Global Journal of Computer Science and Technology: G
Interdisciplinary
Volume 14 Issue 3 Version 1.0 Year 2014
Type: Double Blind Peer Reviewed International Research Journal
Publisher: Global Journals Inc. (USA)
Online ISSN: 0975-4172 & Print ISSN: 0975-4350

Worker Productivity: A Fuzzy Supervised Neural Training Algorithm Approach

By M. D. Okpor

Abstract- Productivity refers to the physical relation between the quality produced (output) and the quantity of resource used in the course of production (input). Productivity is a relative term indicating the ratio between total output and the total inputs used therein on the other hand production is an absolute concept, which refers to the volume of output. Fuzzy Supervised Neural Network Training Algorithm has been designed and implemented with Matrix Laboratory (MATLAB) and Hypertext Preprocessor as the simulation language. This paper demonstrates the practical application of soft computing algorithm techniques in various well-meaning organizations.

Keywords: supervised-neural-network, fuzzy set, fuzzy logic, algorithm.

GJCST-G Classification: I.2.0

Worker Productivity: A Fuzzy Supervised Neural Training Algorithm Approach

M. D. Okpor

Abstract- Productivity refers to the physical relation between the quality produced (output) and the quantity of resource used in the course of production (input). Productivity is a relative term indicating the ratio between total output and the total inputs used therein on the other hand production is an absolute concept, which refers to the volume of output. Fuzzy Supervised Neural Network Training Algorithm has been designed and implemented with Matrix Laboratory (MATLAB) and Hypertext Preprocessor as the simulation language. This paper demonstrates the practical application of soft computing algorithm techniques in various well-meaning organizations.

Keywords: supervised-neural-network, fuzzy set, fuzzy logic, algorithm.

I. Introduction

Productivity refers to the physical relation between the quality produced (output) and the quantity of resource used in the course of production (input) (Susan, 2009):

Productivity (P) = output (O)/ input I

Output implies production while input means land, labour, capital, management etc. Productivity measures the efficiency of the production system. Higher productivity means producing more from a given amount of input or producing a given amount with minimum level of inputs. In other words the more the output from one worker or one machine (or a piece of equipment) per day per shift, the higher is the productivity (Susan, 2009). Higher productivity is not to be taken in sense of higher workloads or faster machines alone but it is always elimination of waste of all type of labour (time and skill) machine time, capital, and material management etc.

Productivity = Output per unit of input

Productivity and production are two different terms. Productivity is a relative term indicating the ratio between total output and the total inputs used therein on the other hand production is an absolute concept, which refers to the volume of output (Gerard and Bart, 2009). The volume of production may increase but productivity may decline due to inefficient use of resource. Efficient use of input may increase productivity but the volume of production may not increase. Production refers to the end result of production system where as productivity reflects its efficiency. The benefits of productivity includes: It helps to cut down cost per unit and thereby improve the profits, gains from productivity can be transferred to the consumers in from of lower priced products or better quality products, productive entrepreneur can have better chances to exploit export opportunities and generate more employment opportunities (Gerard and Bart, 2009).

Productivity may be measured either on aggregate bases or on individual basis, which are called total and partial productivity respectively.

Total Productivity Index= total outputs/ total inputs

This index measures the efficiency in the use of all the resources. Partial productivity Indices, depending upon factors used, it measures the efficacy of individual factor of production (Andersson, 1996).

Workers' productivity can be tied to these parameters (OECD, 2002):

a) In-time Completion of task

The completion and delivery of a particular task from a hand of a specific employ is tied to the overall success of the organization. It determines if the organization project will be completed in time or not. In-time completion of task is an integral criterion for determining the productivity of a particular employee.

b) Duty Punctuality

Punctuality is tied to organization success. How can an organization attain successful, when most employees are not punctual? A particular task not completed in-time result in total delay of the overall organizational project which is highly expensive.

c) Optimal Interaction with staff

Staff cannot, and will not work in vacuum or in isolation. The specification requirement of a small sub-system must be aligned with the overall system project. Therefore discords among staffs, hamper project success and hampers productivity. A particular employee cannot be productivity if he cannot work, closely with other staff.

d) High Maintenance Culture

Organizational tools and equipment are meeting for productive organizational duties. Breakdown of tools and equipment by employees will result less productive activities. Therefore if an employee cannot

Author: Department of Computer Science, Delta State, Polytechnic, Ozoro. e-mail : magaretokpor20@gmail.com

Global Journal of Computer Science and Technology (G) Volume XIV Issue III Version I Year 2014

maintain highly tools and equipment in an organization he or she is not productivity.

e) Minima Dissension with staff

Tolerant is very vital in any organization for it to succeed. Senior executive must tolerant lower level staff and lower level staff must tolerant senior executive failings leading to minima dissension and promote productivity.

f) Improved Technical, Business and people Knowledge

Constant training, attending of seminar, workshop and conference will improved the knowledgebase of any employee, which if applied collectively will improve productiveness of an organization.

g) Extra Secular Activities

All work with no extra secular activities, like after work get together will create depression, disorder and intolerant among staff. Extra secular activities must be encouraged.

