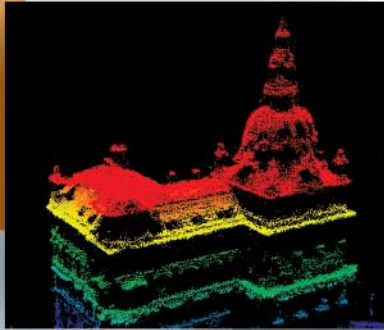


ULTRAMAP^{V3}

Workflow Software System

Highly Advanced Photogrammetric Workflow System for UltraCam Images



Microsoft UltraMap is a state-of-the-art, end-to-end, complete photogrammetric workflow system that provides highly automated processing capabilities to allow organizations to rapidly generate quality data products from one UltraCam flight. With version 3.0, UltraMap continues its innovation trend that has already delivered groundbreaking features such as automatic project-based colour balancing for homogeneous image block color correction, and now delivers revolutionary point cloud and ortho mosaic processing based on an automatically generated digital surface model (DSM) or terrain models (DTM).

The UltraMap 3.0 fully automated processing pipeline for processing UltraCam data now includes:

- *High-density 3D point clouds—higher than LiDAR at several hundred points per square meter*
- *Highly accurate and detailed digital surface model (DSM) generation*
- *UltraCam DSMOrtho (orthomosaic based on an automatically generated DSM) and DTMOrtho (traditional ortho mosaic)*

UltraMap v3 delivers exceptional quality DSMs at high accuracies and without any manual interaction. Since the UltraMap v3 ortho mosaicking approach takes into account all available inputs (i.e. a DSM and also an automatically generated DTM), UltraMap v3 is able to generate seamlines at desired paths; remaining seamline editing for challenging regions are corrected using UltraMap's DragonFly technology, a responsive visualization engine that allows users to conduct quality control on large image blocks in a quick and smooth fashion.

UltraMap v3 is the first fully integrated and interactive photogrammetric workflow solution to provide premium UltraCam data processing from ingest of raw data to delivery of point clouds, DSMs and ortho imagery.

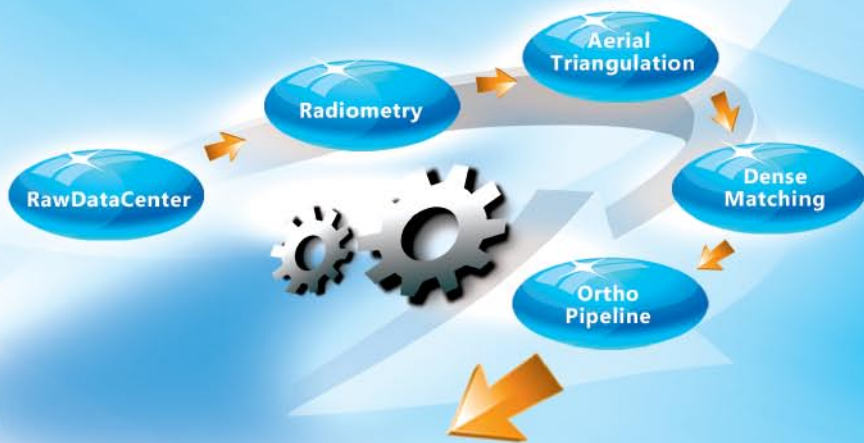


Figure 1: UltraMap v3 processing pipeline

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MODULES

UltraMap RawDataCenter



The RawDataCenter is responsible for processing the UltraCam imagery from Level-0 to Level-2. By exploiting the distributed UltraMap Framework, processing tasks can be handled in parallel.



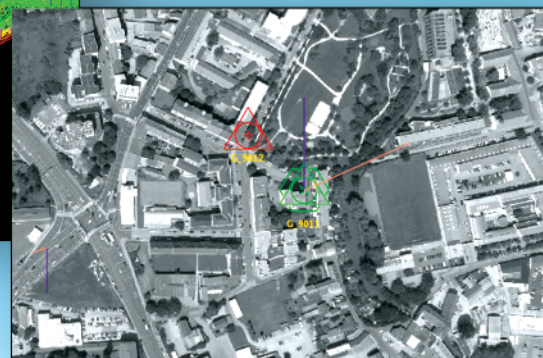
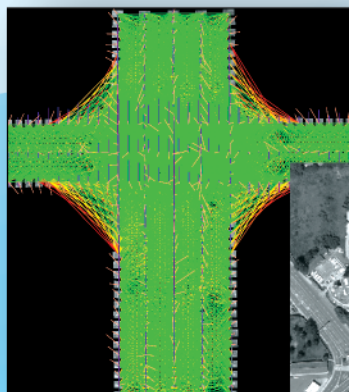
UltraMap Radiometry

