



# Scientific Working Group on Digital Evidence

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## Legal and Scientific Support Related to the Admissibility of Image Examinations

SWGDE 23-I-001-1.0

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## 1. Purpose

The purpose of this document is to provide information to image examiners when preparing for court for the admissibility of image evidence.

## 2. Scope

With the accessibility of information related to forensic analysis, admissibility challenges to opinion-based testimony are becoming more commonplace. Forensic examiners may find themselves being challenged as to their qualifications to give opinion testimony, to the specific analysis performed, to the reasoning behind their opinion, to the inability to create a statistical model for analysis, and ultimately, to any legal standard related to the analysis. This document will address these issues and provide information that may assist in responding to the most frequently encountered admissibility challenges in a courtroom.

## 3. Limitations

This document will not describe discipline specific analytical techniques or their limitations. Rather, this document is intended to assist practitioners and legal personnel in addressing admissibility issues related to image analysis. For further information on specific analytical techniques, see associated SWGDE best practices documents.

Examiners performing image analysis should have sufficient training and experience in image science to allow the formation of conclusions in the field in which an opinion is being rendered.

However, this document is not intended to be a training manual, nor does it give specific guidelines as to topics for image examiner training. For further information on training guidelines, including training topics, see *SWGDE 15-M-001-1.1 Training Guidelines for Video Analysis, Image Analysis, and Photography*.

This document will not address every challenge to image evidence that may arise and does not contain information related to specific products. Image analysis and the associated legal processes are constantly changing and updating, as such additional resources should be consulted to ensure up-to-date information is considered. This document should not be construed as legal advice.

In considering the constraints associated with the use of statistical methods and models, or in the absence of an appropriate model, in image examinations, the limitations should be acknowledged when stating opinions as a part of the legal process. This document will not provide methods or techniques to ascertain statistical certainty of the results. For further information on statistical models for forensic processes, see The American Statistical Association (ASA)'s "American Statistical Association Position on Statistical Statements for Forensic Evidence."

## 4. Legal Standards of Expert Testimony

In the United States, courts use two standards for the admissibility of expert testimony, both of which are grounded in legal precedent. First there is the Frye Standard, which is still in place in some jurisdictions, but has been largely replaced by the Daubert Standard. In addition, Daubert has

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been extended to cover technical experts through what is known as the Kumho Tire Extension. As to the admissibility of expert testimony, each court is empowered with discretion to allow any testimony under *Federal Rule of Evidence 702 (FRE 702)*. Challenges to this admission can be the basis for appeal under review of an abuse of this discretion. The basis for this review was established in *General Electric Co. v. Joiner*.

## 4.1 Federal Rule of Evidence 702

In terms of admissibility, for such testimony to be allowed in consideration of a United States Federal Court as a matter of fact, Federal Rule of Evidence 702 applies. This rule prescribes that:

“A witness who is qualified as an expert by knowledge, skill, experience, training, or education may testify in the form of an opinion or otherwise if the proponent demonstrates to the court that it is more likely than not that:

- the expert’s scientific, technical, or other specialized knowledge will help the trier of fact to understand the evidence or to determine a fact in issue;
- the testimony is based on sufficient facts or data;
- the testimony is the product of reliable principles and methods; and
- the expert's opinion reflects a reliable application of the principles and methods to the facts of the case [1].”

A part of the first point includes a requirement to demonstrate that the expert is more qualified to understand a tool, technique, or scientific principle than the average layperson. As an example, while a juror can look at two photographs to offer an opinion as to whether two individuals depicted are the same person, expert opinion testimony relies upon training and experience to assign significance to the opinion.

Most US states have adopted FRE 702 as worded, though some have adopted modified versions. For further information as to expert witnesses, see *SWGDE 22-Q-001-1.1 Introduction to Testimony in Digital and Multimedia Forensics*.

## 4.2 The Frye Standard

The Frye Standard was derived from *Frye vs. the United States*, 293 F. 1013 (D.C. Cir. 1923), a landmark case from 1923 in which the court held that for scientific evidence to be admitted, the scientific method must have reached general acceptance within the relevant scientific community. The Frye standard (or some variation thereof) is still in place in several states, although in most (as well as in Federal court), the standard has been replaced by the Daubert Standard [2].

