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.

Knowledge-Based Systems

Plaque Burden and Carotid Intima-Media Thickness Measurements in Ultrasound Scans: Are Transformer Tuners a Must for UNet Architectures?

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Abstract:	Abstract Background and Motivation: UNet-based Deep Learning systems have dominated in the field of medical imaging for segmentation of organs; however, it is not accurate, validated, or generalized. Transformers or attention, on the other hand, provide solutions that are sophisticated but use heavy-duty computations and take a long time to converge. This study introduces a two-stage segmentation solution that combines transformers as tuners to the base UNet, resulting in a highly accurate and generalizable solution. Method: Three sets of base UNets were designed, namely, B1:UNet, B2: UNet++, and B3:UNet+++, and four sets of tuners were designed, namely: T1:Transformer-augmented UNet, T2:Attention-guided UNet, T3:Swin Transformer-based UNet, and T4:Pyramid-based network, leading to 12 fusion systems that combine three base UNets and four Tuners, namely: B1+T1, B1+T2, B1+T3, B1+T4; B2+T1, B2+T2, B2+T3, B2+T4; B3+T1, B3+T2, B3+T3, B3+T4. A comparison is made on 13 important metrics, including model size, complexity, training time, inference speed, and accuracy-to-parameter efficiency. Results show that B1+T4, which achieved the highest score of 100%, was the best-performing system. Results: Findings indicate that the two-stage segmentation model is effective and reliable than the single-stage UNet architecture. The combination of single UNet backbones and transformers/attention mechanisms then creates a structure-sensitive and extremely nuanced pipeline. Altogether, the proposed hybrid framework is scalable, high-throughput, and fits properly into the real-life clinical practice where the accuracy and stability of segmentation vital importance. Conclusions: We conclude that Hybrid transformer-based models like B1+T4 provide highly accurate, reliable, and automated techniques that segments and measure the

	risk of CVD.

Author Agreement

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