Geospatial Modeling & Visualization

A Method Store for Advanced Survey and Modeling Technologies

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Close Range Photogrammetry Documentation

This series of posts provides information on how to document and create metadata for your close range photogrammetry projects.
Hint: You can click on any image to see a larger version.

Camera Calibration Documentation

Camera Calibration Documentation for Close-Range Photogrammetry

Each camera (referring to a camera and lens combination) used in a close-range photogrammetry project should be calibrated and a calibration file should be saved with the project data. Some close-range photogrammetry software does not require this information before processing the image block; however, it will provide most of this information after processing. The tables below describe what is appropriate to document for this process. Download a printable form in PDF format here or in a spreadsheet (.xlsx) format here. For each camera/lens calibration:

Camera Calibration Photo

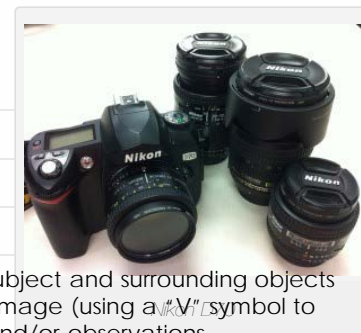| Element	Description
Camera/Lens name	Name used to identify this camera/lens combination (e.g. CAST5DmkII-2_28mm).
Date of calibration	Date that the calibration was performed.
Camera calibration file name	The exact file name for the camera calibration.
Camera specifics	Specific make and model of the camera and lens used.
Array dimensions in pixels	Width and height of digital array measured in pixels.
Array dimensions in mm	Width and height of digital array measured in millimeters.
Focal length	As indicated by camera calibration.
Principal Point	As indicated by camera calibration.
Lens distortions (K1, K2, P1 and P2 parameters)	Radial and decentering distortion parameters as measured by the camera calibration.
Affine distortions	Affine distortion parameters as measured by the camera calibration (if measured).
Calibration Quality Values	Quality values such as overall RMS, maximum residual, and photo coverage (%) from the calibration process.
Calibration adjustment report	A report on the quality of the camera calibration including the correlation between exterior and interior parameters.

For each calibration image (if performing a camera calibration with a target):

Entry	Description
Image file names	File names for calibration images.
Calibration target description	Include target dimensions, creator and description.

Image Acquisition Documentation

Image Acquisition Documentation for Close-Range Photogrammetry

Organization and documentation during image collection in the field is especially important. The table below describes the appropriate documentation for this process. Download a printable form in PDF format here or in a spreadsheet (.xlsx) format here. For each group of images:

Entry	Description
Project name	The project name or name for the dataset.
Number of images	Total number of images.
File name for planimetric sketch or map	File name and extension. Should include outline of subject and surrounding objects (if any), indicated location and orientation of each image (using a "V" symbol to indicate orientation), and other special comments and/or observations.
Camera calibration file	Reference to the camera calibration file if available.
Additional notes	Any additional notes the surveyor feels applicable. Could list images containing control and/or scaling references.
For each image:	
Image file name	File name and extension.
Textural description of location and orientation	Should describe general location (e.g. north side) and camera to subject orientation (e.g. view to south).
Format conversions (if any)	List of format conversions performed on the digital images and the software used.

Control Point Documentation

Control Point Documentation for Close-Range Photogrammetry

If external control is collected for the project, the table below describes the appropriate documentation for this process. Download a printable form in PDF format here or in a spreadsheet (.xlsx) format here. For each control point:
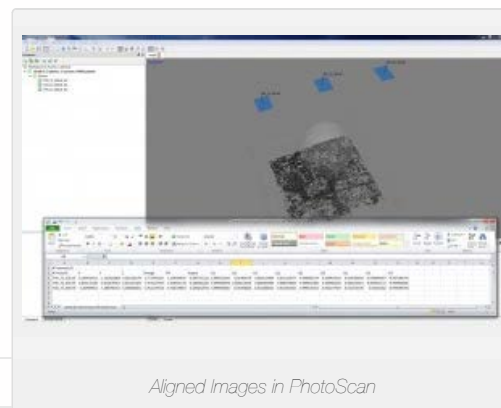
Entry	Description
Point ID	ID or name given to the point.
Source and datum (total station, GPS, etc. and WGS84, UTM, LRF)	Identify the source for control point collection and the datum used during data collection.
xyz coordinates	List the three-dimensional coordinates for each control point.
xyz covariance matrix or estimated error	Provide full correlation if available (from survey adjustment or GPS baseline solution), otherwise provide estimated standard deviation or variance of each coordinate.
Textual description of location	Provided a textual description for the location of each control point.
Image name with control point location indicated	Name of image with the control point location clearly indicated.
Geometric constraints on reference features or control	List any known geometric constraints for reference features or control.
Coordinate System	Name of coordinate system, datum and projection.

Image Processing Documentation

Image Processing and Block Triangulation Documentation for Close-Range Photogrammetry

In order to extract three dimensional points from two dimensional images, it is necessary to perform a triangulation with at least two images (a stereo pair). When more than two images are used in a triangulation, we refer to the group of images as a 'block'. To perform a triangulation, we must measure a sufficient number of tie, control, and/or check points throughout the block. Constraints may also be placed on certain sets of points to enforce angular, linear, and/or planar properties. Once a triangulation is successful, image exterior orientation parameters (along with estimate for accuracy) should be available to the user. These are important pieces of information for downstream deliverables and should be documented. The table below describes the appropriate documentation for this process. Download a printable form in PDF format here or in a spreadsheet (.xlsx) format here.


