An Approach to Study the Applications of Soft Computing

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Abstract: Applications of soft computing using neural networks has been demonstrated. Soft computing found its applications in various fields such as management of power, energy harvesting, SPV system tracking, and management of information security, wireless sensor networks, antenna and FSO. Powerful Soft computing techniques have been used to solve non-linear problems of conventional power tracking by using artificial neural network. Software Defined networks has been used to provide information security management through fuzzy logic. Soft-computing localizations have been used to solve the problem of routing and reliability in wireless sensor networks. These techniques utilize a strong effective machine to improve the accuracy of estimation. Digital beam forming techniques are used to develop smart antenna. In this paper, detailed description of SPV system is shown and we will be discussing how soft computing techniques are used for power management. Here we describe the effect of neural network on FSO link performance.

Keywords: ANN, WSN, FSO, SC, Information Security, SPV System, SDN, Smart Antenna.

Introduction

Whenever FSO links are planned, role of weather plays an important part. Certain amount of energy being transmitted under atmosphere does not only get absorbed but molecules also get scattered which are currently found in the air. Thermal turbulences which are obviously present inside the medium of propagation are responsible in causing defocusation and fading effects which is caused to weather conditions. The performance of FSO link prediction which is based on convenient meteorological data using different Artificial Neural Network (ANN) approaches has been analyzed. The main purpose of using Artificial neural network in FSO is to make a model which should be usable for having the estimation of FSO link fading which is caused by regularly changing weather conditions[1].Smart antenna is helpful to permit the wireless devices at different frequencies to fit and adjust antenna according to environment changes. Beam forming techniques and their algorithms are used to develop smart as well as software defined antenna. These algorithms contain two types. The first one is blind algorithm which is critical than the second one which is non-blind [2].

Soft computing plays an important role in power management. Basically power tracking algorithms are not able to track highest power from the mostly used solar photovoltaic panel (SPV) under constantly varying atmospheric conditions. In order to trace highest power much under these conditions, researchers have introduced low price strong soft computing technique (SC). Because of the capacity to solve and manage non-linear issues, highly adaptable and cooperative nature, MPPT technique which is based on SC is used to obtain extreme power [3,4].There are recent advancements in wireless sensing networks which have been used in various applications including soft computing without the help of GPS system. So SC techniques which include optimization have been used to improve accuracy of estimation using localization schemes [5].Software defined networks are used to provide management of information security based on fuzzy logic. Open-flow networking protocol is used for security detection purposes. So SDN algorithm dependent on SC is used to provide detection of intrusion [7].

Literature Review

The current use of mobile phones and wireless networks has expanded the complex nature of algorithms and overcome the use of existed technology. In paper [2], the existence of EM waves and the use of laser technology were proposed by authors. The use of FSO system has gathered attraction and it acts as promising technology for upcoming wireless networks as given in paper [1, 2].

The concept of genetic algorithm using particle swarm optimization was proposed by authors. MPPT technique was implemented to track peak power and prototype was made by authors to determine the efficiency of the system in [9].In paper [4], wind capacity and energy production of different countries was compared. In reported studies, a renewable energy system was designed with PV, wind turbines, battery in the past years. In paper [6], authors had implemented soft computing

techniques to solve issues of localization. Genetic algorithms were implemented to adjust centroids by deriving weights to sustain higher accuracy. In paper [10], Intrusion detection algorithm was proposed using embedded systems of microprocessor. Detection algorithms were also implemented in literature. Software defined networks played an important role in solving network security issues at houses by using NOX as controller and Open flow switches [11]. So soft computing techniques were used to provide information security as reported in [7].

Proposed System

Performance of FSO

Fig. 1 shows the network architecture where circles are basically present in hidden layer along with layers at output shows perceptron will represent a basic model.In the former time, feed-forward neural networks having multilayers are basically used that has the ability to behave as approximator and use that function which is sigmoid.But there is lot of freedom required to design that networks and develop that input data. But nowadays, non-sigmoid functions are preferred. The basic goal is to design a model of neural network.

Smart Antenna

As given in [2], that there are two algorithms used in digital beam forming methods, now its use and application in soft computing has been explained further. Non-blind algorithms that have less complexity than blind algorithms use LMS, RLS and extended version of RLS. In fact, their combined algorithm has also been used. Actually, non-blind algorithms have their own estimation of channels and they produce reference by their own.This combination of RLS –LMS algorithm has been considered better than RLS or LMS as it is impossible to attain convergence once the absence of reference signal occurs [2].Fig. 2 shows the combination of RLS-LMS algorithm which depicts its use over RLS and LMS processing.

