Research on Delay Control Method of Ultra-Wideband Wireless Communication Based on Artificial Intelligence

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Abstract. In order to improve the intelligence and real-time performance of ultra-broadband wireless communication, it is necessary to control the time delay of intelligent data transmission in ultra-broadband wireless communication. An intelligent data transmission time delay control algorithm for ultra-broadband wireless communication based on artificial intelligence algorithm is proposed. A wireless communication network transmission model based on wireless sensor networking model is constructed, and the position and scale parameters distributed in the process of wireless communication transmission are measured by using different scales. It is found that the time delay control problem is the best replica correlation matched filter detection problem, and the communication delay control is realized to the maximum extent. The simulation results show that the artificial intelligence of ultra-broadband wireless communication delay control is good and the communication quality is high.

Keywords: Artificial intelligence · Ultra-broadband · Wireless communication · Delay control

1 Introduction

With the development of ultra-broadband wireless communication technology, the use of ultra-broadband wireless communication for data transmission has become the development direction of communication in the future [1]. Broadband wireless communication does not need the transmission medium of the channel. The transmission performance of direct communication light realizes remote wireless communication, so ultra-broadband wireless communication has the advantages of strong anti-interference ability and good transmission fidelity, and is widely used in military communication and civil communication and other fields. Ultra-broadband wireless communication has a large bandwidth, which can realize 1 Gbps ultra-broadband data information transmission [2]. In the process of using ultra-broadband wireless communication for remote data transmission, it is easy to be affected by channel offset and multi-path effect, resulting in communication error code and transmission distortion, so it is necessary to carry out delay control processing of ultra-broadband wireless communication. It is of great significance to improve the anti-interference ability of ultra-broadband wireless communication and improve the resolution of signal transmission. The study of time

G. Gui and L. Yun (Eds.): ADHIP 2019, LNICST 302, pp. 99–108, 2019.
https://doi.org/10.1007/978-3-030-36405-2_11

delay control technology of ultra-broadband wireless communication system is of great significance in improving the quality of ultra-broadband wireless communication system [3].

The time delay control of ultra-broadband wireless communication system is based on channel equalization and anti-interference processing. At present, random code spread spectrum technology and Porter interval equalization technology are used for time delay control technology of ultra-broadband wireless communication system. When the transmission channel of ultra-broadband wireless communication channel is affected by inter-symbol interference and the multi-path effect of media in optical transmission channel, the performance of time delay control is not good, which leads to the increase of output bit error rate and easy to cause channel imbalance. In reference [4], the time delay control technology of ultra-broadband wireless communication system based on frequency shift keying anti-interference technology is proposed. The time reversal mirror technology is selected to suppress the channel intersymbol interference and compensate the distortion of the signal by the medium. The frequency shift keying technology is used to process the high amplifier and mixing of spread spectrum signals to realize the time delay control of ultra-broadband wireless communication system. This method has certain anti-interference performance, but with the increase of channel multi-path effect. In order to solve the above problems, an intelligent data transmission time delay control algorithm for ultra-broadband wireless communication based on artificial intelligence algorithm is proposed in this paper. A wireless communication network transmission model based on wireless sensor networking model is constructed, and the position and scale parameters distributed in the process of wireless communication transmission are measured by using different scales. It is found that the time delay control problem is the best replica correlation matched filter detection problem, and the communication delay control is realized to the maximum extent. Finally, the simulation results show the superior performance of this method in improving the delay control ability of ultra-broadband wireless communication.

2 Intelligent Data Transmission Acquisition and Detection Model for Ultra-Wideband Wireless Communication

2.1 Construction of Communication Signal Model

The intelligent data transmission stream of ultra-broadband wireless communication is formed in the host computer of wireless communication transmission, and is annihilated by the normal network traffic sequence in the process of transmission and wireless communication transmission. In this paper, a wireless communication network transmission model based on wireless sensor networking model is constructed [5], and the schematic diagram of ultra-broadband wireless communication transmission model in multi-clustering state is shown in Fig. 1.

