A Portable Low-cost Solution for Early Detection of Valvular Heart Disorders

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Heart diseases are the number one cause of deaths globally, with three-quarters occurring in developing countries (WHO). In India, heart-related mortality rates in rural areas have surpassed those of urban as 75% of rural primary-care is handled by unqualified practitioners or community health workers owing to an acute shortage of doctors. Our goal was to develop a portable, low-cost system that can be used by frontline health-workers for early detection of valvular heart abnormalities such as murmurs which have become rampant in rural areas due to diseases such as rheumatic fever. Our solution has two main components: a low-cost digital stethoscope we developed at 20% cost of available devices and a Cloud-based Artificial Intelligence backend that simulates cardiac auscultation done by trained doctors. The digital stethoscope connects to a mobile app for recording heart sounds. Valvular abnormalities in these heart sounds are detected by converting them into high-quality spectrogram images using FFT and classifying them with a Cloud-based Convolutional Neural Network (CNN). The CNN was trained and tested with normal and abnormal heart datasets from UMichigan, Pascal and PhysioNet and upon optimizing spectrogram parameters (e.g: FFT overlap factor), 95% accuracy was achieved. This project's end-to-end infrastructure can be used to detect other common diseases such as respiratory disorders.

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