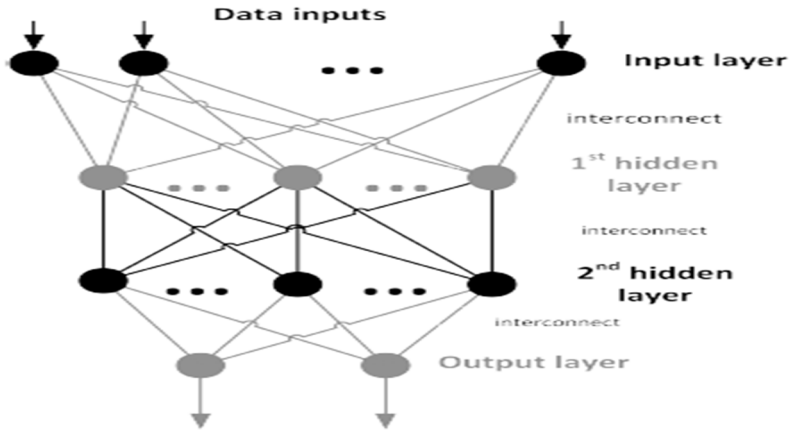

Fig. 1 Basic diagram to show feed forward neural network [1]

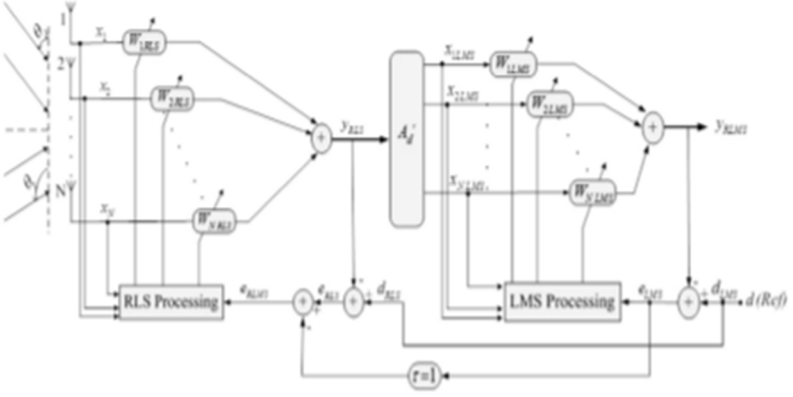

Fig. 2 Combination of Recursive Least Squares with Least Mean Square processing [2]

Solar Power Tracking Systems

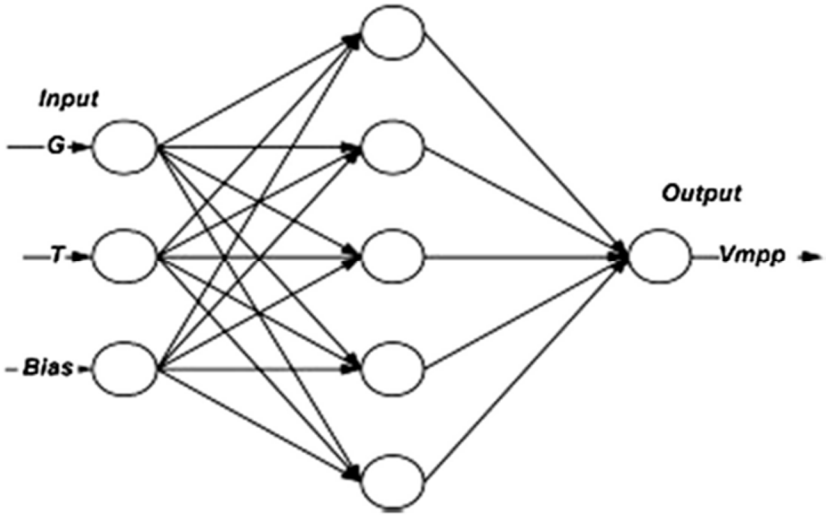

Fig. 3 Structure of neural network [3]

Fig. 3 shows the structure of neural network part in which each layer contains neuron has been linked to the preceding and following layers neuron.Basically Artificial neural networks (ANNs) are algorithms of learning which are motivated as well as developed depend upon animal's nervous system. Brain neuron system is similar to connectors and neurons of ANN. ANN usually comprises of layers that contains input, hidden part and output. Because of this, ANN is able to recognize the pattern. ANN has been trained constantly using specific parameters of input such as irradiation of solar energy, photovoltaic voltage, photovoltaic current and junction temperature. Peak current, peak voltage or duty ratio has been achieved by training of specific input parameters in order to control converters of power. Weights have to be measured and calculation is done through process of training. This has been useful to produce reference signal. Fig.4 shows the schematic Diagram of neural network using power tracking technique.

The function of Artificial intelligence (AI) block is used for determining the next perturbation size of step from present voltage, current and change voltage values [3]. Power management can also be done using solar power hybrid system.

