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How a Photogrammetry Expert Can Help You Win Your Case
By Lee DeChant

Abstract
Attorneys who use close-range photogrammetry experts are better situated to prove their case in court. Photogrammetry is the science of deducing the physical dimension of objects from measurements on photographs. Photogrammetry experts make it easy for attorneys to explain measurements in photos in cases involving accidents, forensic investigations, and intellectual property.

Three-dimensional photo-based measurements are accomplished by extracting two-dimensional information from multiple photographs or digital images. The photo (or image-based) measurement process is called “close-range photogrammetry” or “digital photogrammetry.”

History
Photogrammetry is a science in existence since Leonardo da Vinci. In 1492, da Vinci began working with perspective and central projections with his invention of the Magic Lantern [Gruner, 1977]. The principles of perspective and projective geometry form the basis from which photogrammetric theory was developed.

Today, photogrammetry is used for making 3D measurements in such diverse fields as medicine, forensic investigations, and even the high-tech fabrication of commercial jets. Close-range photogrammetry has been used in many areas of litigation.

In photogrammetry, analog photographs can be digitally scanned, or today’s consumer grade digital camera images are directly imported into specialized PC-based photogrammetry software programs. The result of the photogrammetry work ends up as precise 3D models and measurements displayed in court-ready diagrams for demonstrative evidence. In forensics, photogrammetric mapping of items such as skid marks, road discrepancies, vehicle crash-scene surveys, vehicle crash for Delta-V (speed computations), bullet trajectory mapping, non-contact homicide diagramming, crime scene suspect-height determination, slip and fall cases and a multitude of other measurement needs that assist both plaintiff and defense attorneys.

Why experience is critical in photogrammetry
In most cases, photogrammetry is not as simple as just scanning photographs, or importing digital camera images into a software program and ‘instant, accurate 2D or 3D measurements.’ A photogrammetry expert can determine if your case pictures and requested data can be extracted from the image to meet your objectives. Typically, working with bystander pictures from an unknown camera source, or even the client’s camera, can present many technical problems that must be overcome by an experienced photogrammetrist.

A photogrammetry expert will typically review the analog pictures or digital images to determine if the attorney’s requested measurements are in fact doable from the case pictures. The amount of time to generate the photogrammetric 3D model/measurements is a function of knowledge of the camera specifics, the complexity of the scene, the picture geometry, what is important to extract from the pictures, as well as accuracy expectations. With proper criteria met, accuracy of 3D measurements in the order of a few millimeters can be achieved under good conditions.
In a good percentage of cases, imaged-based 3D measurements are obtained; however, photogrammetry is a science and it is far from ‘magic.’ In some situations the pictures that support a case cannot be measured accurately. The list of situations wherein pictures can’t be measured are lengthy, but in general terms, it is the result of insufficient information within the actual pictures, and/or the improper types of pictures taken of the object(s) of interest that are not conducive to accurate measurement.

The ‘picture geometry’ (i.e. where the person stood when taking the pictures) for photogrammetry requires multiple overlapping images of the objects of interest combined with good perspective camera angle separation. These camera angles form the basis for 'photogrammetric triangulation' to derive accurate three-dimensional data points from pictures. There are also other parameters inside of the camera that must be known too, i.e., lens focal length and the image sensor-size to mathematically calculate the measurements in the PC-based photogrammetry software system.