This research paper is geared toward proposing implementing worker productivity: a fuzzy supervised neural training algorithm approach.

II. Review of Related Literature

The theory of fuzzy logic provides a mathematical strength to capture the uncertainties associated with human cognitive processes, such as thinking and reasoning. In standard set theory, an object does or does not belong to a set. There is no middle ground. In such bivalent systems, an object cannot belong to both its set and its compliment set or to neither of them. This principle preserves the structure of the logic and avoids the contradiction of object that both is and is not a thing at the same time (Zadeh, 1965). However, fuzzy logic is highly abstract and employs heuristic (experiment) requiring human experts to discover rules about data relationship (Angel and Rocio, 2011).

Fuzzy classification assumes the boundary between two neighboring classes as a continuous, overlapping area within which an object has partial membership in each class (Kuang et al., 2011). Fuzzy logic highlights the significant of most applications in which categories have fuzzy boundaries, but also provides a simple representation of the potentially complex partition of the feature space. (Sun and Jang, 1993 and Ahmad, 2011) Conventional approaches of pattern classification involve clustering training samples and associating clusters to given categories. The complexity and limitations of previous mechanisms are largely due to the lack of an effective way of defining the boundaries among clusters. This problem becomes more intractable when the number of features used for classification increases (Christos and Dimitros, 2008).

Artificial Neural Networks (ANNs) constitute a class of flexible nonlinear models designed to mimic biological neural systems. An ANN is a mathematical model or computational model based on biological neural networks (Gutiérrez, 2011), as an interconnected group of artificial neurons, which carries out computation using a connectionist approach. Typically, a biological neural system consists of several layers, each with a large number of neural units (neurons) that can process the information in a parallel manner. The models with these features are known as ANN models (Robert, 2000). ANNs have been widely applied to solve many difficult problems in different areas, including pattern recognition (matching), signal processing, language learning, electronic medical record processsing, tele-diagnosis and computer networking (Robert, 2000). Neural network utilize dataset. The data set is divided into three distinct sets: training, testing and validation sets. The training set is the largest set and is used by neural network to learn patterns present in the data. The testing set is used to evaluate the generalization ability of a supposedly trained network. A final check on the performance of the trained network is made using validation set. Learning methods in neural networks can be broadly classified into three basic types Supervised, unsupervised and reinforced learning (Diogo et al. 2008).

Supervised learning is the machine learning task of inferring a function from supervised training data. The training data consist of a set of training examples. In supervised learning, each example is a pair consisting of an input object (typically a vector) and a desired output value (also called the supervisory signal). A supervised learning algorithm analyzes the training data and produces an inferred function, which is called a classifier (if the output is discrete) or a regression function (if the output is continuous).

Unsupervised learning studies how systems can learn to represent particular input patterns in a way that reflects the statistical structure of the overall collection of input patterns. By contrast with Supervised Learning or Reinforcement Learning, there are no explicit target outputs or environmental evaluations associated with each input; rather the unsupervised learner brings to bear prior biases as to what aspects of the structure of the input should be captured in the output. Unsupervised learning is important since it is likely to be much more common in the brain than supervised learning (Benedetti et al., 2005).

Reinforcement learning, one of the most active research areas in artificial intelligence, is a computational approach to learning whereby an agent tries to maximize the total amount of reward it receives when interacting with a complex, uncertain environment. In Reinforcement Learning, provide a clear and simple account of the key ideas and algorithms of reinforcement learning. Their discussion ranges from the history of the field's intellectual foundations to the most recent developments and applications. The only necessary mathematical background is familiarity with elementary concepts of probability (Richard and Andrew, 2011).

The two most widely used neural networks are the feed-forward networks and recurrent or interactive (feedback) networks, kohonen's self-organizing network, Adaptive resonance Theory (ART) and Counter propagation network are others (Chakraborty, 2010).

Feed-forward ANNs allow signals to travel one way only; from input to output. There is no feedback (loops) i.e. the output of any layer does not affect that same layer. They are extensively used in pattern recognition (Chakra borty, 2010).