## 4.3 The Daubert Standard

The Daubert Standard originated from *Daubert vs. Merrill Dow Pharmaceuticals, Inc.*, 509 U.S. 579 (1993) and guides courts on whether scientific expert testimony is admissible [3]. These considerations include:



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- Whether the theory or technique employed is generally accepted in the relevant scientific community.
- Whether the theory or technique has been subjected to peer review and publication
- Whether the theory or technique has been (or can be) tested
- Whether the theory or technique has a known error rate
- Whether the theory or technique has standards controlling its operation

Courts may also consider if the theory or technique was developed independent of litigation, though courts have regularly shown this is not a limiting factor to expert testimony. In addition, while the court can consider each of these criteria, the criteria are guidelines for the court rather than requirements. Nonetheless, practitioners should be prepared to explain how each consideration is addressed in regard to image examinations. For instance, a question such as, “What is the error rate of this photographic comparison technique?” should be anticipated.

## 4.4 The Kumho Tire Extension and Abuse of Discretion

The Kumho Tire Extension came from *Kumho Tire, Co. v. Carmichael*, 526 U.S. 137 (1999). In this case, attorneys for Carmichael called upon a tire failure analyst to determine if a fatal accident was caused by treatment of the tire beyond manufacturer specifications or a manufacturing defect in said tire. The defense challenged this expert’s testimony under the existing Daubert standard, as it could not meet those four criteria. In their issued opinion, the Supreme Court made clear that while the Daubert standards are often relevant in making admissibility decisions for expert opinion evidence, they are not necessarily required for admissibility. Rather, in determining admissibility under FRE 702, trial judges have some flexibility in determining what information has the greatest probative value [4].

In *General Electric Co. v. Joiner*, 522 U.S. 136 (1997), the Supreme Court clarified Daubert, holding that an appellate court may still review a trial court's decision to admit or exclude expert testimony. The standard of review for this inquiry is the “abuse of discretion” standard [5].

## 4.5 Establishing Legal Basis for Expert Status

In deciding whether to admit expert testimony, a court may give weight to the following items.

### 4.5.1 Certification

Is the witness certified by a recognized scientific agency?

Certification generally involves some type of examination to demonstrate competence at a given task, such as the tasks listed above for image analysts. Certification can be completed by an examiner’s agency or through external agencies and can be completed in a broad area (such as video/image analysis) or in a specific area (such as a piece of software). For further information on certification, see *SWGDE 10-Q-002-3.0 Guidelines and Recommendations for Training in Digital and Multimedia Evidence*.





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## 4.5.2 Accreditation

Is the laboratory accredited by an independent body?

Accreditation is the procedure by which an authoritative body gives formal recognition that a laboratory is competent to carry out specific tasks. Accreditation involves a laboratory demonstrating a complete quality assurance program for all examinations performed, including a training program for the certification of examiners, and a procedure for the assurance of mastery of concepts. Accredited labs also require examiners to complete regular proficiency exams, again to demonstrate knowledge and ability in the tested examination process. For more information on accreditation, see *SWGDE 16-Q-001-1.0 Myths and Facts About Accreditation for Digital and Multimedia Evidence Labs*.

## 4.5.3 Publication

Has the examiner published research through peer-reviewed publications?

Publications support the scientific validity of methods used by the examiner and demonstrate expertise, satisfying Daubert and Kumho Tire criteria. The preference is for scientific research to be completed separate from litigation.

Further, scientific publications can assist with satisfying the Kumho Tire extension, as applied to the expert. Publishing in peer-reviewed publications speaks directly to the personal skill or experience the examiner has with the technique, or in cases where the publication does not directly address the technique, publications may still speak to the personal skill or experience held by the examiner in the relevant field.

## 4.5.4 Training and Experience

Does the witness have training and/or experience that supports that he or she has a sound basis for making expert opinions?

An examiner's training and experience should be considered when determining if they should be qualified as an expert. Training and experience should be documented and accurately reflect the knowledge, skills, and abilities of the examiner. For more information on training guidelines for image analysts, see *SWGDE 15-M-001-1.1 Training Guidelines for Video Analysis, Image Analysis, and Photography*. In addition to training, an examiner's experience can assist in demonstrating their qualifications to be considered as an expert witness.

## 4.5.5 Professional Reputation

Is the practitioner respected in their field?

