This prototype software is developed using Microsoft visual studio 2015. Before running our software, please ensure that you have installed Visual Studio or copied the required '.dll' files into the folder containing the executable file.

This software can achieve the following steps: a) identify the plane of symmetry; b) quantify surface asymmetry; c) profile drawing profile. Please run the Asymmetry detection.exe. The input data is archived in the 'Data' folder.

1. Import the digital model ('File' in the menu bar).

Step 1: Click on 'Open' to import the "skull.sca" file.

The digital model of skull will be displayed. Press and hold the left mouse button while moving it to rotate the object.

2. The identification of the plane of symmetry ('Symmetry plane' in the menu bar).

Step 1: Click on 'Step 1: WKS'.

Import WKS values. The colour map of WKS of each vertex will be displayed.

Step 2: Click on 'Step 2: Growing'.

Perform region growing. Different colours represent different segmented regions.

Step 3: Click on 'Step 3: Merging'.

Perform region merging. Different colours represent various merged regions.

Step 4: Click on 'Step 4: PSR'.

Extract potentially symmetrical regions (PSR) and plane of symmetry of each region. Please press keyboard keys '1' or '2' to cycle through each PSR (blue points) and its corresponding plane (red). Note that regions consisting of a small number of vertices will not be displayed, and hence you may need to press several times to show the PSR.

Step 5: Click on 'Step 5: Cluster'.

Refine symmetrical regions and the consistent plane cluster. All the recognised planes of symmetry will be shown.

Step 6: Click 'Step 6: Result'.

Recognise the 'best-fitted' plane of symmetry (red).

Alternatively, you have the option to click on 'One step' to directly obtain the result. The outcome will be saved in the '*.-coeff.txt' file. It contains the coefficients of

equation of the recognised plane, as well as geometric difference between original and mirrored meshes are saved.

3. Surface asymmetry detection (‘Asymmetry detection’ in the menu bar).

Step 1: Click on ‘Step 1: Mirror’.

Reflect the digital model with regard to the plane of symmetry. The original and mirrored meshes will be displayed.

Step 2: Click on ‘Step 2: Result’.

Quantify the gross asymmetry and visualize the geometric difference between original and registered mirrored meshes. The asymmetry ratio will be shown and subsequently the colour map of geometric difference will be visualised.

Alternatively, you have the option to click on ‘One step’ to directly obtain the result. The outcome will be saved in the *.-result.txt. It contains the coefficients of equation of the recognised plane and asymmetrical ratio.

4. Profile drawing (‘Profile Drawing’ in the menu bar)

Step 1: Click on ‘Result’.

Produce the profile drawings (red points).

The inputs of the software include:

3D model file (*.sca), sampling point file (*-sampling.txt) and wave kernel signature file (*-wks.txt).