

Title: Intelligent graph segmentation of CBCT images for tooth root

Industrial Applications ☐Intelligent Manufacturing ☐Intelligent Driving ☐Intelligent Life ☒Smart Medicine ☐Smart City

Background Description

[Overall background]

With the development and utilization of data mining technology and artificial intelligence technology, the digital medical market in China will increase exponentially to serve the medical market of China's 1 billion and 300 million populations better. According to the report of Boston consulting company, the scale of China's digital medical market is expected to reach nearly 700 billion Yuan by 2020, compared with 20 billion yuan in 2014, and the market is growing at a high speed. The medical field is a field of serious shortage of resources and high cost. The positive effects of artificial intelligence on medical treatment are mainly reflected in three aspects: first, let the machine can replace the doctor to complete part of the work, let medical resources more reach the user; second, it can improve the work efficiency of institutions and doctors, reduce the cost of medical treatment; third, it can improve the rate of self-examination by means of AI, early detection and better management of the disease. The main applications of artificial intelligence in medical field include medical robot, medical image, remote inquiry, drug discovery and so on.

[Business background]

In the field of oral medicine, with the development of 3D technology, the intra mouth scanning equipment can scan the crown and reconstruct the 3D model to form digital medical service. It can be imported into dental software to display dental models in the form of 3D, and can also simulate tooth movement in orthodontic process. For example, the software Insignia from the most famousOrmco company in the industry, provides this kind of function.

However, the intra oral scanning device can only scan the crowns outside the gingiva, and 2/3 of the root cannot reconstruct the 3D model. For dentists, the 3D model of the root part is very important. In the past, only planar graphs could be seen on CBCT. Ormco's Insignia software reconstructs the 3D root model by artificially depicting the root edge of CBCT. But this way is inefficient and cost high. The application of AI technology to this scenario can be done in the CBCT image to segment the root parts semantically, so as to create conditions for reconstructing the root 3D model.

Project description

[Problem description]

In the CBCT images containing the oral cavity, the edge of the tooth / root part is extracted by artificial intelligence technology and the rest is discarded.

[User expectations]

Accurately extracting the edges of teeth / roots in CBCT images, thus creating conditions for 3D technology to reconstruct the 3D model of root teeth.

[Expected economic effect]

At present, Ormco's Insignia related software charges a set of hundreds of thousands of Yuan, while China's domestic market is huge, and there are hospitals and clinics of >7 million. It is assumed that the provision of artificial intelligence technology to serve the market of 1/10 is a very considerable economic effect. Moreover, the market of oral health care in China is increasing rapidly and the market will be larger in the future.

Task requirements

[Technical path]

To use appropriate image processing technology to preprocess CBCT images.

Deep neural network is used to identify the area of the tooth.

Edge segmentation of root is done by using image semantic segmentation technology in the dental region.

[Technical indicators]

1. All contestants train themselves and generate models
2. During the time appointed by the organizing committee, all contestants will test the first batch of test data, and each competitor can submit 3 times to get the highest score.
3. The top 5 contestants will be invited to the semi-finals. The venue is organized by the organizing committee.
4. Test score standard: According to the accuracy of root segmentation, the higher the accuracy, the higher the score.
5. In the field test section, the expert group needs to verify the model.

[Standard submission]

1. Submitting a technical scheme in accordance with the above requirements
2. Designing algorithm and submitting the source code
3. Submitting training models according to the CBCT training images provided.
4. Submitting processing results based on the CBCT test images provided.

[Task list]

1. "Technical specification document" *1
2. Algorithm source code *1
3. Training model *1
4. Test picture processing results *1

Reference information

[Reference tool]

Tensorflow

OpenCV

OpenGL

[References]

High-performance Semantic Segmentation Using Very

Deep Fully Convolutional Networks-2016

Improving Fully Convolution Network for Semantic
Segmentation-2016

Large Kernel Matters - Improve Semantic Segmentation
By Global Convolutional Network-2017

CVPR-2017 Not All Pixels Are Equal: Difficulty-Aware
Semantic Segmentation via Deep Layer Cascade-201

[Data interface]

Provide 100 CBCT image training data

Test data are provided on the day of the game

Link: <https://pan.baidu.com/s/1C1BTgGFJUHj97Wiwi0pyYw> password: pfrq