What the attorney should consider before hiring a photogrammetry expert

Attorneys can save themselves time by using a very basic checklist to determine in advance if their case pictures/images are measurable with close-range photogrammetry. Although the list below is not all-inclusive, it forms the basis of what an expert in photogrammetry requires for the measurement work:

If using Analog (Film) Pictures
- Did the camera employ a fixed focal length lens i.e. 35mm, 50mm, etc; or conversely was it a zoom lens that was in fact zoomed during the picture taking process?
Knowing the focal length of the lens is important to expedite the photogrammetric process. At some point, the camera’s focal length for each picture must be calculated or the photogrammetry solution will not be accurate…photogrammetrists know this, and among other technical issues, they understand how to deal with it.
- If the focal length of the camera that took the pictures is not known, are there still some real-world objects from within the pictures that could be surveyed today?
- Are the film prints original, or where they cropped?
- Are there any known distances in the pictures?
- Are there at least two photos with good angle separation and perspective overlap of the objects of interest for the photogrammetry process?
- Is the make/model of the film camera known?
- Is the camera still available for the photogrammetrist to review?

If using Digital Camera Images
- Are there at least two images with good angle separation and overlap of the objects of interest for the photogrammetry process?
- Are there any known distances in the images?

As can be seen, there are far less obstacles and requirements when using digital camera images. Using mathematically rigorous photogrammetric software programs, i.e., iWitness™ (www.iwitnessphoto.com) for the measurement process, is also key for a good result. For example, the iWitness photogrammetry system automatically recognizes the digital camera make/model, and lens focal length for the photogrammetric measurement process - just by importing the images into the software program. As a result, digital images are far superior and much more mathematically robust for photogrammetry vs. working with scanned analog prints for the task. As digital cameras continue to improve in resolution, the opportunity of making extremely accurate 2D & 3D measurements from litigation pictures is all that much more probable.
What to look for in a Photogrammetry Expert

The photogrammetrist should have a proven record of image-based measurements to support litigation cases – particularly working with attorney-provided photos/images. The attorney should initially expect questions from the expert, as it relates to the provided case pictures being reviewed. With criteria met for the measurement process, the expert should be able to complete the photogrammetry, prove the accuracy of the work and put the data into a usable format that’s easy for the attorney, judge and the jury to understand. An attorney should look for an expert who specializes in photogrammetry, and not one who offers it as a ‘sideline’. The expert should not only have a sound understanding of photogrammetry, but should also be well prepared to rebut the other side’s photogrammetric evidence, if it is in fact technically incorrect.

A competent photogrammetrist should be well versed in forensic measurements, be it academic studies, or alternatively from non-academic use, with years of practical field experience, as well as publishing papers, or articles on the subject matter of photogrammetry.

Although today’s photogrammetric software systems accomplish most or all of the mathematical computations, the photogrammetry expert doesn’t necessarily require a PhD in Geomatics. However, it is important that the expert has years of practical photogrammetric experience, is recognized for work in litigation cases, and can easily communicate the work in laymen terms, and present it to the jury - if required.

Conclusion:

Close-range photogrammetry has a proven record for its virtues helping attorneys settle and win cases by producing accurate three-dimensional measurement data extracted from analog photographs and digital camera images. The fundamentals of photogrammetry do require some initial ‘camera math’ information in order for the final data output to be reliable.

The next time your case file presents itself with a ‘handful of film prints,’ or a CD with digital camera images that require 3D measurement, you can be confident there are photogrammetry software solutions and qualified experts available to help you extract your image-based measurements. Before you retain a photogrammetry expert, make sure they are qualified, and can handle themselves in court, and prove their image-based photogrammetric data provided to your firm.

In digital photogrammetry, pictures ‘do not lie’ based on the mathematics involved to compute the very light-rays that form the foundation of the photogrammetric bundle-triangulation process. An experienced photogrammetrist knows what to do and where to look, ensuring the integrity of the photo-based measurement process, helping the attorney in their casework.

About the Author:
Lee DeChant is the Principal owner of DeChant Consulting Services – DCS Inc., Bellevue, WA. DCS is the co-developer of the iWitness close-range photogrammetry software system designed for accident reconstruction and forensic measurement. For years, DCS has offered its photogrammetric consulting services to attorneys across the nation. Mr. DeChant can be reached at: Phone 425-637-1865 Email: lee@photomeasure.com Websites: www.iwitnessphoto.com and www.photomeasure.com