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Development of an Intelligent Software Solution for Artificial Intelligence Enabled Stethoscope: Accurate Coronary Artery Disease Diagnosis and Real-time Feedback System

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Abstract

Although the classic stethoscope has long been a crucial diagnostic tool for cardiac conditions, it has an elementary level of accuracy in its diagnosis capability. Mainly, the diagnostic capability of a traditional stethoscope relies on the listener's experience and expertise. The proportion of cardiac patients is increasing day by day due to the low accuracy rate of the traditional stethoscope. In addition, it has very limited capability to provide real-time feedback during auscultation. This study aims to develop a software prototype for a tube-free intelligent stethoscope that not only diagnoses heart diseases but also provides real-time feedback and guidance during heart auscultation. This uses modern machine learning algorithms and real-time signal processing to diagnose heart problems accurately and immediately while providing real-time feedback to assist physicians during heart auscultations. The study was mainly based on Coronary Artery Disease (CAD). It captured audio signals from the patient's heart using sensors, and thereby the collected audio signals are pre-processed and converted into spectrograms using a Short-time Fourier Transform for frequency domain analysis. Then the trained Convolutional Neural Network model achieves a high accuracy rate in differentiating between normal and abnormal heart sounds, enabling accurate CAD diagnosis. Finally, the study received an accuracy rate of 65%. This research has significant implications for cardiology and healthcare, revolutionizing heart disease diagnosis by enabling faster, more accurate, effective, and early diagnosis. The integration of real-time feedback and guidance during auscultation provides valuable insights for effective diagnosis and future enhancements in clinical settings.

Keywords: *Tube-free Intelligent Stethoscope, Coronary Artery Disease, Convolutional Neural Network, Cardiology, Real-time heart sound analysis*