Geology Department, Science Faculty of Lisbon University

Rectify Extreme Tool

User Guide

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Rectify Extreme Tool

General information

The Rectify Extreme is a tool to correct the images distortions and rectify them into an orthogonal equivalent view based on the principles of photogrammetry.

The correction of the image distortions requires the acknowledge of each camera intrinsic parameters (i.e. effective focal length, the principal point position, pixel skew and the coefficients of distortion) which can be stored in a xml file (Cameras.xml).

For the rectification, i.e. the transformation of originally oblique images into vertically equivalent ones where precise measurements can be made, the Rectify Extreme tool needs an initial approximation for the camera position (XL, YL and ZL) and a linkage table where the ground and image coordinates of several ground control point are related. This linkage table, also in xml file format, can be created through this tool.

The Rectify Extreme tool, freely available at http://cosmos.fc.ul.pt/index.html is characterized by a graphical interface customized in Microsoft Visual Studio C# as it entirely provides the necessary user interfaces (UI) including standard interfaces (e.g. text boxes, check boxes and list boxes).

A more complete explanation of this tool procedure can be found in the following section Detailed Description.

Detailed Description – Rectify Extreme Tool

Correction of images distortions

1. Select the images you want to correct in **File** -> **Open Images;**

2. Define the camera internal parameters in **Camera** –> **Internal Parameters** by browsing the camera.xml[1] file and select the IP of the camera that acquired the respective images. After you choose the camera internal parameters the camera is now defined, you can confirm that in the left bottom corner of the Rectify Extreme window the text "Camera: defined" is now visible (opposing to the "Camera: not defined" that appears previously).
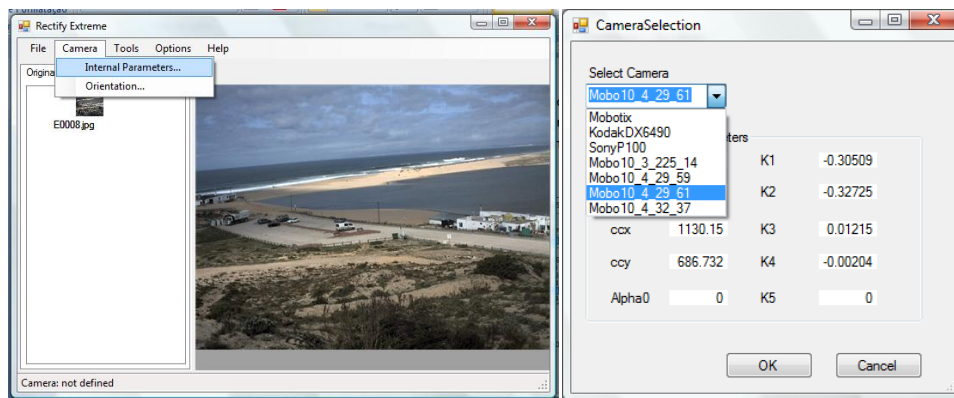
3. Correct the image in **Tools**-> **Correct Image**, selecting the size of the resulting image by the relative dimensional percentage to the initial image size, or through the definition of maximum and minimum x and y values. By default the tool uses the 110% of the original image size which were suitable for the 3 MegaPixel resolution cameras used (for cameras with higher resolutions this percentage probably needs to be increased).

4. After the correction processing, the new undistorted images appear within the tab "Corrected". These images are stored in the same directory as the original images,

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[1] This Camera.xml file can be edited using for e.g. excel. The intrinsic camera parameters must be previously determined in laboratory using for e.g. open-source software like the computer application Camera Calibration Toolbox for Matlab developed by VISION CALTECH (http://www.vision.caltech.edu/bouguetj/calib_doc/#examples) .

with the same name, only differing in the image extension which is now ".JPGc" and can only be recognized by the Rectify Extreme software. If you want to see or open this images in another software, you have to change the extension back to ".JPG".

Image rectification

The image rectification requires the recognition of the camera orientation relating to the ground.

Computing the camera orientation based on Ground Control Points (GCP's)

