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Name : Noraishah Shamsuddin, *PhD*
Title : Heart Sound Diagnosis Using Nonlinear Arx Model
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This thesis presents a research work on a diagnosis system for heart sound based on nonlinear ARX (NARX) model. The system uses neural network for model estimation and classification of several heart diseases. Six NARX models which represent Normal and other five categories of heart diseases such as Atrial Septal Defect (ASD), Pulmonary Stenosis (PS), Patent Ductus Arteriosus (PDA), Ventricular Septal Defect (VSD) and Mitral Regurgitation (MR) are estimated. A Lipschitz method and Levenberg Marquardt algorithm is used to determine the model order number and train the network respectively. The R-square value of the OSA prediction of the signal is above 99% for all heart sound signals. The best network architecture for modeling the heart sounds is 2-4-1. As for classification, the features are extracted and selected from the modeled signals and their distinctive patterns are used as inputs to the classifier. To make the system more robust, the background SNR ranging from 3dB to 20dB is injected to the modeled signal. The Resilient Backpropagation (RPROP) algorithm is used to train the network. The optimized learning parameter used is 0.07 and the network has best performance when hidden neurons equal to 220. The architecture of the network is32-220-6. The accuracy of the network when validated with the diagnostic test is found to be above 97% which suggests that the network performs well and is doing as 'gold standard'. The classification result is further improved to 100% when overall testing is performed. This result has surpassed the result of heart sound classification based on linear model. The accuracy of the linear approach to analyse certain heart diseases varies from 88.5 to 91.6%. The nonlinear approach has successfully estimated the sounds from the heart such that the heart diseases are classified accordingly.