Aligned Images in PhotoScan

Entry	Description
For each block:	
Name and version of the software	Include all details of the software name, manufacturer, version, and build used for image processing and file format conversions.
Description of image processing	Describe and image processing and/or file format conversions performed and the settings used.
Name and version of the software	Include all details of the software name, manufacturer, version, and build used for triangulation.
RMSE values	Root Mean Square Error (RMSE) for control and check point measurements, indicating whether the RMSE is for control points only, check points only, or all points.
Constraints on object points	List of constraints used during processing.
For each point:	
Point ID	ID or name used for the point.
Point type	Tie, Control, or Check point.
XYZ priori and a priori	If available, provide the XYZ coordinates before and after bundle adjustment (control and check points only).
Covariance matrix a priori	If available, provide the covariance matrix.
Image coordinates and residuals	A list of images on which the point is indicated. For each image on the list, provide the uv coordiates and residual.
For each image:	
Exterior orientation	List exterior orientation parameters for each image.

Deliverables Documentation

File Exports and Deliverables Documentation for Close-Range Photogrammetry

Typical deliverables created as the end result of a CRP project could include 2D vector graphics (planimetric or elevation type CAD drawings), dense point clouds, 3D polylines, facetized models (mesh) of an object or surface, and raster graphics such as rectified or fully orthorectified images. Each deliverable created should include appropriate metadata for each of the above mentioned steps, as well as metadata for the additional processing performed to create the final file. Because the diversity of possible end products and software packages associated with photogrammetry, it is difficult to specify the metadata required. We recommend using the ADS Guides to Good Practice to identify the

3D View of DEM Overlaid With 3D Breaklines
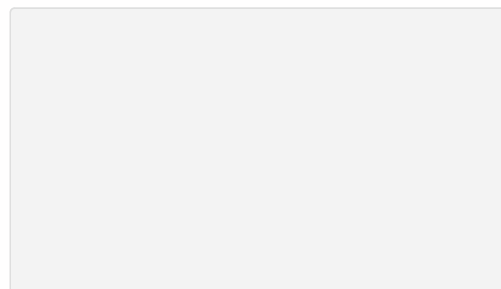
appropriate metadata for your specific file. Below is a list of ADS Guides and the file types they should be used for: 2D CAD drawings and 3D vectors: http://guides.archaeologydataservice.ac.uk/g2gp/Cad_Toc 3D point clouds and facetized models (mesh): http://guides.archaeologydataservice.ac.uk/g2gp/LaserScan_Toc Raster images: http://guides.archaeologydataservice.ac.uk/g2gp/RasterImg_Toc

Project Level Documentation

Project Level Documentation for Close-Range Photogrammetry

A number of guides and documentation standards for the collection and processing of close-range photogrammetric data (or in some cases for photographic documentation in general) have been published by various organizations. This form and other metadata forms on this site follow the Archaeology Data Service (ADS) Guides to Good Practice. See the list of helpful webpages and publications for a link to the ADS guides and other helpful links. Every CRP project should contain project level documentation, including a description of the project and site, date(s) of the survey, name(s) and organization(s) of the surveyor(s), and other useful notes. The table below describes the appropriate documentation for this process and you can download a printable form in PDF format here or in a spreadsheet (.xlsx) format here.

Element	Description
Title	The project name or name for the dataset.
Description	The original purpose for the survey work.
Subject	Keywords for the subject content of the dataset (qualified using e.g. the English Heritage NMR Monument Type Thesaurus or the MDA Object Type Thesaurus).
Coverage	Site location and description. The address, or coordinates for the site and a description of the site and object or structure to be surveyed. Coverage should also include any relevant period terms.
Creators	Full name and organization(s) of the surveyor(s)
Identifiers	Project or reference numbers (e.g. HABS/HAER/HALS survey number) used to identify the dataset.
Dates	Date or dates that the survey was conducted in both the field and/or lab.
Intended accuracy or scale of the survey	The originally intended accuracy or scale that the survey was to achieve.
Make & model of camera(s) and lens(es)	Detailed make and model of the camera and lens used for the survey. List the associated calibration files if applicable.
Description of reference information used	Describe any existing reference information available to the surveyor(s), including paper plans or digital spatial data of the site or object.
Additional project notes	Any additional project notes that the surveyor feels applicable.
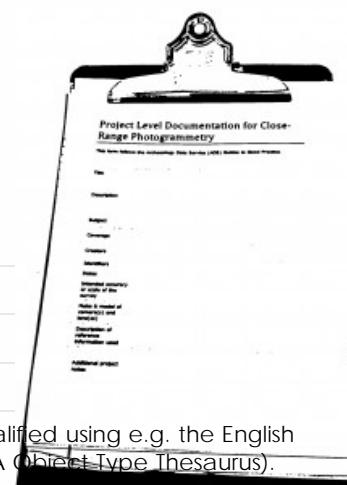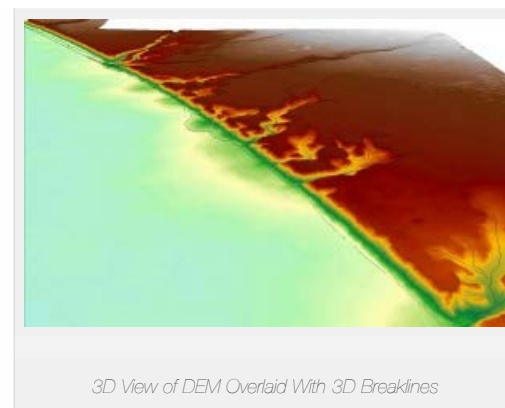
You are reading the series: Close Range Photogrammetry
Four Basic Steps of a Close-Range Photogrammetry Project
Checklist for Close-Range Photogrammetry Image Collection
Acquire Images for Close-Range Photogrammetry
Computer Requirements for PhotoScan and PhotoScan Pro
Close Range Photogrammetry Documentation

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