1. Go to the camera orientation menu: **Camera** -> **Orientation.** The tab "Orientation" that appears is where the camera extrinsic parameters i.e. orientation will be displayed after the computation.
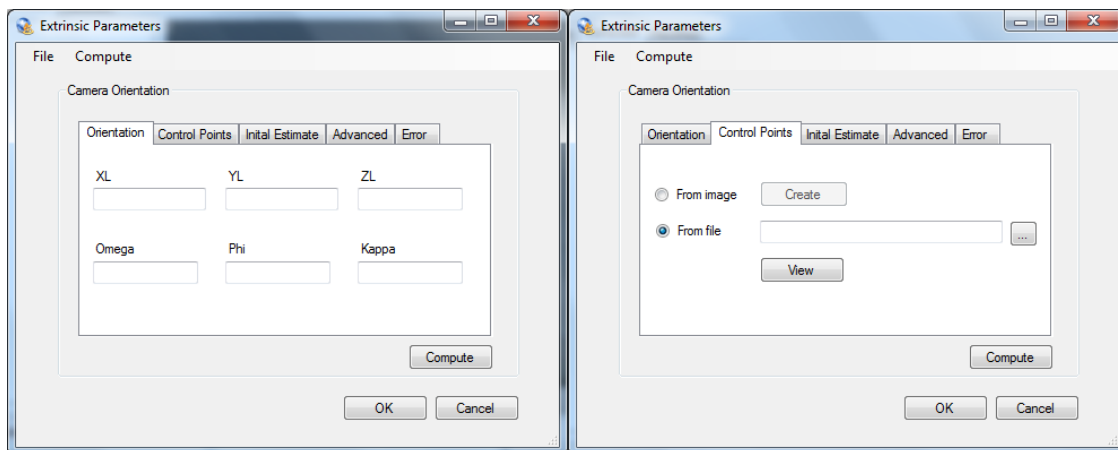

2. Select tab **Control Points** to browse for the linkage table where the ground and image coordinates of several ground control point are related (.xml file).

   If this file is not yet created you can produce it using the option "From image" in this tab:

    a. Open the corrected image(s) where the Ground Control Point(s) is(are) visible and pick those points. At the same time fill the Ground information (ID, GCPX, GCPY and GCPZ) for the respective points. If the GCP's are in different images

you can, without exiting this menu, open successive images and fill the linkage table for all surveyed CGP's. Save the linkage table in **File** -> **Save CP.**
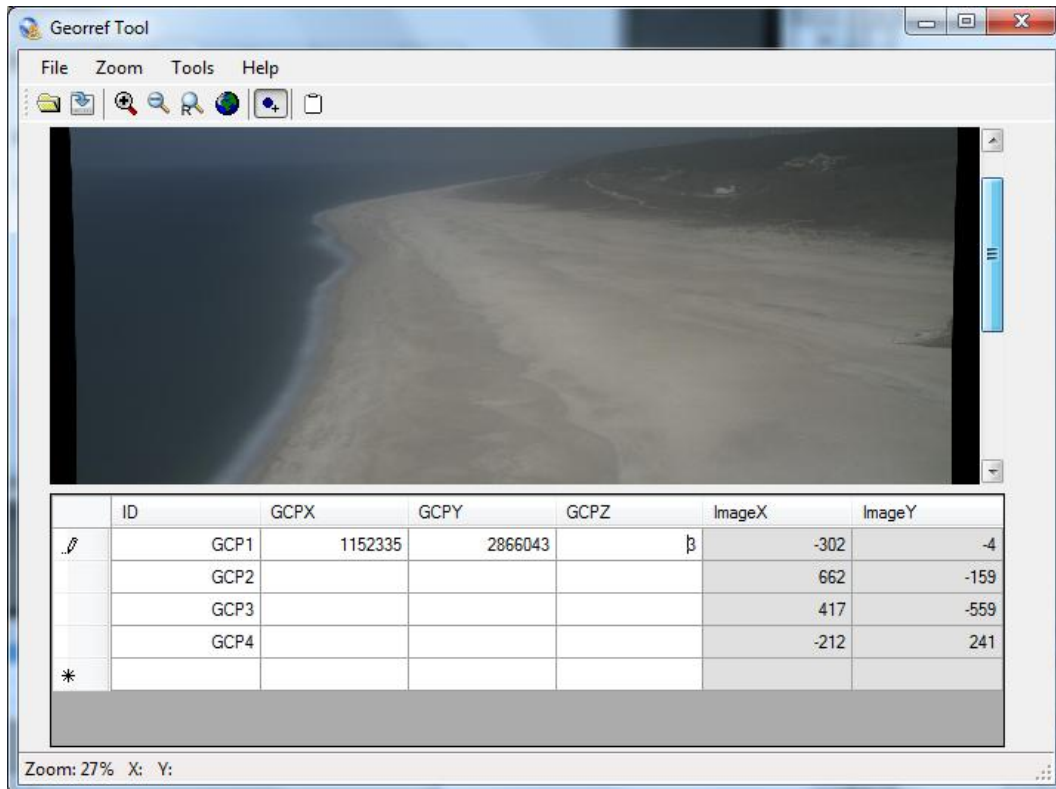

3. In the tab "Initial Estimates" you must provide the camera position first approximation and press **Compute.** (Note that sometimes the use of zeros works as initial estimate but this procedure must be taken carefully as the computation can fall into a local minimum during the iterations, therefore is recommended to have a critical view of the results in the "Orientation" tab or to use as initial estimate the position of the camera surveyed in the field).

4. Verify the orientation errors in the tab "Error". In "Details" you can see each GCP error and erase the weakest points to re-compute camera orientation with less error.

