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.

Biomedical Signal Processing and Control

A Comparative study of the latest Artificial intelligence-based Models for Plaque Measurement in a Carotid Ultrasound-based Japanese Cohort

--Manuscript Draft--

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Abstract:	Background and Motivation Accurate plaque measurement in carotid ultrasound images is essential for effective diagnosis and CVD risk stratification. Traditional methods for plaque assessment rely on manual segmentation and rule-based approaches, leading to inconsistent results and observer variability. Although deep learning (DL) models have increased segmentation accuracy, they face challenges in dealing with complex plaque structures

	as well as low contrast ultrasound images. This study aims to compare state-of-the-art AI-driven models for carotid plaque measurement, evaluating their efficiency, robustness, and clinical applicability in a Japanese cohort. Method This study evaluates three deep learning models, i.e., (i) conventional neural networks(cNonAtt-dsCNN), (ii) attention-enhanced U-Net(cAtt-ssUNet),(iii) a two-stage attention-based method(cAtt-dsUNet) and compares against commercial AtheroEdge™ 2.0(AE2.0) from AtheroPoint, CA, USA-an automated method. All three DL models were trained on the same Japanese data with identical hyperparameters using the Adam optimizer, batch size 32, and a learning rate of 0.001 on an NVIDIA GPU cluster. The metrics used were: (i) total plaque area, and carotid intima-media thickness (cIMT), giving the automated lumen-intima, and media-adventitia (LIMA) boundaries in the far wall carotid ultrasound scans. The performance of these models was assessed using (i) Dice similarity, (ii) Jaccard index on binary segmented walls, and (iii) polyline distance metric for measuring cIMT. Results The results indicate the correlation between (i) plaque area to ground truth area cAtt-ssUNet<AE2.0<cAtt-dsUNet; (ii) for cIMT: cNonAtt-dsCNN<cAtt-dsUNet, (iii) for model size: AE2.0 <cNonAtt-dsCNN<cAtt-ssUNet<cAtt-dsUNet. (iv) Similarly, for dice similarity index cAtt-ssUNet<cAtt-dsUNet. Conclusions cAtt-dsUNet outperformed traditional DL methods and is comparable to the commercial system AtheroEdge™.

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