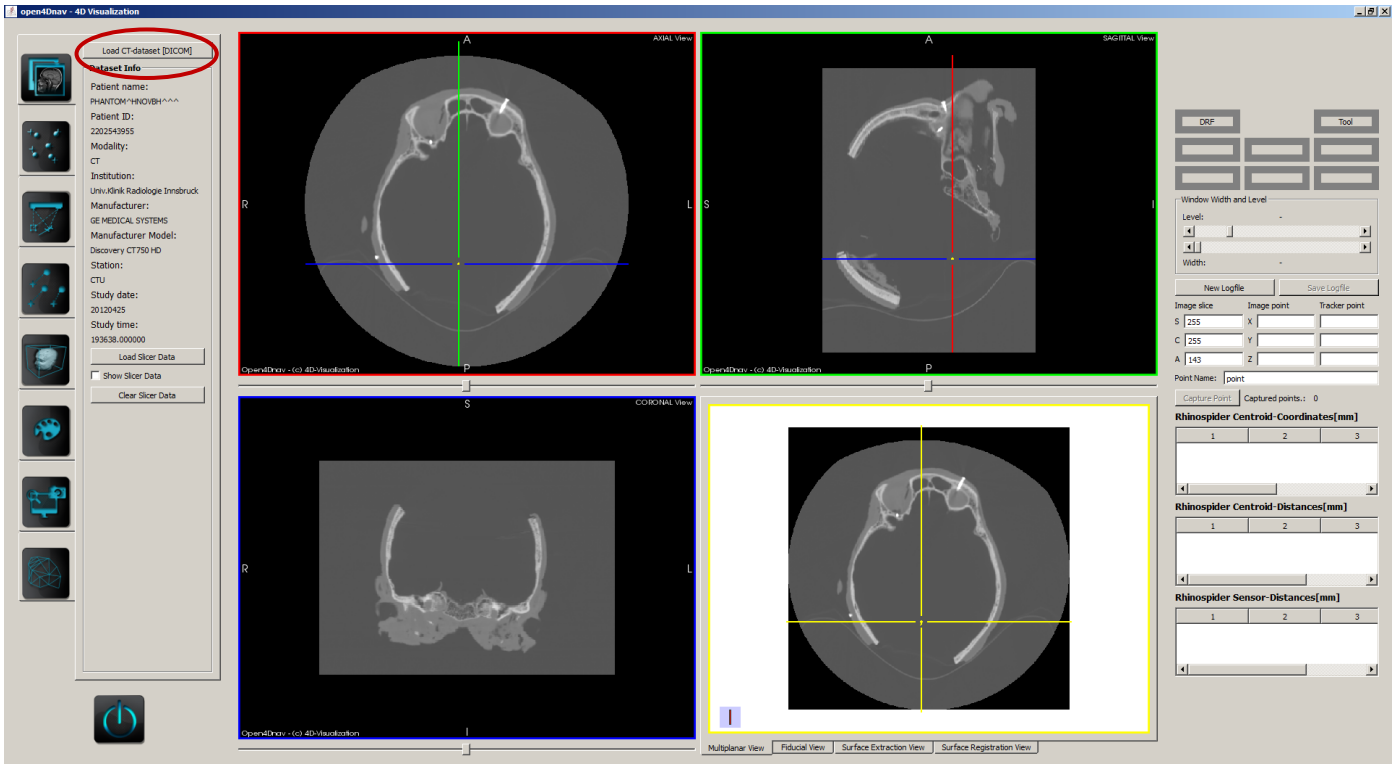
Surface based registration/navigation for open4DNav