In the ultra-broadband wireless communication transmission mode, the wireless communication transmission signal is sent out by several signal pulse of the network user and the terminal device, and the hacker carries on the wireless communication transmission to the computer, or other illegal calls [6]. When the hacker computer

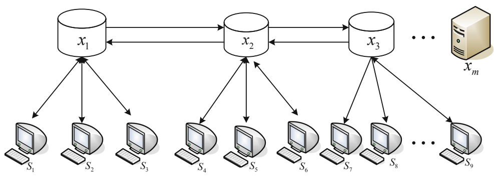

Fig. 1. Schematic diagram of Ultra-Wideband Wireless communication transmission

wireless communication transmission, the hacker will cut into the user's computer. Assuming that the number of network terminal devices in the multi-cluster state is m, the data are tested on the H terminals, and the amplitude of the wireless communication transmission signal is A, and the amplitude adjustment coefficient of the input signal is expressed as follows:

$$\tilde{s}(t) = \sqrt{E_t}\int_{-\infty}^{+\infty}\tilde{f}(t-\lambda)\tilde{b}_R(\lambda)d\lambda + n(t) \tag{1}$$

When the data structure is established, the ternary prime points, lines and surfaces are used as the elements to realize the segmented processing of high frequency and low frequency features. The variance and mean value of correlation noise distribution $p(e_k|v_k)$ are as follows:

$$\begin{cases} H_0 : \tilde{x}(t) = \tilde{w}(t) \\ H_1 : \tilde{x}(t) = \sqrt{E_t}\int_{-\infty}^{+\infty}\tilde{f}(t-\lambda)\tilde{b}_R(\lambda)d\lambda + \tilde{w}(t) \end{cases} - \infty \leq t \leq +\infty \tag{2}$$

Therefore, the network communication diagram $G(V, r)$, of ultra-broadband wireless communication intelligent data transmission is constructed, that is, the short distance link is considered for data transmission. In $G(V, r)$, if there is an edge between the two nodes, the whole network is divided into several square areas with equal side lengths. According to the data mining method, the data of the design structure is excavated to extract more obvious features. This strengthens the ability of data analysis [7].

2.2 Feature Detection Algorithm for Intelligent Data Transmission

Based on the design of the above model of intelligent data transmission for ultra-wideband wireless communication, in order to ensure the security of the network, it is necessary to detect the data and design the characteristic detection algorithm of intelligent data transmission [8]. On the 2D plane of the time scale, a wavelet scale decomposition model is used to represent the correlation dimension characteristic components of the signal to be detected:

$$\tilde{s}(t) = \sqrt{E_t}\int_{-\infty}^{+\infty}\tilde{f}(t-\lambda)\tilde{b}_R(\lambda)d\lambda \tag{3}$$

$$s(t) = \sqrt{2}\mathrm{Re}\left[\sqrt{E_t}\tilde{s}(t)e^{j\omega_c t}\right] \tag{4}$$

In the above formula, $\tilde{w}(t)$ is a statistically independent zero-mean complex white Gaussian process. $\tilde{v}_k = v_k - d + 1$ represents the wireless communication transmission signal in a single clustering mode. When the ultra-broadband wireless communication transmission signal is a weak signal, it is a normal threshold in the potential well of the random field. The position and scale parameters of t distribution are obtained as follows:

$$l = \frac{1}{N_0}\int_{-\infty}^{+\infty}\int_{-\infty}^{+\infty} \tilde{x}(t)\tilde{h}(t,u)\tilde{x}(u)dudt, \quad \tilde{\Sigma}_k = \frac{1 + V_{11,k}}{(v_k - d + 1)V_{11,k}}\Lambda_k \tag{5}$$

The optimal detector for detecting the time delay control problem is the replica correlation integral detector, and the camouflage signal is converted into sine wave. The detector is designed as shown in Fig. 2.