5. When you are pleased with the camera orientation parameters press ok, and in the left bottom corner of the Rectify Extreme menu you should now see also "oriented".

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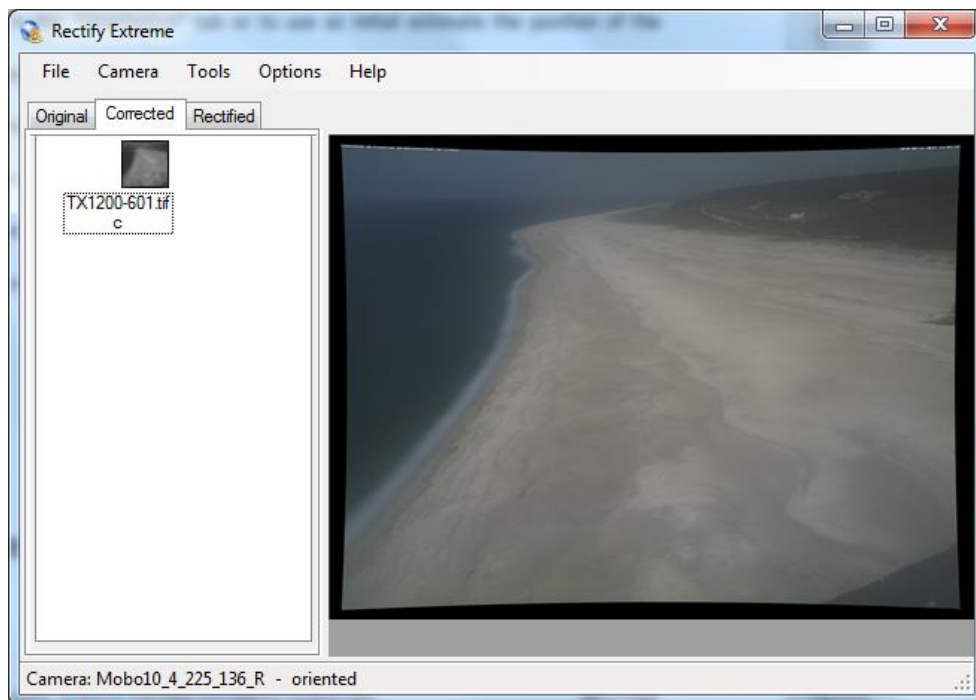
Rectification process

- The image rectification is done in **Tools** -> **Rectify** through the selection of the vertical reference for each rectification (or each image). Each image rectification should account for the tidal level in the moment it was acquired. By default the software provides the mean vertical reference of the used GCP's.

  The user should also provide the pixel size for the rectified image, the interpolation method to be used and the extent of the rectification in order to maximize the computation and eliminate areas without interest.
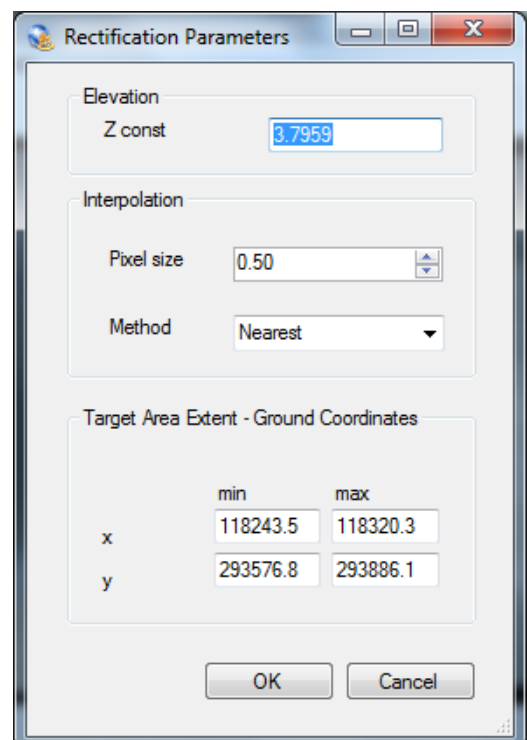
- The rectified image is then created in ".tiff" format and stored in the same directory. Simultaneously the software Rectify Extreme created a ".tfw" file with the same name that provides the automatic geographic positioning of the image when it is imported into ArcGIS.

Authors and contacts

This Software was developed by Ana Silva and Rui Taborda from the Geology Department of Lisbon Science Faculty in the scope of a master thesis; more details on this procedure can be found in the following reference and website:

- **Silva AN, Taborda R, Catalão J and Freire, P (2009). DTM Extraction Using Video-monitoring Techniques: <u>Application</u> to a Fetch limited Beach. JOURNAL OF COASTAL RESEARCH, Volume: 1, Sp. Iss. 56, Pages: 203-207, Published: 2009**
- **http://cosmos.fc.ul.pt/index.html**

Any questions about the present tool please contact us:

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