Automatic 3D Tooth Model Reconstruction From CT Images

Cape Town, South Africa – Today, at the 92nd General Session & Exhibition of the International Association for Dental Research (IADR), held in conjunction with the IADR Africa/Middle East Regional Meeting, lead researcher Z. Xia, Shenzhen Institutes of Advanced Technology, Chinese Academy of Sciences, will present a study titled “Automatic 3D Tooth Model Reconstruction From CT Images.”

Three-dimensional (3D) tooth models provide important information to orthodontists in treatments. Currently, some information requires reconstruction of 3D tooth models from CT images manually, which is laborious and time-consuming. The objectives of this study were to develop an automatic, fast and accurate 3D tooth model reconstruction method from CT images and to assess the accuracy.

The reconstruction procedure consists of two stages, a 2D segmentation and a 3D surface rendering. In the segmentation stage, a hybrid active contour model (HACM), which consists of four image energies, i.e. a local region intensity energy, a global region intensity energy, an edge energy, and a pixel-wise posterior energy, is applied to extract tooth contours. The coupled multiple version of HACM is employed to separate neighboring teeth. After the segmentation, teeth are distinct by assigning different gray levels. In the surface rendering stage, isosurfaces of each tooth are extracted using the marching cube algorithm by setting corresponding thresholds. Simplification and smoothing of triangular mesh is executed to the isosurface to obtain the final tooth model. CT images of five patients were tested using this method. The accuracy of this method was estimated by comparing to the manual segmentation results of experienced clinicians. Precision-recall framework was used to evaluate the segmentation accuracy. Processing times of the whole reconstruction procedures was recorded.

The researchers noted that when 2D tooth contours were extracted accurately, the precision and recall are higher than 94% and 95%, respectively. Three-dimensional tooth models of dentition were reconstructed for all tested volumetric images. All procedures including 2D segmentation and 3D reconstruction were completed within 10 minutes. The presented method based on hybrid active contour model and marching cube algorithm can be used to reconstruct individual 3D tooth models of the dentition effectively.

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This is a summary of abstract #1398, “Automatic 3D Tooth Model Reconstruction from CT Images,” to be presented by Z. Xia on Saturday, June 28, 2014, 10:45 a.m. – 12:15 p.m. in Meeting Room 1.43 of the Cape Town International Convention Centre.

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