APPLICATION OF NEURAL NETWORKS FOR SOLVING INTERPOLATION TASKS

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Artificial neural networks (ANN) are fundamental solution for most of nowadays algorithmic and optimization problems [1]. The most frequently encountered artificial neuron models are neurons with multiple inputs and single output, named feedforward neural network (FNN). Structure of FNN shown in Figure 1, where $x = (x_1, x_2, \dots, x_3)$ represents the input vector, $W = (w_1, w_2, \dots, w_3)^T$ a weight vector, and the φ input-output function or the activation function of the neuron.

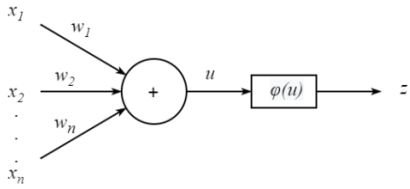

Figure 1. Feedforward neural network

Let *z* represent the output, then the relationship between input and output can be represented:

$$z = \varphi(\sum_{i=1}^{n} w_i x_i) = \varphi(X \cdot W) \quad (1)$$

Most common activation function is called sigmoid:

$$1/(1 + e^{-x}) \quad (2)$$

Usually, neural network splits in 3 layers (input, hidden, output) and all computations run throw hidden layer(s).

The most important aspect of neural network is its learning ability, which is achieved by adjusting the connecting weights by training the neural network. One of the training methods is called backpropagation which is applies the result of neural network and adjust all weight corresponding to it.

In our work we used FNN for interpolation of received signal data which is allowed us to increase length of signal.

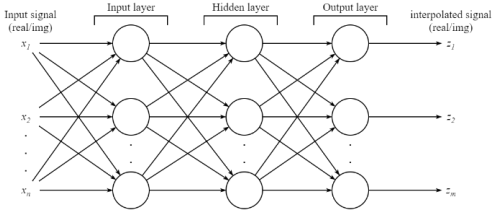

Figure 2. FNN for interpolation

Where n is length of received signal, and m is length of scaled interpolated signal. We have trained this network by using full signal and its sliced copy as an input. Results of modeling are shown in Figure 3.

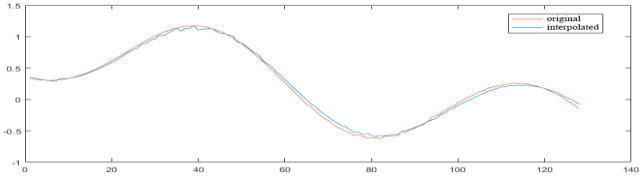

Figure 3. Modeling results

This approach can be applied for solving interpolation tasks in orthogonal frequency division multiplexing (OFDM) communication systems [2-5]. Structure of received OFDM symbol is shown in Figure 4.

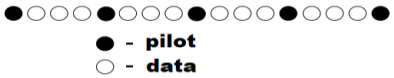

Figure 4. Structure of received OFDM symbol

Receiver uses pilot signals for estimation channel frequency response. When receiver obtained estimation of channel frequency response on pilot subcarriers it should perform interpolation of values of channel frequency response on subcarriers with data.

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