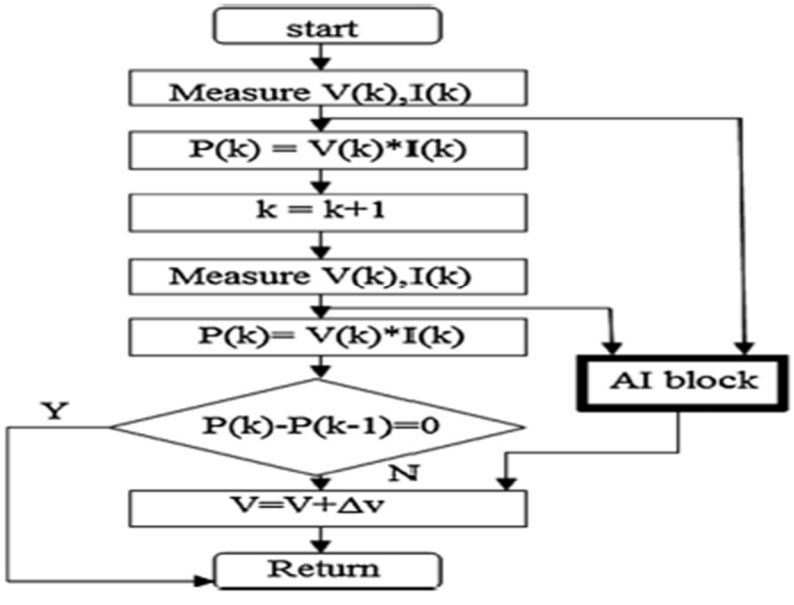

Fig. 4 Schematic Diagram of neural network using power tracking technique [3]

Applications of Soft Computing

Free Space Optics

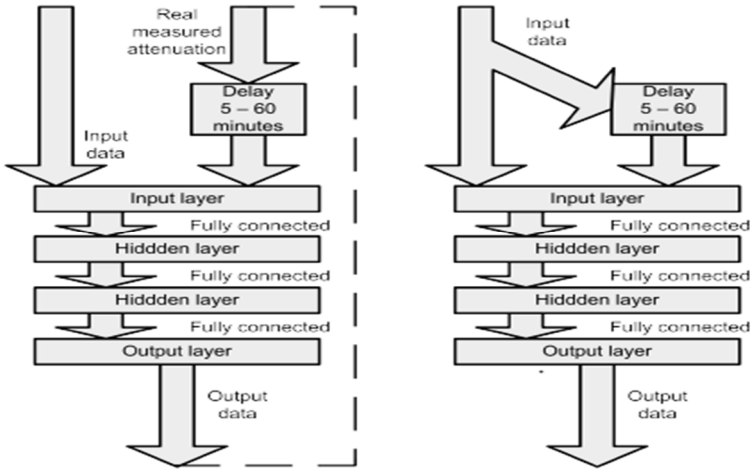

Fig.5 Neural network Architecture of delayed attenuation and delayed data of weather [1]

Fig. 5 shows the Neural network Architecture of delayed attenuation and delayed data of weather.Soft computing has deep effect on FSO link performance. The layer at input is responsible for consisting distribution elements [1].To see the effect of neural network o FSO performance, four aspects have been used:

1. Preparation of manual data
2. Create dataset and normalize it
3. Then train neural network
4. Validate the neural network

These four steps uses Gradient Descent algorithm and then network has to be trained using time interval between 0 and 1and using metrological data, it has been found that errors are mostly found during weak rain and strong winds.

Wireless Sensor Networks

Fig. 6 shows the neural networks and GA that has applications in localizations of WSN [5].Wireless sensing networks have diverse applications in soft computing such as management of disaster, security purposes, detection of intrusion, monitoring of weather, and services of health care [6]. It is known that GPS signals are accessible only in open areas and they are not reachable in indoor areas. The main disadvantage of using GPS with wireless sensors is that it will decrease the life of sensor and overhead cost is also high [8].

So to reduce the errors, researchers have preferred SC techniques which contain optimization that is used to solve various problems in engineering field to achieve practical implementation at less cost. So localization can be done in wireless networks which solve the problem of uncertainty and non-linearity.

