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HIGH-END PHOTOGRAMMETRY SOFTWARE

GENERATING TRUE ORTHOS WITH CORRELATOR3D™

1 What is an Ortho

The orthophoto is one of the most essential map products, because it allows for accurate tracing of features such as roads, utilities, and building footprints to create true planimetric maps. To create an ortho, photogrammetry software is used to eliminate distortion caused by the camera and terrain. Once created, the orthos are merged into much a larger orthomosaic. It is important to note that any distortion in the individual orthos will create issues in the larger orthomosaic at the seamlines where they merge.

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2 DTM Ortho vs True Ortho

Traditional orthos are most often created using a DTM, while true orthos are created from DSMs to account for the vertical exaggeration of manmade structures. Which one to use and when is driven by the final map's intent.

For example, city officials might want an overall map of their downtown area for emergency purposes. If there is little vertical relief, DTM orthos (Figure 1a) will provide a clear top-down view with some building lean. This can be perfectly ok considering that most people will recognize buildings from their side views and the DTM orthos will provide that visual cue.

In areas where there is a lot of vertical relief from high rise structures and such, a true ortho generated from a DSM (Figure 1b) may provide a better final product as building lean is eliminated. For this, conceptually the imagery is draped over the DSM akin to shrink wrapping. The underlying DSM must be produced at the highest resolution and vertical accuracy possible.

Figure 1a: Sample DTM ortho.

Figure 1b: Sample true ortho.

3 Generating DTM Orthos with Correlator3D

In Correlator3D, a DSM must be first generated after completing project setup and aerial triangulation. DSM output resolution can be 5 to 10 times the GSD of the imagery. This reduces processing time and is in general more than sufficient to generate quality orthos. Once the DSM is created, a DTM must then be extracted.

Since a lower resolution DSM is used to create the DTM, minimal editing will be required as the vertical differences should not significantly change the final output orthos. The DTM is then used for orthorectification. Once the orthos are generated, a mosaic can be produced and seamlines reviewed.

4 Producing True Orthos with Correlator3D

True orthos are more challenging as they really rely on vertical definition. The higher the GSD and vertical accuracy of the DSM used for orthorectification, the better the results will be. This will ensure there will be minimal artifacts in the final output orthos.

Typically, a DSM having a horizontal resolution of at least 3 times the GSD of the imagery is necessary. Increasing the GSD even more may result in better edges in the true orthos along vertical structures. The tradeoff is that there may be some editing required on the DSM, as it may show additional noise.

Note that the option in Correlator3D to generate a point cloud with DSM optimized for true ortho can be used to improve results on drone projects. However, it may be best to create a traditional DSM when dealing with larger format cameras flown on aircraft, as the resulting data will be massive and may not significantly improve the resulting true orthos.

5 Understanding the Resulting True Orthos

Typically, DSMs that have a coarser resolution than the output true orthos will create artifacts and/or smear (Figure 2a). Note the exaggeration along the side of the buildings. Ideally, one needs to ensure that the resolution of both the DSM and output orthos are as close as possible, to ensure the highest quality (Figure 2b). Note the near vertical lines on the side of the structure, which indicate a good true ortho.

Figure 2a: True ortho from coarse DSM.

Figure 2b: True ortho from fine DSM.

Additionally, individual orthos can also look incomplete, with missing pixels due to occlusions. This is why overlap in acquisition is so important. These empty gaps are filled during the mosaic creation process using the overlap in other orthos. Note the empty pixels in the individual ortho of Figure 3a, and how they are filled with additional overlapping images from other individual orthos (Figure 3b) and finally merged in the mosaic (Figure 3c).

Figure 3a: Individual ortho with empty pixels.

Figure 3b: Empty pixels filled with additional overlapping images.

Figure 3c: Overlapping images merged in the mosaic.