When evaluating the professional reputation of a witness, their participation and standing within relevant scientific organizations (such as SWGDE, AAFS, OSAC, IAI, or others) could be considered. Recognition by the relevant scientific community, such as receiving an award, honor, grant, or other forms of acknowledgment, could provide support for their status as an expert. Likewise, if an assumed expert is known to be in the process of conducting research on a topic prior to litigation, it could contribute to the court's decision on the expert's status. Additionally, the witness's courtroom history is significant; being previously deemed an expert in court enhances





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their professional standing, whereas any instances of being found insufficiently knowledgeable to testify, removal from a scientific community, or receiving ethical complaints could undermine their credibility.

## 5. Admissibility Factors Specific to Forensic Image Analysis

The component parts of forensic image analysis are derived from numerous sources to ensure the process is both scientifically and legally valid. These sources include the practical observations of forensic practitioners, legal opinions issued by the courts, and from academic studies. It can be difficult for examiners presenting findings to have a complete understanding of both the legal and scientific basis for those findings.

Observation is the foundation upon which all image analysis methods are built. Even the most advanced computer-aided analysis should not be done without some observation. Such observation is the basis for hypothesis and experimentation, in the process of examinations and the formation of opinions. The process of methodical observational analysis is and always will be a critical part of image evidence analysis.

An overview of the legal and scientific foundations of forensic image analysis is presented below.

### 5.1 Image Content Analysis

Image Content Analysis involves the drawing of conclusions about an image based upon the image itself. Targets for content analysis include but are not limited to the subjects/objects within an image, physical aspects of the scene (e.g., lighting or composition), and/or the process by which the scene was captured. For further information on content analysis, see *SWGDE 16-I-001-121 Best Practices for Image Content Analysis*.

#### 5.1.1 Academic Support for Image Content Analysis

See section 8.1.

#### 5.1.2 Legal Support for Image Content Analysis

The legal system has relied upon image content analysis since shortly after the invention of photography, and prior to that with the generation of likenesses for identification purposes. Therefore, there are far too many examples to specifically list in this section. For examples of precedence that relies upon image content analysis, see cases listed elsewhere in this document, or any other that utilizes facial comparison or identification using images.

### 5.2 Photographic Comparison

Photographic comparison is the process of comparing images of questioned objects or persons to known objects or persons or images thereof and making an assessment of the correspondence between features in these images for rendering an opinion regarding identification or elimination. For further information on photographic comparison, see *SWGDE 15-I-002-1.1 Best Practices for Photographic Comparison for All Disciplines* and *SWGDE 18-I-003-1.0 Technical Overview for Forensic Image Comparison*.



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## 5.2.1 Academic Support for Photographic Comparison

See section 8.2.

## 5.2.2 Legal Support for Photographic Comparison

See section 8.3.

## 5.3 Photogrammetry

Photogrammetry is the process of obtaining dimensional information regarding objects and people depicted in an image. Photogrammetry used forensically usually involves examinations to determine the height of a subject within an image, the length of an object within an image, or the speed of an object depicted within video. For further information, see *SWGDE 15-I-001-1.2 Best Practices for the Forensic Use of Photogrammetry*.

### 5.3.1 Academic Support for Photogrammetry

See section 8.4.

### 5.3.2 Legal Support for Photogrammetry

See section 8.5.

## 5.4 Image Authentication

Image authentication is defined as the application of image science and domain expertise to discern if a questioned image is an accurate representation of the original data by some defined criteria, and/or the determination of the original source of the image. In layman's terms, image authentication is used to determine whether the content captured in imagery is real or manipulated, as well as determining the device used to capture the imagery. For further information on image authentication, see *SWGDE 18-I-001-2.0 Best Practices for Image Authentication*.

### 5.4.1 Academic Support for Image Authentication

See section 8.6.

### 5.4.2 Legal Support for Image Authentication

See section 8.7.

## 5.5 Image Enhancement

Enhancement is any deliberate alteration that is intended to improve the visual appearance of an image or specific features within an image. This can be done to reveal information which is not visually apparent. There are multiple platforms and tools that can be used to conduct such enhancements. For further information on image enhancement, see *SWGDE 15-M-002-1.0 Image Processing Guidelines*.

### 5.5.1 Academic Support for Image Enhancement

See section 8.8.



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## 5.5.2 Legal Support for Image Enhancement

See section 8.9.