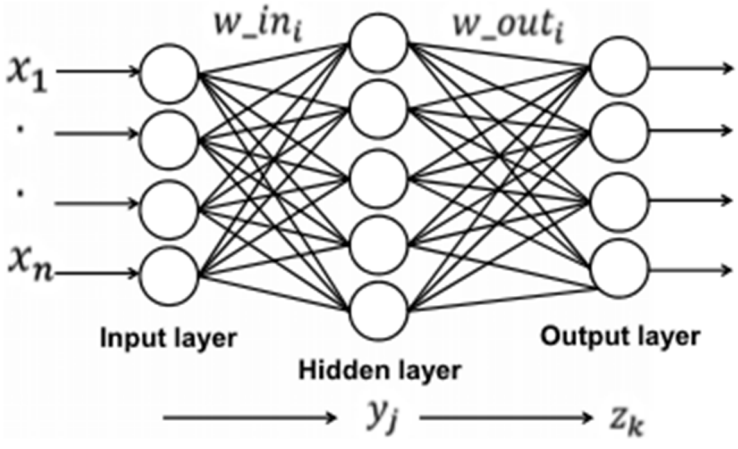

Fig. 6 Block Diagram of ANN in wireless sensor network [5]

The first step to use genetic algorithm and neural network in WSN is that population is initiated by giving a specific threshold at RSSI. Then ranking of population is done in decreasing order. Then crossover, mutation operation is performed by node selection. Estimated location is calculated and RSSI is updated. The difference of RSSI between two successive rounds is calculated. Finally, fitness function is performed. In the same way, fuzzy logic has been implemented in WSN [5].

Information Security System

Soft computing has diverse applications in the Information Security Systems. Software defined networks are those which have control over data flows and it is used to access infrastructure of networks. Open Flow Protocol is used for security purposes and an algorithm is proposed based on fuzzy logic which is used for management of information security.

An approach to study SDN information security algorithm is that the collected statistical data and traffic has been analyzed as given in [7]. Lightweight algorithms can be implemented. The complex data structures are used in information security system and the main actions performed are:

1.Traffic passing
2. Traffic filtering
3. Host checking

This whole process is controlled by switch. Algorithms adaptation and training is required and decision making process occurs by implementing modules of learning.

So techniques of SC are preferred basedfuzzy logic to detect suspicious activities based on variables of inputs used. Processing of statistical data is also required which involves the use of wavelets, search of pattern, clusters and then calculation of characteristics is done. This process also contains operating system of networks having control of SDN used to provide security applications [7].

Fig. 7 shows the whole process of Information Security System.

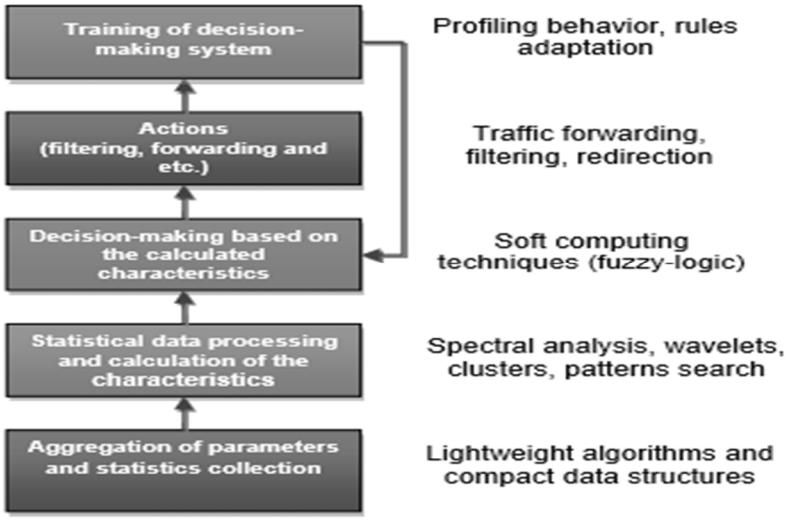

Fig. 7 Algorithm for Information Security [7]

Conclusion

In this paper, applications of soft computing have been discussed in different fields. It basically describes the method and concept of neural network for the estimation of weather influence on performance of FSO. It has been proved that the feedback and inputs has higher effects on FSO rather than the hidden layer size. It is noticed that Open flow protocol technology has been useful in security purposes and information management in big networks.

The basic classes of soft computing have been discussed and concept of genetic algorithm has been used in WSN. High learning machines has been of great use but more advancement and research is required in aggregation of data. The SC technique used with MPPT concept is very innovative as it has the capacity to trace MPP over much larger range of conditions of atmosphere. These are basically the processors of very high speed. Researchers have basically selected this specific technique in regards with various parameters like cost, efficiency of tracking and also taking into account of speed parameter.

The power management can be achieved through techniques of soft computing by using hybrid renewable systems. The renewable systems are useful for understanding of energy degradation and will look for energy sustainability.The concept of

RLS with combination of LMS has also been discussed. Beam forming techniques has been useful for the development of smart antenna.

Future Scope

In future, model of fuzzy security can be implemented which contain network operating system. The model can be useful to detect risks linked with access. Research and more optimization techniques can be used in localizations of WSN. In addition, the concept of localization can be useful in WSN by properly selecting the performance of routing protocol. Investigation of hybrid schemes can be useful in wireless sensing networks for future purposes. More routing techniques and its integration should need to be investigated in the future. These techniques are really useful in the field of soft computing.

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