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FPaper review: Deep learning analysis of blood flow sounds to detect arteriovenous fistula stenosis

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Deep learning analysis of blood flow sounds to detect arteriovenous fistula (AVF) stenosis is a paper by G.Zhou et al published in September 2023 which proposes deep learning based automated AVF screening to ensure patient safety via early detection of at-risk vascular access. In hemodialysis patients, vascular access complications such as stenosis can occur, which causes the otherwise laminar blood flow to become turbulent leading to a high pitched systolic bruit or thrill. The paper investigates the possibility to detect stenosis via deep learning models based on the sound of AVF blood flow using supervised learning with data validated by duplex ultrasound. The paper also explores two preprocessing methods to convert one dimensional blood flow sounds into visual representation via Spectrogram and Recurrence plot in order to leverage computer vision models. It emphasizes on contextualizing sound with location metadata as the blood flow varies along the AVF and establishes the superiority of the vision transformer which can learn long range dependencies and aggregate global information in early layers resulting in more accurate predictions in analyzing the spectrogram. This novel approach proposed in the paper is scalable, automated and has capability comparable to a stenosis clinical examination conducted by a nephrologist, serving as a patient friendly tool for at-home, self-screening of stenosis.