## 6. Conclusion

In conclusion, this document serves as a resource for image examiners navigating the complex realm of image-based forensic evidence in court. By addressing the most common examination requests and challenges, it equips forensic image examiners with the necessary knowledge and strategies to effectively present their qualifications, analysis methods, and reasoning behind their opinions. Furthermore, it acknowledges the limitations in creating statistical models for analysis and emphasizes the importance of complying with legal standards throughout the process. With the information provided in this document, image examiners will be well-prepared to confidently respond to the frequently encountered admissibility challenges they may face in the courtroom.

## 7. References

- [1] United States, Congress, House. Rule 702—Testimony by Expert Witnesses, from *Title 28, Judiciary and Judicial Procedure: Appendix*, 1966.
- [2] United States, Court of Appeals of the District of Columbia. *Frye v. United States*, 293 F. 1013, Docket no. 3968, Nov. 1923.
- [3] United States, Supreme Court. *Merrill Dow Pharmaceuticals, Inc.*, 509 U.S. 579, Docket no. 92-102, Oct. 1993.
- [4] United States, Supreme Court. *Kumho Tire Co. v. Carmichael*, 526 U.S. 137, Docket no. 97-1709, Oct. 1999.
- [5] United States, Supreme Court. *General Electric Co. v. Joiner*, 522 U.S. 136, Docket no. 96-188, Oct. 1997.

## 8. Support Resources

### 8.1 Academic Support for Image Content Analysis

- Bramble, Simon, et al. “Forensic Image Analysis.” *13<sup>th</sup> INTERPOL Forensic Science Symposium*, Lyon, France, Oct. 16-19, 2002.
- Kara, Ilker, et al. “A Forensic Method for Investigating Manipulated Video Recordings.” *Computer Fraud and Security*, vol. 2023, no.1, Feb. 2023.
- Milliet, Quentin, et al. “A Forensic Science Perspective on the Role of Images in Crime Investigation and Reconstruction.” *Science & Justice*, vol. 54, no. 6, Dec. 2014, pp 470-480.

### 8.2 Academic Support for Photographic Comparison

- Adams, Norman, et al. "Upper-Bounding the Incidence Rate of Associations Between



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- Camouflage Uniforms and Surveillance Images." *Journal of Forensic Sciences*, vol. 54, no. 6, 2009, pp.1393-1406.
- Alghamdi, Mona, et al. "Person Identification from Fingernails and Knuckles Images Using Deep Learning Features and The Bray-Curtis Similarity Measure." *Neurocomputing*, vol. 513, Nov. 2022, pp. 83-93.
  - Black, Sue, et al. "The Incidence and Position of Melanocytic Nevi for the Purposes of Forensic Image Comparison." *International Journal of Legal Medicine*, vol. 128, 2014, pp. 535-543.
  - Cameriere, Roberto, et al. "Ear Identification: A Pilot Study." *Journal of Forensic Sciences*, vol. 56, no. 4, 2011, pp. 1010-1014.
  - Dan, Lilly, et al. "The Persistence of Knuckle Creases During Finger Flexion for the Identification of Perpetrators from Digital Images of Their Hands." *Forensic Science International*, vol. 348, no. 111603, July 2023.
  - Hauser, Kitty. "A Garment in The Dock; or, How the FBI Illuminated the Prehistory of a Pair of Denim Jeans." *Journal of Material Culture*, vol. 9, no. 3, Nov. 2004, pp. 293-313.
  - Hegde, Dhananjay Kumar Krishna, and Priyanka Gupta. "A Study on Identification of Knuckle Print." *International Journal of Forensic Medicine*, vol. 6, no. 1, Jan. 2024, pp. 41-48.
  - Hoogstrate, A. J., et al. "Ear Identification Based on Surveillance Camera Images." *Science & Justice*, vol. 41. No. 3, 2001, pp. 167-172.
  - Jackson, Graham, and Sue Black. "Use Of Data to Inform Expert Evaluative Opinion in the Comparison of Hand Images—The Importance of Scars." *International Journal of Legal Medicine*, vol. 128, 2014, pp. 555-563.
  - Johnson, D. B., et al. "Establishing Likelihood Ratios for Patterned Garment Comparisons from Seam Measurement Data." *Journal of Forensic Sciences*, vol. 58, no.3, May 2013, pp. 631-644.
  - Kadane, Joseph B. "Knuckles and Fingerprints: A Comparison and Case Study." *Journal of Forensic Identification*, vol. 70, no. 3, 2020, pp. 265-274.
  - Kumar, Ajay, and Zhihuan Xu. "Can We Use Second Minor Finger Knuckle Patterns to Identify Humans?" *Proceedings of the IEEE Conference on Computer Vision and Pattern Recognition Workshops*, 2014.
  - Kumar, Ajay, et al. "Personal Authentication Using Hand Images." *Pattern Recognition Letters*, vol. 27, no.13, Oct. 2006, pp. 1478-1486.



