Proposed Algorithm for Bussiness Management by using Swarm Intelligence and Neural Network in Supply Chain System

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***Abstract*— Neural network technology has been successfully applied in many business areas. This paper systematic summarizes the applications of neural network technology in supply chain management, which include three areas: optimization , forecasting and decision support. It uses supply chain - specific parameter estimation using supply chain processing techniques to model the optimal network system. It then joined with generic data compression algorithms to form compact bitstream. Artificial neural network (ANN) in supply chain management was established from bussines neural network and also known as connectionist system. Artificial intelligence (AI) is shown by software and machines. The present study aim to evaluate the proposed algorithm for supply chain encoding by using random overlapped and swarm intelligence. The study can be concluded as the proposed algorithm take more time than overlapping algorithm. Because, the key is generated by the lion optimization algorithm (LOA) and using of features make the algorithm faster. The restored signal accuracy 100% and the size of encoded file equal to the input file.**

Keywords*— *Swarm intelligence, Peak signal-noise ratio, Lion optimization algorithm, Signal accuracy, Artificial intelligence.

1. Introduction

Supply chain is an application of data compression of digital supply chain between costumer, producer and seller in the bussines procedure. Neural networks are an emerging artificial intelligence technology, which is put forward based on the modern biology research achievements of human brain tissue. Simulating the human brain structure and behavior is its principle [1]. For efficient outcome, it is must find out the effective methods for specific cases where the programming of computer is the unknown task. In data mining application machine learning algorithm plays an important role [2]. In many cases such as speech or supply chain recognition, these machine learning algorithms give the best result with comparison to other method. The system which learns the data, termed as machine learning which deals with an artificial intelligence. It was known to everybody that email system offers various facilities. The machine receives the incoming mails and categorized them into different sections such as primary, updates, spams, social, etc. Artificial neural network (ANN) in supply chain management was established from business neural network [3]. It is also known as connectionist system. Artificial intelligence (AI) is shown by software and machines. Many applications are implemented using AI like various image operations (restoration and processing). Application fields of artificial intelligence have high impact on different fields as more proficient system is broadly used those days for solving highly complex problem [4]. It covers many areas like weather forecasting [5], medicine (medical) [6], engineering [7], science (hospital) [8], business [9], Power system stabilizers (PSSs) Design [10], Network Intrusion Detection (path finding) [11] etc. Artificial Intelligence (AI) improves the efficacy and quality.

Before last two decades, there was significant interest in cellular technology. Cellular technology follows the grouping format. Further research in cellular technology leads in swarm. This concept was introduced by Beni and Wang [12], [13] and [14]. Swarm function is same as aggregative motion. Initially only the business scientists were dealing with the swarm protocol. Furthermore, many researchers are putting their significant interest in swarm behavior becomes swarm intelligence [15]. Swarm intelligence (SI) is fundamental base in related to artificial intelligence [16]. Swarm intelligence evolved by Reynolds (1986), which imitates flocking etiquette of birds. The higher complexity problem needs a quality solution within realistic time period. Swarm intelligence is inspired by te business neural system as it is based on principle of collective behavior in the presence of different groups like group of animal, people etc. [17]. It is an associate protocol for self-grouping system with decentralization. It can be artificial or natural. Swarm is applicable in different areas. Recently it plays an important role in various applications such as defense system particularly military application and traffic issues [18], optimization in telecommunication engineering [19], robotic engineering [20] etc.

Many reasons are responsible to increase the growing

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popularity of the Swarm intelligence based algorithm because of it offers versatility and flexibility. The self-learning capability and remodeling are key points for swarm intelligence. Swarm intelligence is more efficient as it supports real time world.it also supports to solve design problems which are nonlinear in nature and will find the optimal solution. Swarm intelligence is also applicable to high end applications like navigation control, sensing of planetary motion. Moderate research paper was available on swarm intelligence [21].

Boids are one of the important terms in swarm intelligence which are interacting in own environment with each other. An aggregation of the boids is termed as Swarm intelligence. Boids (simple rules perceived by agents) work in absence of centralized structure. Separation, alignment and cohesion are the basic rules are applied in simple birds' world. The interaction of the individual boids causes the complexity. The hypothesis of swarm intelligence is studied with natural examples such as bird flocking, bird flocking, growth of bacteria, ant colonies, etc. Swarm algorithm is consisting of set of generalized algorithm. Swarm intelligence has two important and required properties such as self-organization and labor division. Self-organization is termed as the ability of system to release its boids, i.e. agents (components) in another appropriate form without introducing external help. Self-organization depends on few more properties like fluctuations, multiple interactions, positive feedback and negative feedback. Swarm intelligence has more preferable because of its simplicity and reliability. With this background, we aim to evaluate the proposed algorithm for supply chain encoding by using random overlapped and swarm intelligence.