Yusuf ÖZBEK
30.05.2012

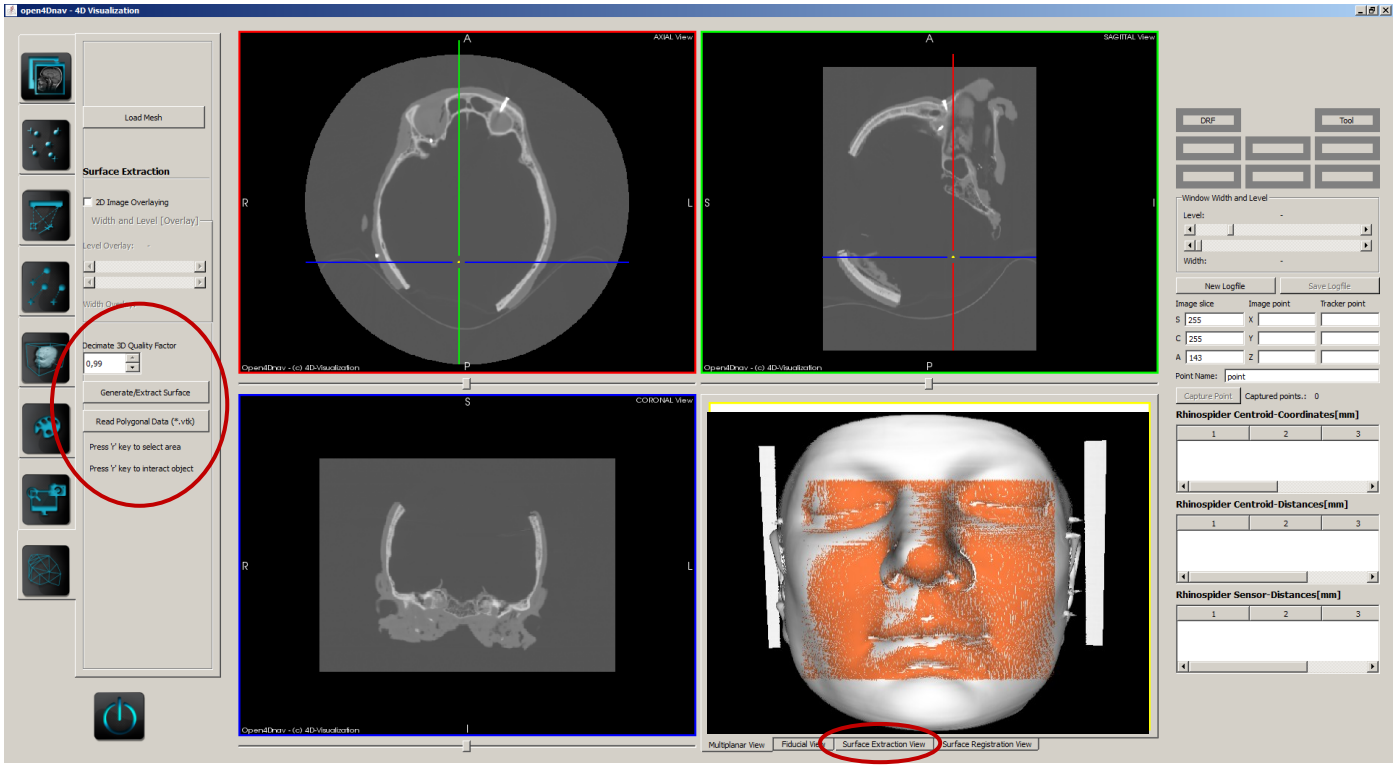
Using open4Dnav with Surface Extraction

1. Step: Load image dataset



2. Step: Surface extraction, surface based registration and navigation

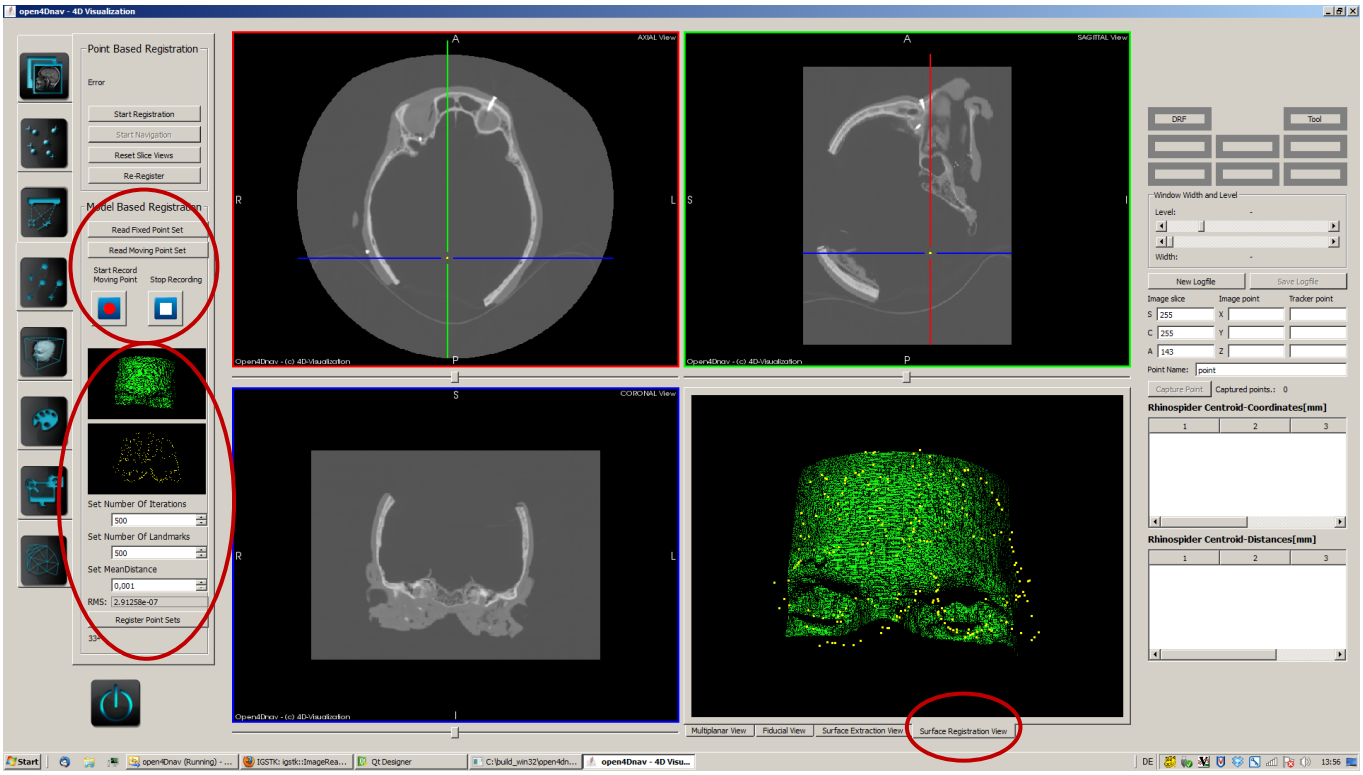
Surface based registration and navigation method enables a surface-based registration between the image and the patient through the use of an iterative closest point algorithm (ICP). The goal is to get in the first step a point cloud from segmented computed tomography (CT) data set by using the surface extraction, which is later used as reference points for ICP. The second point cloud is recorded by the patient with a tracker by tracking a probe position, which is later used as target points for the ICP. In the second step are both point clouds with the ICP accordingly registered and visualized. The user has the possibility to enter the number of iterations, the number of control points and the maximum arithmetic mean value between two iterations manually and to register point clouds with the entered values iteratively. After each registration the root-mean-square error (RMS) and a transformation matrix is computed and stored separately with registration result (registered model) in poly file format and navigation is made possible through this surface based registration.



Step 2.1. : To surface-, point-extraction from segmented model to collecting fixed-point clouds for the registration the user clicks “Generate/Extract Surface” button. After the segmentation is

done the user can clicking the “r” button and keep clicking left mouse button to choose/select a area on segmented CT-dataset, which is to be extracted. The selected or extracted area are marked as orange color and saved as fixed point in log folder. The user can leave the selection mode with clicking “r” button and interact the 3D object with mouse buttons again. Here, the user has the possibility with "Decimate in 3D Quality Factor" spin box to enter the quality of the generated 3D object in factor. This process can be repeated as often. The Result of this process is shown bottom right quadrant in “Surface Extraction View” tab.