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- Macdonald-McMillan, Briony. *The Quantification of Dorsal Hand Features of Interest to Assist Forensic Human Identification*. 2011. University of Dundee, MA of Science, MA thesis.
- Mallett, X. "Hand Comparison: The Potential for Accurate Identification/Recognition in Cases of Serious Sexual Assault." *Proceedings of the American Academy of Forensic Sciences*, University of Dundee, Scotland, 2010.
- Malone, Christina, et al. "Inter-/Intra-Observer Reliability of Hand Assessment Using Skin Detail: A Count-Based Method." *Journal of Forensic Sciences*, vol. 60, no. 6, 2015, pp. 1605-1612.
- Malone, Christina. "Photographic Analyses Using Skin Detail of the Hand: A Methodology and Evaluation." *Journal of Forensic Sciences*, vol. 60, no. 2, 2015, pp. 326-300.
- Porter, Glenn, and Greg Doran. "An Anatomical and Photographic Technique for Forensic Facial Identification." *Forensic Science International*, vol. 114, no. 2, 2000, pp. 97- 105.
- Slot, Ana, and Zeno JMH Geradts. "The Possibilities and Limitations of Forensic Hand Comparison." *Journal of Forensic Sciences*, vol. 59, no. 6, 2014, pp. 1559- 1567.
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- Vorder Bruegge, Richard W. "Photographic Identification of Denim Trousers from Bank Surveillance Film." *Journal of Forensic Sciences*, vol. 44, no. 3, 1999, pp. 613-622.
- Vyas, Ritesh, et al. "Robust End-to-End Hand Identification Via Holistic Multi-Unit Knuckle Recognition." *2021 IEEE International Joint Conference on Biometrics (IJCB)*, Shenzhen, China, 2021, pp. 1-8.



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## 8.3 Legal Support for Photographic Comparison

- *United States v. Legs*, 28 F.4th 931 (8th Cir. 2022)
  - Any alleged error in admitting expert testimony regarding photographic comparison of hands in a CSAM case was harmless, photographs could be compared by trial jurors who could discern similarities and find guilt beyond a reasonable doubt.
- *United States v. McKreith*, No. 20-10450 (11th Cir. Apr. 11, 2022)
  - Trial court properly admitted expert testimony involving photographic comparison of hands and shirt (Successful Daubert hearing).
- *United States v. Alexander*, 816 F.2d 164 (5th Cir. 1987)
  - Testimony of photographic comparison expert, who was former no FBI agent admissible in case where only substantial evidence connecting defendant to robbery was bank employee's identification of defendant's driver's license photograph.
- *United States v. Oaxaca, et. al.*, 569 F.2d 518 (9th Cir. 1978)
  - Comparison photographs of clothing properly admitted in armed robbery trial.
- *United States v. Hayes*, 553 F.2d 824 (2d Cir. 1977)
  - "Photographic comparison may be sufficient to establish guilt beyond a reasonable doubt... and thus... may constitute probable cause for an arrest" in a serial robbery case.
- *United States v. Brown, et. al.*, 501 F.2d 146 (9th Cir. 1974)
  - Testimony of expert in photographic identification identifying clothing and pistol seized from apartment as items depicted in photographs taken by bank surveillance camera at time of robbery was admissible in bank robbery prosecution.
- *Commonwealth v. Fitzpatrick*, 463 Mass. 581, 977 N.E.2d 505 (Mass. 2012)
  - Photographic comparison of a pickup truck.

## 8.4 Academic Support for Photogrammetric Examinations

- Bruehs, Walter E., and Dorothy Stout. "Determination of Average Vehicle Speed Utilizing Reverse Projection." *Journal of Forensic Science*. vol. 67, no. 1, Jan. 2022, pp. 188-199.
- Epstein, Brandon, and Bryce Garreth Westlake. "Determination of Vehicle Speed from Recorded Video Using Reverse Projection Photogrammetry and File Metadata." *Journal of Forensic Sciences*, vol. 64, no. 5, Sept. 2019, pp. 1523-1529.





