MODELING RESPONSES OF MIDBRAIN AUDITORY NEURONS TO RANDOM FM SOUND USING ARTIFICIAL NEURAL NETWORK

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In this paper, a system consisting of (a) a multi-scale classification process and (b) an artificial neural network composed of two FIR neural network modules and a maximum network is introduced to simulate rats' auditory cell responses to FM signals. The multi-scale classification process segments rats' responses into strong responses and weak responses based on an accumulation of the rat's responses from multi-scale perceptions extracted by multiple-scale Gaussian filters. Besides for capturing multi-scale perception of the response data, the multiple-scale Gaussian filters also function to shape the response distribution into normal, used as the purpose of smoothing and transforming the response distribution to that of large-sampled data. As strong responses and weak responses present different characteristics in both the activation inputs and the time delays of the cell response, two FIR neural network modules are used in the artificial neural network to model the strong responses and weak responses respectively. The outputs of these two FIR networks are fused in the maximum network for final decision. For evaluating the system's performance, two quantitative evaluation measures are applied. One measures the point-to-point match between the system outputs and the desired outputs. Another counts the number of consistent responses between the desired and system outputs. Considering the physical situation where cells respond in variable time delays, the latter measurement method also takes a more lessened response time interval in measuring the match. Considering that the cells respond in stochastic, the results show that the proposed system predicts the rats' responses satisfactorily.