Hint: If the user already has generated a 3D model from the CT dataset (polygonal *. vtk file), does not generate a new 3D objects from same CT dataset. The user can click on the "Read Polygonal Data (*. vtk)" button and extracts the fixed point sets from this loaded 3D model.



Step 2.2. : To surface-extraction from patient to collecting moving-point clouds for the registration clicks the user on “Start Record Moving Point” button and collect points with probe from patient. Once the user has clicked on the button, hear a sound. During the process, the number of collected points on the "Model-Based Registration" view shown. If the user with recording is finished, clicks on “Stop recording” button. Once the user has clicked on “Stop recording” button, the collected points are saved as moving point in log folder.

Step 2.3. : If the user now has the fixed points and moving points, ICP registration and then navigation can take place. For this the user clicks "Read Fixed Point Set" button and choose the fixed point file in log folder, which saved in step 1. After loading the fixed point set it is as green visualized on the "Model-Based Registration" area. For the loading the moving point set user clicks "Read Moving Point Set" button and choose the moving point file in log folder, which saved in step 2. After loading the moving point set it is as yellow visualized on the "Model-Based Registration" area. And finally, the user clicks the “Registers Point Sets” button and registers two point clouds together. The Result of this process is shown bottom right quadrant in “Registration View” tab. Now the user can navigate with computed RMS.