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Research Article

Improving the Performance of Heart Disease Diagnosis by Combining the Cochleogram Transformation and Variable Auto-Encoder (VAE) Network

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Abstract

Early detection of abnormal heart sounds can largely prevent sudden death caused by heart diseases. A low-cost and non-invasive method for detecting abnormal heart sounds is the use of PCG signal. In this article, after segmenting the heart sound signal, the two-dimensional representation of the signal is obtained by cochleogram transformation, then with the help of deep learning and variable autoencoder network, 4 final features are extracted from each signal. Finally, support vector machine and k-nearest neighbor with k-fold validation are used to classify the heart sound signal into one of the predetermined categories of normal and abnormal sound class. In this research, the Physionet database, which has 3482 heart sounds from a standard collection, is used to train and evaluate the proposed method. The best results of the proposed method for classifying the two classes of heart sounds are 99.55, 98.75 and 99.70 in terms of accuracy, sensitivity and specificity, which is the higher ability of the proposed method compared to other methods. This abnormal sound detection system can be used very usefully in rural health centers and small hospitals to help doctors without expertise to diagnose heart problems.

Keywords: Cochleogram Transformation, Heart Disease Diagnosis, Variable Auto-Encoder Network, Support Vector Machine, K-Nearest Neighbor.

Highlights

- Gammatone filter bank extracts frequency info via cochleagram transformation.
- Latent space from autoencoders provides effective, compact features for classification.
- Autoencoders excel in unsupervised learning by compressing features efficiently.
- Robust to noise, autoencoders improve accuracy using compact latent features.

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