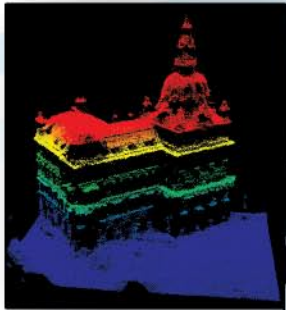
The UltraMap Radiometry module is responsible for defining the final color of the Level-2 input data. It also provides model-based radiometric correction to compensate for or remove hotspots, atmospheric effects and haze, exploiting Dragonfly technology for image interaction and visualization of large image blocks.

UltraMap AT

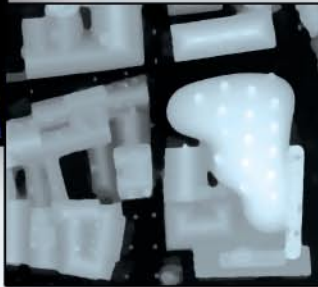


The Aerial Triangulation (AT) module provides an interactive workflow while calculating image correspondences in order to generate a precise exterior orientation for an entire image block.





UltraMap Dense Matching



The Dense Matching module creates high-density point clouds, a DSM and an internally used DTM from Level-2 images, extrapolating precise exterior orientation data to generate per-pixel height values. The 3D point cloud and the DSM data can be exported in standard file formats for further 3rd party processing.



UltraMap Ortho Pipeline

The Ortho Pipeline module generates the final ortho mosaic from all available inputs such as Level-2 imagery, AT results, radiometric settings, and the DSM/DTM.



Fully Automated Ortho Pipeline

Microsoft UltraMap v3 introduces a fully automated processing pipeline that allows processing UltraCam imagery to a digital surface model (DSM) including a DSMOrtho (ortho mosaic based on an automatically generated DSM). In addition, UltraMap v3 produces an UltraMap DTMOrtho (a traditional ortho mosaic). An additional output of the ortho pipeline is a 3D point cloud, with a very high point density per square meter.

Ortho rectification

1

The first step in the ortho pipeline is called ortho rectification which re-projects the input images on a defined proxy geometry.

Seamline generation

2

After the ortho rectification process, the next step is to find seamlines between projected ortho patches. Seams correspond to transitions from one input image to another one.

Ortho Compositing

3

Once all pixel information in the ortho image mosaic is known, it is necessary to blend them together in order to create a visually appealing result.

Ortho Pipeline delivers high quality ortho imagery.

ULTRAMAP^{V3}

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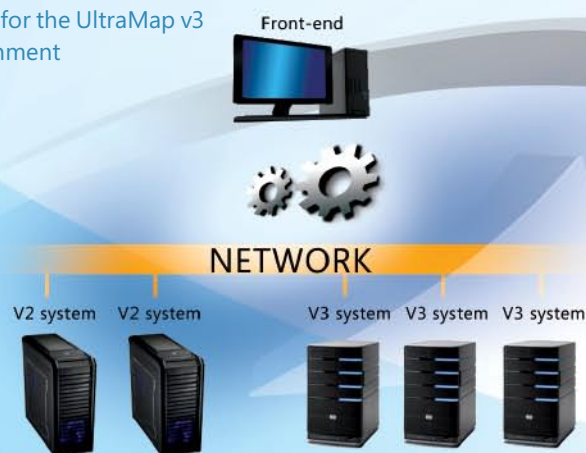
PROCESSING ENVIRONMENT

Microsoft UltraCam offers support for different processing environments for the UltraMap v3 processing pipeline.

- One configuration allows the complete DSM/ortho pipeline to be processed on scalable CPU-only machines, while dense matching allows runs on dedicated GPU nodes.
- GPU nodes deliver high-speed ups as the dense matching is ideal for a SIMD architecture such as graphics cards.
- New V3 machines (resource intensive machines) provide high performance, as an entire machine can be used to work on one task at a time. V3 machines can either be configured as CPU only or as GPU-enabled nodes.

The front-end machine is used to interact with the data and is not designed for processing. A very important part of the processing environment is the network required to transfer the data efficiently between processing nodes and disk storage.

Figure 2: Example for the UltraMap v3 processing environment



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