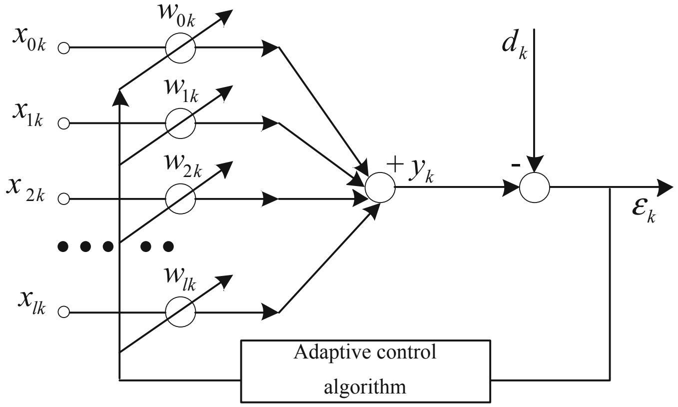

Fig. 2. Schematic diagram of replica correlation integral detector

Based on the above analysis, the design of the feature detection algorithm for intelligent data transmission is obtained. because the time domain diffusion distortion of the channel is taken into account, it is more robust than the general replica correlation detector [9].

3 Improved Implementation of Algorithm

3.1 Communication Channel Equalization Processing

On the basis of the above signal model and detection model, the intelligent data transmission time delay control and wireless communication transmission time delay in ultra-broadband wireless communication are carried out, which provides the time difference for the accurate detection of intelligent data transmission. According to the link balance of ultra-broadband wireless communication system, the multi-path interference suppression is carried out, the tap filter is designed to filter the interference, and the channel transmission model of the communication system is constructed [10]. After the output of the signal is modified by the equalizer, the sampling decision equalizer is used to compensate the channel deflection randomly. The channel equalization model is obtained as shown in Fig. 3.

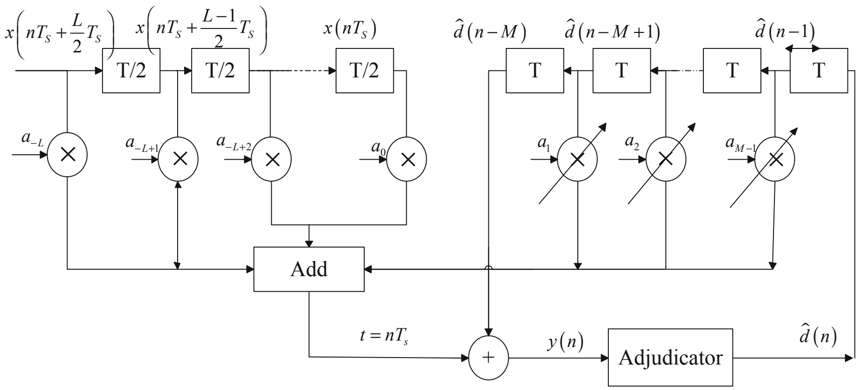

Fig. 3. Channel equalization control model

Assuming that the power spectrum of the two pieces of data x1(t) and x2(t) is s1(ω) and s2(ω), the resulting time delay control delay is:

$$d_I(s_1, s_2) = \ln\left[\int_{-\pi}^{+\pi} \frac{1}{2\pi} \frac{s_1(\omega)/\sigma_1^2}{s_2(\omega)/\sigma_2^2} d\omega\right] \tag{6}$$

According to the above description, the transmission signal data of ultra-broadband wireless communication in multi-clustering state is self-correlated with $s_i(k)$, but it is integrated with each other, but as for the position of fusion form, it needs to be realized by an effective signal detection model. Before that, it is necessary to design a single-mode time delay control algorithm for ultra-broadband wireless communication transmission. In this paper, the signal separation method is adopted, and the self-phase components of each independent variable can be characterized by the limit separation characteristic of non-Gaussian function. The output of the time delay control system for ultra-broadband wireless communication transmission is obtained as follows:

$$x_1(t) = -\sum_{k=1}^{p_1} a_{1k} x_1(t-k) + W\varepsilon_1(t) \tag{7}$$

In this formula, W matrix is $n \times m$-dimensional separation matrix, x1(t) and x2(t) can be described by AR model, the source data and wireless communication transmission data are demultiplexed and separated, which provides the premise for the realization of single-mode time delay control.

