

Fault Recovery on Automatically Generated 3D Models

Objective

Perform the fault recovery on the multiple 3D models generated by photogrammetry.

Challenge

Our Client, a large software and hardware distributor, reached out to Intetics with the request to perform fault recovery on 3D models generated by photogrammetry.

The model generated in this way has some drawbacks due to imperfections in technology, shooting errors, and natural limits of accuracy.

The client wanted to minimize its influence to be able to build more precise and accurate models.

Quick Facts

- ✓ All critical faults were recovered
- ✓ The largest object processed at the moment had the area of 180 hectares
- ✓ The largest model consisted of 250 000 tiles and 300 million polygons

Within the framework of this project, the Intetics team faced the need to correct the following defects:

- Texture distortion or darkening caused by an error in radiometry.
- Distortion of shape, gaps, and holes in geometry, interpolation of polygons (fusion of nearby objects) due to incorrect recognition. The reason is usually shadows, glare, or the fact that some parts of the object did not get into the frame (perhaps it was closed by another object).

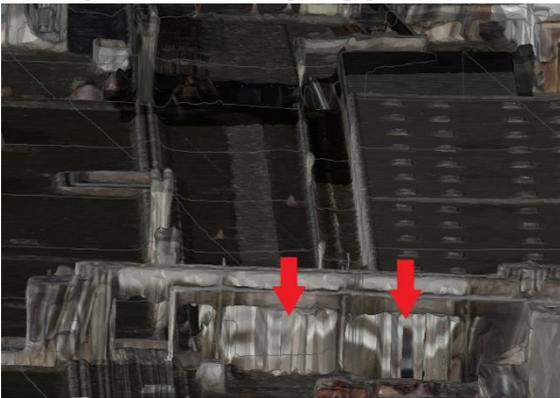
Texture darkening



Holes and geometry distortion



Interpolation of polygons



Solution

★ 01 Working with large-scale models

During the project, it was necessary to work with large-scale models such as industrial zones, airports, settlements, etc. Such models are usually not integral but consist of tiles of relatively small size. The number of tiles may reach several thousand, and it allows working with the entire model by loading all the tiles at once, as well as with individual parts of the model, by loading only one or more tiles. Working with the entire model requires a lot of hardware resources and is inconvenient for the processing of its small elements. Intetics engineers used the “assembled” model only during the analysis stage and then after processing to check the overall final result.

During the initial analysis of the model, the tiles with some defects are selected for further work. Also, the surrounding details or their parts are often selected to build the picture. These tile groups are classified and processed individually and then distributed to the appropriate specialists. Tracking is created to keep statistics and accounting records, as well as to avoid confusion in a large number of tiles and a variety of types of defects to be eliminated.

★ 02 Model analysis for defects

The defects are classified and then for each type of defect, we found the optimal way of correction. We calculated the processing time of the average statistical situation of each type and, based on this, calculate the time and labor costs for processing the entire model.

★ 03 Correction of texture defects

One of the most common defects is the blackout of some parts of textures, which is corrected by changing the brightness, contrast, and saturation settings for them. For this correction, there is an important nuance – not to mix up the darkening of texture and the real shadow on the object.

However, there are also non-standard situations that may require a separate approach, for example, zonal infringement of colors, when only part of blackout is restored.

The texture has the wrong color besides blackout. When standard lightening settings are applied, it leads to an effect as in the example. In such cases, retouching for low visible and dark areas of texture is used, or stamp tool to restore the type of texture by using neighboring areas of good quality.

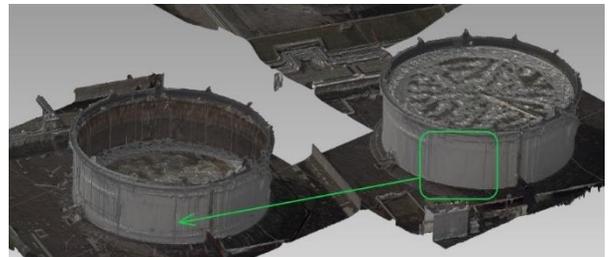
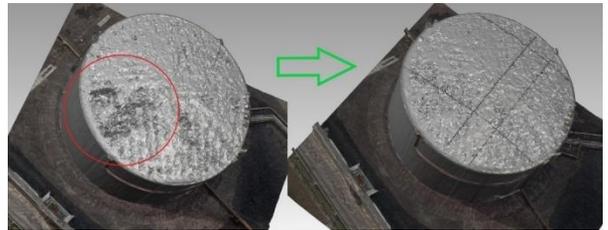
For mixed cases when several defects are present in the model, the variety of tools and approaches is used for the correction..



★ 04 Fixing geometry defects

Methods of correction of the model defects may differ depending on the type and level of geometry distortion.

- If the shape distortion of the surface has a small scale, correction is performed by aligning polygons and vertices without changing the structure of the object.
- In case of more serious defects, clones of similar model elements can be used, which will cover the problem area. This method allows saving the utmost original appearance of the model.



- In situations where the model/part of the model has uncorrectable defects or is almost completely "destroyed", the only way to fix it is to create a new model. The initial model is used as a template. In this case, when creating a new model (it's part) and textures, it is necessary to maximize the use of photos, from which the original model was generated.



- The complexity of this method is that the redesigned part should look natural as much as possible and not stand out against the environment with its "ideal" appearance. Also, in the case when the geometry is severely damaged, but the texture is fine, you can bake the old texture on the new geometry.

Client's reference



Involving Intetics experts allowed us to solve this challenge quickly and with highest quality possible. Yours team professionalism and ability to get to the bottom of the situation quickly exceeded our expectations.

Benefits and Results

- ★ Intetics team did a large volume of work and performed faults recovery on multiple 3D models, from small and simple to large and complicated ones.
- ★ The greatest complexity of recovering large models that have rough violations of geometry and texture, was successfully overcome.
- ★ The client received a corrected model with restored textures and now has the opportunity to conduct high-quality presentations on a holographic table.