OPEN ACCESS Freely available online

Journal of Medical Diagnostic Methods

ISSN: 2168-9784

Opinion Article

Using a VMD, PSR, and RBF Neural Network Hybrid For Prediction of ECG Signals

Liaquat Mirza*

Department of Experimental and Clinical Pharmacology, University of Engineering and Technology, Lahore, Pakistan

ABOUT THE STUDY

A hybrid prediction method for ECG signals in order to investigate a technique to predict ECG signals in Body Area Networks (BANs). To anticipate an ECG signal, the suggested technique integrates Variational Mode Decomposition (VMD), Phase Space Reconstruction (PSR), and a Radial Basis Function (RBF) neural network. We use VMD to divide the ECG signal into many Intrinsic Mode Functions (IMFs) with finite bandwidth, which helps to increase prediction accuracy by reducing the non-stationarity and randomness of the ECG signal.

The RBF neural network's input parameters have an impact on both the computational load and prediction accuracy. To make the RBF neural network's input parameters as optimal as possible, we use PSR. ECG Signals Hybrid Prediction Method Based on VMD, PSR, and RBF Neural. On ECG data from the MIT-BIH Arrhythmia Database, we run numerous simulation tests to assess the prediction performance of the suggested technique.

In contrast to some competing prediction methods, which have RMSE and MAE of 10-2 magnitude, the experimental results demonstrate that the suggested method's RMSE and MAE are of 10-3 magnitude. Our method clearly increases the prediction accuracy of ECG signals when compared to other different prediction methods. Doctors use ECG signals extensively to identify a variety of cardiac disorders. Accurately predicting ECG signals is important. ECG signals can be accurately predicted to give clinicians an early indication of a patient's status and to save energy in Body Area Networks' sensors (BANs). Some sensors used in BANs are positioned internally or behind the skin, making battery replacement difficult. It is difficult to figure out how to make these sensors use less energy while extending their lifespan.

If a prediction model is set up in both the sensor and sink nodes, the sensor node will communicate the measured data when the prediction error is above the defined threshold value; otherwise, it won't send the measured data, and the sink node will use the predicted data as the measured data. In other words, prediction can lower the amount of delivered data, which lowers the sensor's energy use. Numerous physiological indications, including the ECG, body temperature, and blood pressure, are present in BANs. The amount of data transmission and the energy consumption of the sensor will be significantly decreased if these physiological signals can be accurately anticipated from the historical and present data. Physiological signals can be predicted using a variety of techniques. A popular prediction technique among them is the Artificial Neural Network (ANN), which has gained popularity due to its nonlinearity, self-adaptation, and quick calculation speed.

Radial Basis Function (RBF) neural networks have gained popularity in time series prediction because they are a type of ANN that has the benefits of quick training speed and the capacity to resist falling into the local optimum. The main challenge in creating an RBF neural network is figuring out the characteristics of the network structure, such as the hidden layer's center of gravity, base width, and output layer's weight.

The issue of parameter optimization has been addressed by a number of methods in recent years. An improved MSIQDE (Improved Quantum-Inspired Differential Evolution) algorithm based on combining various strategies was presented to resolve global optimization issues. Compared to the DE (Differential Evolution), QDE (Quantum-inspired Differential Evolution), QGA (Quantum Genetic Algorithm), and MSIQDE algorithms, this algorithm is better at optimization. It was suggested to use the wavelet basis function in a novel, enhanced DE method.

This algorithm successfully resolved a real-world airport gate assignment problem and has superior optimization capabilities compared to existing DE algorithms. Song et al. proposed a new multi-population parallel co-evolutionary DE algorithm that demonstrated higher accuracy and reliability than other several methods in extracting parameters of solar modules in order to improve the parameters of photovoltaic models and increase the conversion efficiency of solar energy.

Only optimizing an RBF neural network's internal structure parameters is insufficient when trying to forecast time series

Correspondence to: Liaquat Mirza, Department of Experimental and Clinical Pharmacology, University of Engineering and Technology, Lahore, Pakistan, E-mail: mizraliaquat594@gmail.com

Received: 02-May-2022, Manuscript No. JMDM-22-20516; **Editor assigned:** 04-May-2022, PreQC No. JMDM-22-20516 (PQ); **Reviewed:** 24-May-2022, QC No. JMDM-22-20516; **Revised:** 02-Jun-2022, Manuscript No. JMDM-22-20516 (R); **Published:** 13-Jun-2022, DOI: 10.35248/2168-9784.22.11.378.

Citation: Mirza L (2022) Using a VMD, PSR, and RBF Neural Network Hybrid Method for Prediction of ECG Signals. J Med Diagn Meth. 11:378.

signals. The input parameters of its input layer must also be optimized. A RBF neural network's input parameters are input dimension and delay time. Prediction outcomes vary depending on different input characteristics. Finding the ideal input parameters is challenging. One of the useful techniques for resolving the input parameter optimization issue of RBF neural networks is Phase Space Reconstruction (PSR). Through a one-dimensional time series signal, PSR can recreate the original system's multidimensional phase space structure. The neural network's input dimension and delay time are taken to be the embedding dimension and PSR's delay time, respectively. PSR has been used by several studies to enhance the neural network's input parameters and produce an accurate prediction outcomes. A hybrid prediction technique for ECG signals that combines RBF, PSR, and VMD. The ECG signals are preprocessed using VMD technology to get rid of their non-stationary and unpredictability before prediction. By comparing the residual energy to the original signal energy, we may calculate the VMD parameter. We use PSR to calculate the input dimension and delay time of the RBF neural network in order to find the optimal input parameters for it. We assess the proposed method's prediction ability using ECG data from the MIT-BIH Arrhythmia Database as the data source. The proposed method's RMSE and MAE are of 10^{-3} magnitude, whereas some widely used prediction methods' RMSE and MAE are of 10^{-2} magnitude.