Adaptive Neural Net Preprocessing for Signal Detection in Non-Gaussian Noise

Authors: Richard P. Lippmann, Paul Beckman

Abstract: A nonlinearity is required before matched filtering in mInimum error receivers when additive noise is present which is impulsive and highly non-Gaussian. Experiments were performed to determine whether the correct clipping nonlinearity could be provided by a single-input single(cid:173) output multi-layer perceptron trained with back propagation. It was found that a multi-layer perceptron with one input and output node, 20 nodes in the first hidden layer, and 5 nodes in the second hidden layer could be trained to provide a clipping nonlinearity with fewer than 5,000 presentations of noiseless and corrupted waveform samples. A network trained at a relatively high signal-to-noise (SIN) ratio and then used as a front end for a linear matched filter detector greatly reduced the probability of error. The clipping nonlinearity formed by this network was similar to that used in current receivers designed for impulsive noise and provided similar substantial improvements in performance.