Task1: Classification of the circle of Willis configuration variants

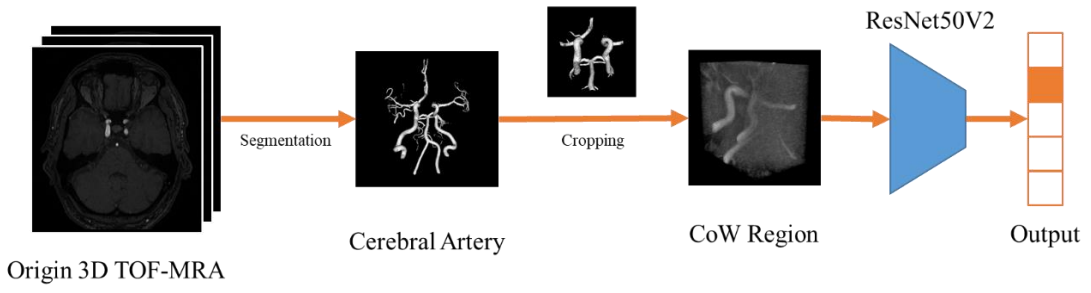
Method

A cerebral 3D TOF-MRA dataset contains the complete image of the cerebral vascular structure, which is excessively informative for classifying the circle of Willis (CoW) configuration variants. In order to obtain the proper region of interest for classification, We used an algorithm to crop the CoW arteries from the whole image. The boundary box of image cropping was determined using the statistics information from segmented artery voxels.

An intensity normalizing and enhancing process was applied to the input TOF-MRA image. High-intensity voxels were extracted through binary segmentation to serve as the seed point set. Then, the seed point set was used as parameters for region growth segmentation. The threshold of region growth segmentation was calculated by the intensity distribution based on Gaussian distribution model.

After arterial segmentation, the distributions of segmented artery voxels were calculated along different axis projections. We picked the X-coordinate from the center of input image, the Y-coordinate from the peak of the distribution curve, and the Z-coordinate from the barycenter of cropped voxels as the reference coordinates for image cropping. Finally, a boundary box with reference coordinates as the center point and a fixed size was obtained.

To implement automatic annotation for the classification of CoW configuration variant, we used the simple ResNet50V2[1] architecture. Two separate networks were trained to obtain annotations of class variants in both the anterior and posterior parts. The cropped input image for the networks was resampled into 32×64×64. Data augmentation such as flipping, affine transforming, and gamma changes was performed during the training phase.



Reference

[1] He, Kaiming, et al. "Identity mappings in deep residual networks." Computer Vision–ECCV 2016: 14th European Conference, Amsterdam, The Netherlands, October 11–14, 2016, Proceedings, Part IV 14. Springer International Publishing, 2016.