Based on the idea of independent self-phase component analysis, a joint function is designed, which is considered by the joint distribution of time and frequency. That is, the signal is divided into some parts for analysis and investigation, rather than the global analysis and judgment, and the Fourier transformation is carried out for two scalar time series y_1 and y_2. By using independent self-phase component analysis, the transmission signal detection characteristics of wireless communication network are represented as the complete localization information of wireless communication transmission signal, that is:

$$x(t) = e^{j2\pi v_x(t)t} \tag{8}$$

$$v_x(t) = v_0 + 2\beta t \tag{9}$$

$$W_x(t, v) = \delta(v - (v_0 + \beta t)) \tag{10}$$

Based on the construction of the above model, the balanced configuration of ultra-broadband wireless communication is realized, and on this basis, the time delay control of ultra-broadband wireless communication is carried out.

3.2 Time Delay Control Optimization

Suppose that in an ultra-broadband wireless communication channel, $f(e(i))$ represents the carrier frequency of the transmission chain roadside e on channel i, $k(e)$ represents the set of edge e, and K represents the link set of the output of ultra-broadband wireless communication. $C(e, i)$ represents the information energy of the ultra-broadband wireless communication at a lower frequency, where $f(e(i)) \leq C(e, i)$, the impulse response of the ultra-broadband wireless communication channel is obtained as:

$$Int(e, i) = \frac{f(e(i))}{C(e, i)} + \sum_{e \subseteq k(e)} \frac{f(e'(i))}{C(e', i)} \tag{11}$$

When there is multi-path interference on the edge set e of the transmission channel, the phase offset of the transmission path is deterministic, and the output link sum F of the ultra-broadband wireless communication channel is constant, from which the interference estimation model of the communication signal is obtained as:

$$\begin{cases} \min \sum_{1 \leq i \leq K} \sum_{e \subseteq k(e)} \frac{f(e(i))}{C(e,i)} \\ 0 \leq f(e, i) \leq C(e, i) \\ F = const \\ \sum_{1 \leq i \leq K, e \subseteq k(e)} \frac{f(e(i))}{C(e,i)} + \sum_{e \subseteq k(e)} \frac{f(e'(i))}{C(e',i)} \leq k(v) \end{cases} \tag{12}$$

The complex model is used to accurately simulate the pulse response of UWB wireless communication channel. $\theta_i(t)$ is used to represent the phase offset of each path in UWB wireless communication system. According to the phase deflection characteristic $\theta_i(t)$ and symbol rate f_s, The channel transmission model of ultra-broadband wireless communication is represented by $h(t) = \sum_i a_i(t)e^{j\theta_i(t)}\delta(t - iT_S)$. According to the above analysis, the time delay control of intelligent data transmission in ultra-broadband wireless communication is realized.

4 Simulation Experiment and Result Analysis

In order to test the performance of the proposed algorithm, simulation experiments are carried out. The sampling signals are sampled at symbol 1/3 and 2/3, and the sample data of ultra-broadband wireless communication transmission signal are extracted. The signal setting period is 1.25 s, the intensity is 1024 Mbps, continuous wireless communication transmission time is 1024 ms, and the number of network information samples used for ultra-broadband wireless communication transmission time delay control is 1024, and the number of web visits is 10332. The types of ultra-broadband wireless communication transmission can be divided into the following categories: scanning and detecting (Probe), denial of service wireless communication transmission (DoS), illegal access (U2R) and unauthorized remote access (R2L). The distribution of four kinds of wireless communication transmission samples is calculated respectively, as shown in Table 1.

Table 1. Model parameter design.

Channel model	Modulation parameter	Multi-path delay parameter (Ts)
Model 1	(1, 0.24, −0.43, 0.15, −0.16)	(0, 0.23, 0.43, 0.32, 0.43)
Model 2	(1, 0.53, −0.4, 0.13, −0.14)	(0, 1.45, 2.45, 3.34, 4.21)
Model 3	(1, 0.54, −0.5, 0.17, −0.13)	(0, 1.45, 2.03, 3.45, 4.20)
Model 4	(1, 0.35, −0.7, 0.16, −0.126)	(0, 0.43, 1.34, 2.56, 3.35)

According to the above simulation environment and data acquisition results, the time delay control simulation of ultra-broadband wireless communication intelligent data transmission is carried out, and the time delay control detection statistics of different wireless communication transmission data segments are obtained as shown in Fig. 4.

