



# Carotid Artery Plaque Segmentation in US Images

Project Management and Software Development  
for Medical Applications

## General Info

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## Project Abstract

Ultrasound imaging technology is the most commonly used medical imaging tool for carotid artery diseases. Measuring the carotid plaque area and Intima-media thickness (IMT) through US images is an essential way of identifying patients at increased risk of stroke, myocardial infarction, and vascular death. Several deep learning based approaches have been proposed to automatically segment the carotid plaque in either longitudinal or transverse view. However, performance of the deep learning model largely depends on the dataset. In order to increase the generalizability of the network, attention mechanisms have been introduced to the imaging processing field. The aim of this project is to exploit the performance of the attention network in carotid US segmentation tasks.

## Background and Motivation

As mentioned above, recently using attention mechanisms to overcome the problem of biased dataset is a hot topic in the medical imaging processing field. Song et al. proposed a Global and Local Feature Reconstruction Network to exploit the semantic and spatial information of the images [1]. They implemented their network to different scenarios but not including US. Similar to [1], Zhao et al. also introduced a network based on self-attention mechanism to segment the thyroid

nodules from US images. Apart from attention network, in the US carotid segmentation field, Zhou et al. tried to use smaller dataset to train a generalizable network by fusing segmentation outputs from eight individual UNet++ networks with different backbones.

## Student's Tasks Description

In this project, the student should try to implement the proposed method of [1] and [2] ([3] is optional) to a new scenario, namely carotid artery plaque segmentation and compare their performances. If there is time left, we can also try out other network structures or other techniques like domain adaptations to increase the generalizability of the network.

## Technical Prerequisites

Python (pytorch or tensorflow)

Medical imaging processing

## References

[1] Song, Jiahuan, et al. "Global and Local Feature Reconstruction for Medical Image Segmentation." IEEE Transactions on Medical Imaging (2022).

[2] Zhao, Shi-Xuan, et al. "A Local and Global Feature Disentangled Network: Toward Classification of Benign-malignant Thyroid Nodules from Ultrasound Image." IEEE Transactions on Medical Imaging (2022).

[3] Zhou, Ran, et al. "Deep learning-based measurement of total plaque area in B-mode ultrasound images." IEEE Journal of Biomedical and Health Informatics 25.8 (2021): 2967-2977.