Neural Net Receivers in Multiple Access-Communications

Authors: Bernd-Peter Paris, Geoffrey Orsak, Mahesh Varanasi, Behnaam Aazhang

Abstract: The application of neural networks to the demodulation of spread-spectrum signals in a multiple-access environment is considered. This study is motivated in large part by the fact that, in a multiuser system, the conventional (matched fil(cid:173) ter) receiver suffers severe performance degradation as the relative powers of the interfering signals become large (the "near-far" problem). Furthermore, the optimum receiver, which alleviates the near-far problem, is too complex to be of practical use. Receivers based on multi-layer perceptrons are considered as a simple and robust alternative to the opti(cid:173) mum solution. The optimum receiver is used to benchmark the performance of the neural net receiver; in particular, it is proven to be instrumental in identifying the decision regions of the neural networks. The back-propagation algorithm and a modified version of it are used to train the neural net. An importance sampling technique is introduced to reduce the number of simulations necessary to evaluate the performance of neural nets. In all examples considered the proposed neu(cid:173) ral ~et receiver significantly outperforms the conventional recelver.