Enabling Ankle-Brachial Index Prediction From Dopplers Using Deep Learning for Peripheral Arterial Disease Diagnosis

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Peripheral Arterial Disease (PAD) is caused by the blockage or narrowing of arteries supplying the lower extremities regions which affects approximately 10% of the U.S population and is one of the leading causes of limb amputations world-wide (approx. 50%). The current clinical procedure used for the identification of PAD involves the Ankle-Brachial Index (ABI) examination. The ABI is a metric calculated by dividing the ankle-tibial blood pressure (BP) measurement from the brachium and is a definitive procedure for PAD diagnosis. The value can be categorized for specific clinical outcomes and workflows. However, the ABI is currently challenged due to its vast limitations such as the in-accessibility of measurement across patients afflicted by diabetes, renal disease, and more, due to calcification of arteries and falsely-elevated measures. Additionally, ABIs are time consuming and potentially subjective. If ABIs are unable to be accurately measured at the point-of-care setting, patients are referred to formal vascular laboratories where treatment is significantly delayed. This project proposes a custom signal processing based deep learning system which can accurately classify ABI ranges from tibial doppler flow of the ubiquitous hand-held continuous wave doppler, enabling accurate point-of-care ABI measurements, which are fast, simple, and accessible to all patients without having the problem of falsely-elevated measures caused by calcified arteries. The proposed algorithm has undergone significant statistical validation and has received a classification accuracy of 98.85%. The aim is to improve PAD assessment and prevent amputation in all patients in a timely and accessible manner.

Awards Won:
Third Award of $1,000