Methodology

Supply chain management and neural network

Supply chain is a network which includes some companies and sectors. In this network, the material is acquired and processed into intermediate or finished products, and finished products then are sent to the users. Therefore, it can be seen as a multi-level system , including production , distribution, retail and other sectors. Supply chain management means that through designing, planning and controlling the supply chain, logistics, information flow and capital flow, a balance between supply and demand is achieved, customer satisfaction is improved, and overall operating costs of the supply chain is reduced. Based on the foregoing characteristics, neural networks currently applied in the supply chain management are mainly in the following three areas: optimization, forecasting and decision support

Proposed Algorithm

The proposed algorithm is used for supply chain encoding. It is a new method of scrambling the supply chain data.

It consist of four stages. Those are as follows

1) The first stage

The key for supply chain encoding was initialized through the lion swarm optimization algorithm (LOA) (Figure 1).

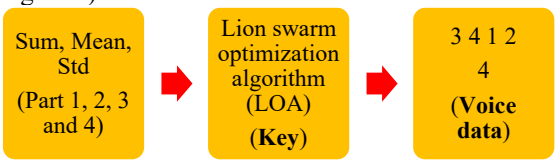

Figure 1. The lion swarm optimization algorithm (LOA)

This stage consists of the following steps

Step1: The supply chain data was split into four parts and each supply chain part was compute the their features.

They were calculated as follows

a) Extract the summation of the each sample values

Sum value (k)=∑_(i=1)^N s(i) (1)

Where, N = length of samples; K= number of samples

b). Standard deviation of the each sample values

Standard value

(K) =√(1/N ∑_(i=1)^N [(x_i-x)]^2 (2)

Where; N = Sample length; K = Sample number

c). Extract the mean of each sample values

Maen value (K) =(∑_(i=1)^N x(i))/N (3)

Where; N = Sample length; K= Sample number

Step 2: The lion optimization algorithm was used to calculate maximum difference between two supply chain parts.

Step 3: Create the key to detect the overlap of each part

2) Second stage

Random overlap was applied according to the key value.

Partkey(i) overlapped with part key(i+1)

Snew(i) = sold(j)pkey(l)

I = 1 to N and j, k = M to 1 (4)

Snew(i+1) = sold(k)pkey(l+1) (5)

Where; N: Supply chain length; M: Part length

3) Third stage

At this stage, the encoded supply chain was restored.

Sdecode(i) = snew(j)pkey(l)

i = 1 to N and j, k = M to 1

Seode(i+1)=snew(k)pkey(l+1) (6)

Where; N: Length of supply chain; M: Length of part

Results

The proposed algorithm was provided with many advantages over the random overlapped process such as security of supply chain encoding. Strength of proposed algorithm was evaluated by encoded and restored file size with time. Execution time was analyzed for encode the supply chain using the proposed algorithm in comparison with overlapped algorithm. The time taken to encode the supply chain

commands by proposed algorithm was more than random overlapping. However, the differences in time were non-significantly small and can be neglected. Table 1 represents the results of encoding time required for the random overlapped and proposed algorithm

Table 1. Encoding supply chain time of in the business system.

File	Input file	Random overlapping	Algorithm	Encoded file	Restored file
Test 1	4 kb	0.00245 Sec	0.0391 Sec	4 kb	4 kb
Test 2	8 kb	0.00606 Sec	0.0320 Sec	8 kb	8 kb
Test 3	10 kb	0.007102 Sec	0.0412 Sec	10 kb	10 kb

Table 2 showed peak signal to noise ratio (PSNR) of encoded signal by the proposed algorithm. In the random overlapping and proposed algorithm, as the file size increase to 8kb, the resulting PSNR gets increased followed by the fall in the values.

Table 2. The PSNR of encoded signal by proposed algorithm

File name	File Size (Kb)	Random overlapping	Proposed algorithm
Test 1	4 kb	70.19012	75.7532
Test 2	8 kb	73.1432	79.6781
Test 3	10 kb	72.657	76.2435

As we have mentioned earlier, the results of three tests i.e. test 1, test 2 and test 3 are depicted in the Figure 2, 3 and 4, respectively. The signals for input command supply chain, encoded signal and restored signals by using a proposed signal are showed in each figure.

