# Examensarbete 30 hp i Medicinsk Teknik

Generation of fake ultrasound images to motivate healthier living

Medicinsk teknik FoU är en forsknings- och utvecklingsavdelning vid Centrum för Informationsteknik och Medicinsk teknik på Norrlands universitetssjukhus, Region Västerbotten. Avdelningen bedriver internationell forskning, utveckling och utbildning inom det medicintekniska området, med kompetens inom exempelvis sensorer och mätsystem, bild- och signalanalys och biomekaniska modeller. MT-FoU står också bakom kompetenscentret AI for Medicine in Northern Sweden, AIM North, som stöttar kliniska forskningsprojekt med teknisk metodkompetens inom maskininlärning och AI.

Background

Atherosclerosis leads to thickened arterial walls and focal plaques, and it is the major cause of cardiovascular disease (CVD), with a very high incidence of related deaths. In this project we are studying how atherosclerotic disease progression can be modelled at a personalized level. We aim to train models to take images of a healthy person's carotid artery and generate a new image with features of pronounced disease but with preserved anatomical features. In general, such generated images could be used for educational purposes and simulation of disease progress. Moreover, in our research group we have showed that presenting an image of a patient's carotid artery disease severity increases a patient's adherence to treatment and lowers CVD risk factors [1]. Therefore, such generated images could be used as a tool in primary prevention and CVD risk communication within a health conversation.
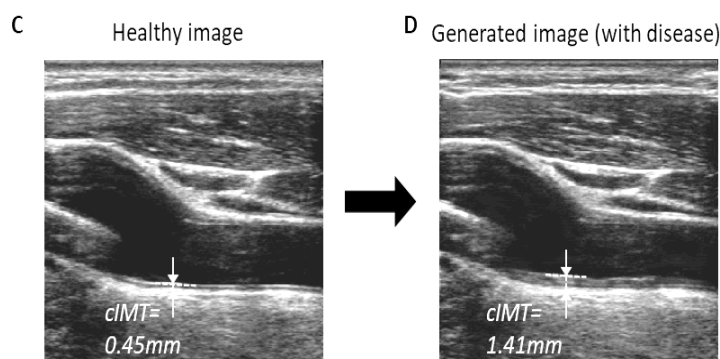
The problem we want to solve is equivalent to translating features from one image domain to another. So-called domain-to-domain translation methods (deep learning models) have been proposed for similar tasks in medical imaging applications. Previously we have evaluated the 2D cycleGAN model to solve this task, where translation between images of two domains with different feature distributions was obtained while retaining content of the original images [2].

Aim

This work aim to develop and evaluate various generative models (e.g. GANs, Generative adversarial networks), to generate disease in existing ultrasound images of the carotid arteries. In particular, so-called latent space interpolation techniques would be interesting to explore for this application.

Work description

To be decided together with the master student.

References

[1] Näslund et al., The Lancet, 2018
[2] Ali et al., Biomedical Signal Processing and Control, *submitted*

Handledare vid Medicinsk teknik FoU
Christer Grönlund
CIMT, Medicinsk teknik – FoU, Region Västerbotten
E-post: christer.gronlund@regionvasterbotten.se
Web: https://www.regionvasterbotten.se/medicinsk-teknik-forskning-och-utveckling