver based photographic procedures have been performed.

4.1.1 Specialists will initiate a separate Latent Print Digital Imaging Requisition form (LPDIR) for each item of evidence and will ensure all information is accurate. (See Appendix A).

4.1.2 Specialists will submit the form and appropriately sealed evidence to the Latent Photography & Digital Imaging Group (LPDIG).

5. Evidence Receiving in Latent Photography & Digital Imaging Group:

5.1 LPDIG personnel will ensure that the LPDIR form and the evidence are submitted properly, and will sign for receipt.

6. Digital Image Capture:

6.1 Upon receipt, the LPDIG Supervisor or designee will assign the submission to a photographer trained in digital imaging.

6.1.1 The assigned photographer will initiate a LPU Latent Print Digital Imaging Processing form (LPDIP). (See Appendix B)

6.1.2 The assigned photographer will use a digital image capture device to record the image of the latent print(s) in question and save the original image for each latent print using the file name structure to be defined.

6.1.3 The photographer will record the file name(s) assigned to the image(s) on a separate LPDIP form for each latent print . If the evidence is no longer needed, it will be stored in the evidence storage facilities in the LPDIG.

7. Digital Image Processing:

7.1 The LPDIG Supervisor and Technology Development & Support Group (TDSG) Supervisors or respective designees will determine which specialist or photographer should perform the processing.

7.2 If the case specialist is not a digitally trained specialist, the specialist/photographer assigned will then contact the case specialist, to arrange a time for the processing, so that the case specialist can be present when the processing is performed.

7.3 All processing steps will be recorded in the order they are performed either on a LPDIP form or within the computer program, if the program has that capability.

7.4 Once the case specialist is satisfied that the best possible image has been achieved, the image will be saved with a second file name assigned and recorded on the LPDIP form.

7.5 The case specialist will receive the original of the LPDIR and LPDIP forms along with all appropriate computer printouts for case documentation. A hard copy of both the original and processed images will also be provided for comparison purposes.

7.6.1 If no improvement results from this process and no images will be utilized by the case specialist, the original forms will be returned to the case specialist for case documentation, and a notation on the worksheet must be made that reflects the results of this effort. No image files will be stored when no improvement results.

8. Storage and archiving of images:

8.1 All images, both original and processed, will be stored temporarily on the hard drive of the imaging station until the examination(s) is completed.

8.2 A back-up copy of the images will be created weekly by the LPDIG Supervisor or designee and maintained in a locked cabinet within the LPU LPDIG until the examination(s) is completed.

8.3 Once the examination(s) is completed, the LPDIG Supervisor or designee will record the resultant images on two Digital Video Disks (DVD's) or Compact Disks (CD's) along with any associated case information. One DVD/CD will be designated a working copy and kept with the digital imaging equipment in a locked cabinet. The second DVD/CD will be designated as archival and kept in a locked cabinet within the TDSG.

8.3.1 The LPDIG Supervisor or designee will enter the appropriate DVD/CD serial numbers on both the LPDIR and LPDIP forms, return the originals to the case specialist, and file the duplicate copy of the LPDIP form within the locked cabinet along with the archival DVD/CD.

8.3.2 The DVD/CD's will be filed by the engraved serial number in numerical order in the above mentioned cabinets. A database will be maintained by the LPDIG Supervisor or designee for access and retrieval of the images.

FORENSIC ANALYSIS SECTION
LATENT PRINT DIGITAL IMAGING REQUISITION

Specialist _____ Unit/Team _____
Date_____

Case ID # _____ Submission # _____ Specimen Type _____

Copy ____ Specimen # _____ Page # _____ Front/Back _____ Process Type ____

EVIDENCE MUST BE SECURED AT ALL TIMES

☐ SPECIAL ☐ BIOHAZARD ☐ HANDLE WITH GLOVES

Type of Evidence (one specimen per requisition):

- ☐ **Photograph**
- ☐ **Negative**
- ☐ **Lift**
- ☐ **Paper Specimen**
- ☐ **Check/Money**
- ☐ **CD**
- ☐ **Box**
- ☐ **Adhesive Tape**
- ☐ **Plastic Bag**
- ☐ **Fingerprint Card**
- ☐ **Palm Print Card**
- ☐ **Other (see below)**

Evidence received by _____ Date _____ Time _____

Latent print(s) previously photographed? _____

Assigned to:

Photographer _____ Date _____ Time _____

Specialist _____ Date _____ Time _____

SEE ATTACHED FOR CAPTURE AND IMAGING INFORMATION

Storage:

DVD/CD Serial # _____

Archive DVD/CD Serial # _____

Evidence returned by _____ Date _____ Time _____

Evidence received by _____ Date _____ Time _____

Lab # _____ Page # _____ of _____

FORENSIC ANALYSIS SECTION
LATENT PRINT DIGITAL IMAGE PROCESSING

Case Specialist _____ Unit/Team _____

Digital Image File Number (Original)

_____

_____

Capture Device & Specifications:

Photographer_____ Date _____Time _____

Specialist_____ Date _____ Time _____

☐ Digital Camera
Type _____
Lens _____
F-Stop _____
Shutter Speed _____
Lighting _____

☐ Flatbed Scanner
Type_____
Resolution _____
Reflect/Trans _____
Mode _____

☐ Film Scanner
Resolution _____
Mode _____

☐ See attached computer printout if available

_____

Imaging History:

Photographer_____ Date _____ Time _____

Specialist_____ Date _____ Time _____

Software Package Utilized:

_____

1) _____ **6) _____**

2) _____ **7) _____**

3) _____ **8) _____**

4) _____ **9) _____**

5) _____ **10) _____**

☐ See attached computer printout if available

File Name (Enhanced Version): _____
_____

Output Device:_____GS / RGB / CMYK (Circle)

_____

Storage:

DVD/CD Serial # _____

Archive DVD/CD Serial # _____

_____