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- Meline, Kimberly A., and Walter E. Bruehs. “A Comparison of Reverse Projection and Laser Scanning Photogrammetry.” *Journal of Forensic Identification*; vol. 68, no. 2, 2018, pp. 281-292.
- Miller, Seth Higgins. *A Comparison of Four Photogrammetry Methodologies in Determining Unknown Height of Persons*. 2020, University of Colorado at Denver, MA of Science, MA thesis. *ProQuest Dissertations & Theses*, no. 27957879.
- Smith, Gregory C., and Douglas “L” Allsop. “A Case Comparison of Single-Image Photogrammetry Methods.” *SAE Transactions Journal of Passenger Cars*, vol. 98, 1989, pp. 862-869.
- Sneddon, James P. “Performing Reverse Projection Photogrammetry of Surveillance Video with HVE.” *2019 HVE Forum*, Las Vegas, NV, US, Feb. 25-Mar. 1, 2019.

## 8.5 Legal Support for Photogrammetric Examinations

- *United States v. Kyler*, 429 Fed. Appx. 828 (11th Cir. 2011)
  - Following Daubert hearing, height analysis through reverse projection photogrammetry was determined to be sufficiently reliable to be admitted at trial.
- *United States v. Williams*, 235 F. Appx 925 (3d Cir. 2007)
  - Following Daubert hearing, reverse projection photogrammetry technical was sufficiently reliable to determine height of suspect captured on surveillance camera in bank robbery case to be admitted at trial.
- *United States v. Holmes*, 30 Fed. Appx. 302 (4th Cir. 2002)
  - Photogrammetric analysis properly established height of robbery suspects.
- *United States v. Johnson*, 114 F. 3d 808 (8th Cir. 1997)
  - Photogrammetry expert properly testified as to height of suspects in robbery video.
- *United States v. Quinn*, 18 F.3d 1461 (9th Cir. 1994)
  - Expert's testimony regarding use of “photogrammetry” to render opinion as to height of individual in bank surveillance photograph was properly admitted at trial.
- *Chapman v. Bernard’s, Inc.*, 167 F Supp. 2d 406 (D.Mass 2001)
  - Testimony of photogrammetric expert properly admitted in negligence action.
- *Maryland v. Matthews*, 479 Md. 278, 277 A.3d 991 (Ct.App. 2022)
  - Trial court properly admitted photogrammetric analysis despite expert’s inability to calculate effect off all potential variables on degree of uncertainty.
- *Guidry v. Beauregard Electric Cooperative, Inc.*, 164 So. 3d 266 (La.Ct.App. 2015)
  - Trial court did not abuse its discretion by accepting engineer who testified on truck driver's behalf as expert in photogrammetry in driver's action against electric

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company to recover damages for injuries allegedly sustained when his truck came into contact with an electric line owned and maintained by company; engineer had 46 years of experience in his field, expert employed photogrammetry in his profession throughout his career, and expert had previously testified in court to findings made using photogrammetry.

## 8.6 Academic Support Image Authentication

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- T. Prabakar Joshua, et al. "Comparison of and DWT Image Compression" *International Journal of Computer Science and Mobile Computing*, vol. 5 no. 4, Apr. 2016, pp. 62-67.
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- Yang, Jiyun, et al. "Digital Image Forgery Forensics by Using Undecimated Dyadic Wavelet Transform and Zernike Moments." *Journal of Computational Information Systems*, vol. 9, no. 16, 2013, pp. 6399–6408.
- Zeno, Geradts, et al. "Methods for Identification of Images Acquired with Digital Cameras." *Proceedings of the Enabling Technologies for Law Enforcement and Security*, vol. 4232, 2001, Boston, MA, US.

## 8.7 Legal Support for Image Authentication

- *United States v. Gutierrez*, 625 F. App'x 888 (10th Cir. 2015)
  - Photographs properly authenticated based on metadata in child sexual abuse material prosecution.
- *United States v. Hager*, 710 F.3d 830 (8th Cir. 2013)
  - Image authentication based on metadata.
- *Tamara Las Vegas Properties v. Travelers Indemnity Company*, 586 F.Supp.3d 1022 (D.Nev. 2022)
  - Photographs of roof taken by insured's contractor properly admitted in breach of contract action following denial of coverage based on photograph's metadata and associated stipulations.
- *Bueno v. Benhamou*, 2022 WL 1592593 (CD.Cal 2022)
  - Photographs properly considered in summary judgment adjudication of business litigation based on party opponent's authentication as well as metadata.
- *United States v. Post*, 997 F. Supp. 2d 602 (S.D.Tx. 2014)
  - Use of GPS coordinates in metadata to determine location where image was taken did not violate Fourth Amendment and could be otherwise admitted at trial.
- *John C. Depp II v. Amber Laura Heard* (CL-2019-2911)
  - Image authentication via metadata, showing it was imported into photo editing software.