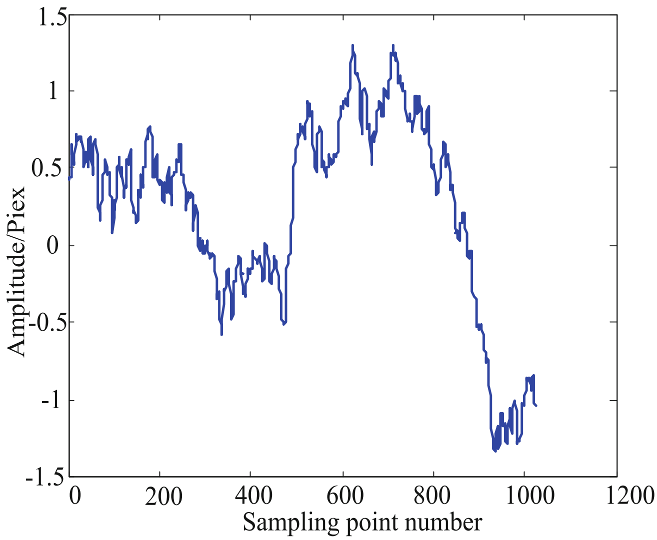

Fig. 4. Time delay control detection statistics

It can be seen from the diagram that the proposed algorithm has good control performance of intelligent data transmission time delay, which provides a time capacity for the detection of wireless communication transmission data. Further intelligent data transmission detection experiment is carried out, and the time delay distribution is shown in Fig. 5.

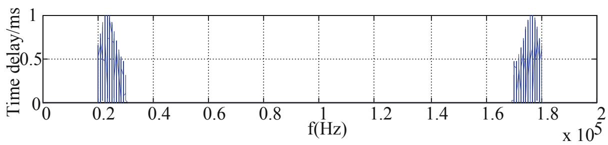

Fig. 5. Time delay

In order to compare the performance of the algorithm, the detection probability of ultra-broadband wireless communication transmission signal is compared and analyzed by using 20000 Monte Carlo implementation. Based on this algorithm and the traditional method, the detection probability of ultra-broadband wireless communication transmission signal is compared and analyzed. The simulation results are shown in Fig. 6. As can be seen from the figure, the accurate detection probability of ultra-broadband wireless communication transmission characteristic signal is higher than that of the traditional scheme by using this algorithm, which shows the superior performance and high application value of this algorithm.

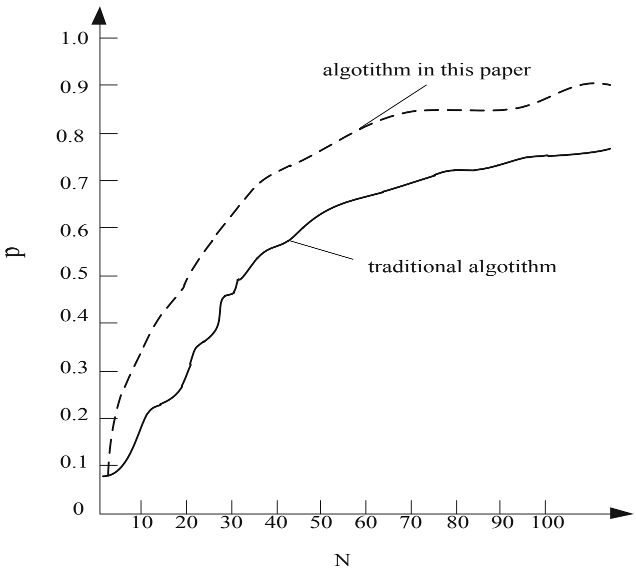

Fig. 6. Performance comparison

5 Conclusions

In this paper, an intelligent data transmission time delay control algorithm for ultra-broadband wireless communication based on artificial intelligence algorithm is proposed. A wireless communication network transmission model based on wireless sensor networking model is constructed, and the position and scale parameters distributed in the process of wireless communication transmission are measured by using different scales. It is found that the time delay control problem is the best replica correlation matched filter detection problem, and the communication delay control is realized to the maximum extent. The simulation results show that the artificial intelligence of ultra-broadband wireless communication delay control is good and the communication quality is high.

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