# A Residual-Dense-Based Convolutional Neural Network Architecture for Recognition of Cardiac Health Based on ECG Signals

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**Abstract:** Cardiovascular disorders are often diagnosed using an electrocardiogram (ECG). It is a painless method that mimics the cyclical contraction and relaxation of the heart's muscles. By monitoring the heart's electrical activity, an ECG can be used to identify irregular heartbeats, heart attacks, cardiac illnesses, or enlarged hearts. Numerous studies and analyses of ECG signals to identify cardiac problems have been conducted during the past few years. Although ECG heartbeat classification methods have been presented in the literature, especially for unbalanced datasets, they have not proven to be successful in recognizing some heartbeat categories with high performance. This study uses a convolutional neural network (CNN) model to combine the benefits of dense and residual blocks. The objective is to leverage the benefits of residual and dense connections to enhance information flow, gradient propagation, and feature reuse, ultimately improving the model's performance. This proposed model consists of a series of residual-dense blocks interleaved with optional pooling layers for downsampling. A linear support vector machine (LSVM) classified heartbeats into five classes. This makes it easier to learn and represent features from ECG signals. We first denoised the gathered ECG data to correct issues such as baseline drift, power line interference, and motion noise. The impacts of the class imbalance are then offset by resampling techniques that denoise ECG signals. An RD-CNN algorithm is then used to categorize the ECG data for the various cardiac illnesses using the retrieved characteristics. On two benchmarked datasets, we conducted extensive simulations and assessed several performance measures. On average, we have achieved an accuracy of 98.5%, a sensitivity of 97.6%, a specificity of 96.8%, and an area under the receiver operating curve (AUC) of 0.99. The effectiveness of our suggested method for detecting heart disease from ECG data was compared with several recently presented algorithms. The results demonstrate that our method is lightweight and practical, qualifying it for continuous

monitoring applications in clinical settings for automated ECG interpretation to support cardiologists.