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## 8.8 Academic Support for Image Enhancement

- Chiluka, Praveen K. “Digital Wavelet Transform Based Image Forgery Detection Using Post-Processing.” Society for Design and Process Science, Nov. 2015.
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## 8.9 Legal Support for Image Enhancement

- *United States v. Seifert*, 445 F.3d 1045 (8th Cir. 2006)
  - Discussing admissibility of image enhancement generally.
- *United States v. Fisher*, 2022 WL 392597 (D.Montana 2022)(No. CR21-11- BLG-SPW (D. Mont. Feb. 9, 2022))
  - Image stills are admissible as duplicates under Rule 1003 because they were produced by an electronic process and accurately reproduce the original despite enhancement.
- *Commonwealth v. Auken*, 681 A.2d 1305 (Pa. 1996)
- Chevrolet representative conducting a make/model examination with enhanced images properly admitted.

## 9. Additional Resources

- American Statistical Association. “American Statistical Association Position on Statistical Statements for Forensic Evidence.” *ASA Forensic Science Advisory Committee*, Jan. 2019, <https://www.amstat.org/asa/files/pdfs/POL-ForensicScience.pdf>.
- Scientific Working Group on Digital Evidence. *Best Practices for the Forensic Use of Photogrammetry*. SWGDE 15-I-001-1.2. *SWGDE*, 2015, <https://www.swgde.org/15-i-001/>.
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- Scientific Working Group on Digital Evidence. *Best Practices for Image Content Analysis*. SWGDE 16-I-001-1.2. *SWGDE*, 2024, <https://www.swgde.org/16-i-001/>.
- Scientific Working Group on Digital Evidence. *Best Practices for Photographic Comparison for All Discipline*. SWGDE 15-I-002-1.1. *SWGDE*, 2015, <https://www.swgde.org/15-i-002/>.
- Scientific Working Group on Digital Evidence. *Guidelines and Recommendations for Training in Digital and Multimedia Evidence*. SWGDE 10-Q-002-3.0. *SWGDE*, 2024, <https://www.swgde.org/10-q-002/>.

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  - Scientific Working Group on Digital Evidence. *Introduction to Testimony in Digital and Multimedia Forensics*. SWGDE 22-Q-001-1.1. SWGDE, 2022, <https://www.swgde.org/22-q-001/>.
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  - Scientific Working Group on Digital Evidence. *Technical Overview for Forensic Image Comparison*. SWGDE 18-I-003-1.0. SWGDE, 2018, <https://www.swgde.org/18-i-003/>.
  - Scientific Working Group on Digital Evidence. *Training Guidelines for Video Analysis, Image Analysis, and Photography*. SWGDE 15-M-001-1.1. SWGDE, 2016, <https://www.swgde.org/15-m-001/>.



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## 10. History

| Revision  | Issue Date | History                                                                                                          |
|-----------|------------|------------------------------------------------------------------------------------------------------------------|
| 1.0 DRAFT | 6/14/2023  | Initial draft created.                                                                                           |
| 1.0 DRAFT | 9/19/2023  | Draft for internal review.                                                                                       |
| 1.0 DRAFT | 1/11/2024  | SWGDE voted to release as Draft for Public Comment.                                                              |
| 1.0 DRAFT | 3/1/2024   | Formatted for release as a Draft for Public Comment.                                                             |
| 1.0 DRAFT | 1/15/2025  | Addressed public comments related to section 4. SWGDE voted to release as a Draft for Public Comment.            |
| 1.0 DRAFT | 2/10/2025  | Formatted for release as a Draft for Public Comment.                                                             |
| 1.0 DRAFT | 9/18/2025  | No additional comments/changes. Moved forward for SWGDE membership vote to release as a Final Approved Document. |
| 1.0       | 11/18/2025 | SWGDE voted to approve as Final Approved Document. Formatted for release as a Final Approved Document.           |