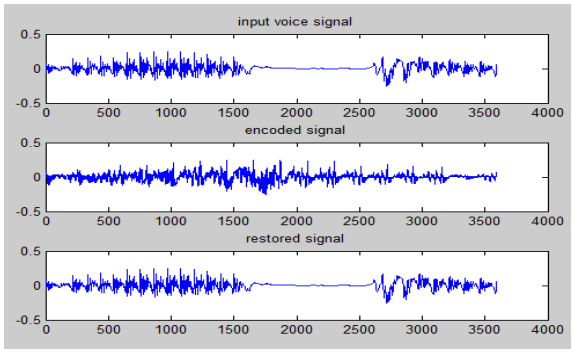

Figure 2. Results of Test 1

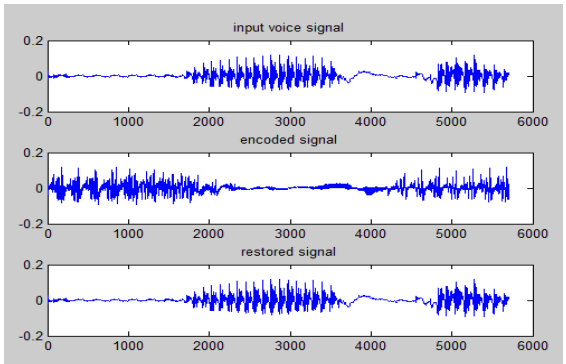

Figure 3. Results of Test 2

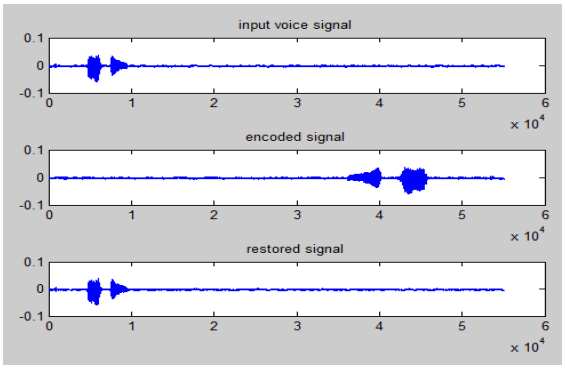

Figure 4. Results of Test 3

Discussion

Many researchers done work in artificial Intelligence which is further modified to swarm intelligence [20]. In 2011 Kowalski, reported about the human nerve system and artificial intelligence [2]. Similarly, the basics of artificial intelligence and its application in various fields were also reported by various authors [2] to [11].

Some most useful swarm intelligence algorithm are: Cuck-oo Search Algorithm (CSA), Ant Colony Optimization (ACO), Artificial Bee Colony (ABC), Particle Swarm Optimization (PSO), Differential Evolution (DE) and Glowworm Swarm Optimization (GSO). All listed algorithms have set out the potential to resolve many optimization difficulties. Basics stapes of swarm intelligence are: Initialize population, Define condition pause or stop, evaluation of fitness function, update and movement of agents and back to the global best solution [16] and [14].

Different combinations along with the basic swarm intelligences (SI) algorithm resulted into hybrid swarm algorithm which gives best optimized outcome [8]. Swarm intelligence algorithm is used in various recognition such as image, speech and supply chain. Swarm with Viterbi and PSO-Viterbi is two algorithms used for supply chain encoding.

Now a day, huge growth is noticed in supply chain recognition as number of artificial and swarm intelligence algorithms are available. Speech or supply chain encoding is used to transfer the secure message in the form of emotions, language, gender, etc. Genetic algorithm is used or supply chain encoding. Accuracy or reorganization rate depends on various methods of the feature extraction like Linear Predictive Coding Coefficient (LPCC), Perceptual Linear Prediction (PLP), Rasta Perceptual Linear

Prediction (RASTA PLP) and Mel Frequency Cepstral Coefficient (MFCC). The overlapping supply chain effect can be optimized with the help of spectrogram analysis where phase and magnitude component are considered.

In [12] reported the importance of swarm algorithm in the robotics and robotics engineering. In [14] reported overview of the swarm intelligence in context with the ant colony optimization. In [17] reported inspiration analysis with their applications. Swarm intelligence on basis of insects and animal were evaluated. Algorithmic steps for generic algorithm along with details and diagrammatic explaination of artificial ant colony and its optimization was reported [20]. Particle swarm algorithm, cuckoo search algorithm and glowworm swarm optimization were also explained with suitable example.

The algorithm for convolutional recurrent neural networks in supply chain for localization and detection of overlapping sources for sound event was reported. Similarly, Spratling et. al. reported the unsupervised learning for overlapping data. reported speech recognition application using artificial intelligence. Our reports are accordance with these reports.

Conclusion

Neural network is the most popular computing technology to solve the optimization problems. It has an important significance for supply chain management. Currently, it has been studied how to apply neural networks to solve the supply chain management optimization problem, such as shop scheduling, warehouse management, selection of transportation route and so on. Some of these problems are the core problems to build the logistics information system of the enterprise. In addition, compared with other technologies, neural network has a strong adaption ability, and it can promptly consider and accommodate emerging constraints with real-time processing capabilities. Following conclusions can be explained the basis of the execution and eventual comparison between random overlapping and proposed algorithm

1. The proposed algorithm take more time than overlapping algorithm. However, the difference between them was found to be non-significant. So, this can be neglected.
2. The neural network displays a satisfactory ability to solve most of difficult problems appeared in supply chain management. In addition, Neural network has a strong ability to adapt and easily combines with other technologies, which can learn from each other and make up their own deficiencies. The hybrid model can solve more problems appeared in supply chain management, which is a subject worthy of studying in the future.

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