Note from the First Author:

If you are a member of a university admissions committee or a professor whom I have contacted, and you would like to review the full manuscript for admission evaluation, please feel free to email me. I will be happy to share it.

This PDF contains only a brief excerpt of the work, as I am currently awaiting arXiv preprint endorsement to upload the complete version. I hope this snippet is helpful. Thank you.

Measurement

Attention/Transformer-based Artificial Intelligence Models for Carotid Segmentation and Intima Media Thickness/Plaque Area Measurements in Japanese Ultrasound Scans

--Manuscript Draft--

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Abstract:	Background and Motivation: Accurate plaque segmentation and measurement in carotid ultrasound scans is essential for effective diagnosis and cardiovascular disease (CVD) risk stratification. The latest techniques based on solo single stage deep learning UNet (SS-UNet) leads to inconsistency in low contrast scans. We hypothesize that variants of UNet such as transformers can be more powerful paradigms. Method: Design and develop novel single-stage UNet-based transformer (SSXmer-UNet) for the far wall segmentation and intima-media thickness/plaque area measurements in Japanese diabetic cohort. We use augmented data and cross-validation protocol for performance evaluation and generalization. Performance

	evaluation includes 13 novel metrics, namely model complexity, model size, training efficiency, performance to model size ratio, performance to complexity, and training time. We benchmarked our novel transformer system against four models utilizing single and double stage attention-based configurations namely SS-UNet, single-stage with attention-UNet (SSwAtt-UNet), double-stage with attention-UNet (DSwAtt-UNet) and double-stage with attention in decoder UNet (DSwAttDec-UNet), Results: The results showed that DSwAttDec-UNet achieved a perfect normalized score of 100%, while SSXmer-UNet followed closely with a 96%. Both models consistently outperformed SS-UNet, SSwAtt-UNet, and DSwAtt-UNet across all the 13 metrics. The final ranking of the UNet models were: DSwAttDec-UNet > SSXmer-UNet > DSwAtt-UNet > SSwAtt-UNet > SS-UNet. Although DSwAttDec-UNet leads in performance, SSXmer-UNet demonstrates comparable effectiveness with greater efficiency, making it a strong alternative. Conclusions: We conclude that transformer-based models like SSXmer-UNet provide highly accurate, reliable, and automated technique that segments and measures the risk of CVD.

Title Page with Author Information

Attention/Transformer-based Artificial Intelligence Models for Carotid Segmentation and Intima Media Thickness/Plaque Area Measurements in Japanese Ultrasound Scans

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