This multi-layered structure of a feed-forward network is designed to function as a biological neural system. The input units are the neurons that receive the information (stimuli) from the outside environment and pass them to the neurons in a middle layer (i.e., hidden units). These neurons then transform the input signals to generate neural signals and forward them to the neurons in the output layer. The output neurons in turn generate signals that determine the action to be taken. It is important to note that all information from the units in one layer is processed simultaneously, rather than sequentially, by the units in an "upper" layer (kuan and white, 1994).

a) Feedback Network or Recurrent Neural Networks

Feedback networks can have signals travelling in both directions by introducing loops in the network. Feedback networks are dynamic; their 'state' is changing continuously until they reach an equilibrium point. They remain at the equilibrium point until the input changes and a new equilibrium needs to be found (Chakraborty, 2010).

Kohonen's Self-Organizing Network is a two-layer, feed-forward network (Beale and Jackson, 1990 and Dayh off, 1990).The first is an input layer and the second is a grid or map arranged in a one or two-dimensional array. The second layer is known as a competitive layer. Incoming patterns are classified by the nodes that they activate in the competitive layer. Similarities among patterns are mapped into closeness relationships on the competitive layer. After training, the pattern relationships and groupings are observed from this layer.

Adaptive Resonance Theory (ART) is an unsupervised, competitive learning algorithm (Beale and Jackson, 1990).It is a two-layer network arranged in feedback and feed-forward connection. The layers have different functions, unlike the Multilayer or Kohonen networks. The first layer can be either an input or a comparison layer and the second layer can be either an output or a recognition layer. Both are interchangeable during training.

III. Methodology and Design

Existing approaches in determining worker productive are based on classical set method which usually tied precision to these variables. This is usually flawed in approach because the parameters for accessing worker productivity are imprecise; therefore fuzzy logic will handled this approach very well.

Numerous algorithm has be proposed for solving real worker productivity problems such tele-computing through telematics, but still date few Fuzzy-neural network algorithm has be proposed for objective recognizing worker productivity.

IV. The Proposed Fuzzy Supervised Neural Network Training Algorithm Approach

The proposed Algorithm imbibes artificial intelligence techniques in tying the parameters for identifying worker productivity into a learning paradigm thereby establishing a conclusive boundary. Unlike the current approaches, in which success or failure are based on the wills and experiences of relevant personnel designing and administrating the approach in other to elicit relevant recognition points, success and failure in this approach are not dependent on human intuitions, but success, is closely linked within tuned-up approaches within the carefully and systematic implemented algorithm variables. The Algorithm is depicted on Figure 1

Worker productivity: Target Result ("Productive Worker", "Might be Productive Worker" and "Not Productive Worker")

Input Parameters : *Productivity Criteria*

Degree of membership function

$\geq$ *0.50 = High degree membership function (serious)*

$\leq$ *0.50 = Low degree Membership Function (minor)*

WP = Worker productivity

P = Parameters for worker productivity

Fuzzy predefined Rules

More than five Parameters =Productive Worker

Exactly four symptoms = Might be Productive worker

Three symptoms and below = Not Productive worker

Global Journal of Computer Science and Technology (G) Volume XIV Issue III Version I Year 2014

// Initialization WP (P0)

1. Randomly pick a Worker K;
2. Save Target Result in Knot;
   // Loop till terminal point
3. While WP (P)<>7do;

// Not Productive Worker

1. If WP (P1); in-time completion of task is high, while other P is Low or exempted THEN Not Productive Worker
2. If WP (P2); in-time completion of task and duty punctuality is high, while other P is Low or exempted THEN Not Productive Worker
3. If WP (P3); in-time completion of task, duty punctuality and optimal interaction with staff is high, while other P is Low or exempted THEN Not Productive Worker
4. Else
5. End If

// Might be Productive Worker

6. If WP (P4); in-time completion of task, duty punctuality, optimal interaction with staff and high maintenance culture is high, while other P is Low or exempted THENMight be Productive Worker
7. Else
8. End If

// Productive Worker

9. If WP (P5); in-time completion of task, duty punctuality, optimal interaction with staff , high maintenance culture and minima dissension with staff is high, while other P is Low or exempted THEN Productive Worker
10. If WP (P6); in-time completion of task, duty punctuality, optimal interaction with staff, high maintenance culture, minima dissension with staff and Improved technical, business and people knowledgeis high,while other P is Low or exempted THEN Productive Worker
11. If WP (P7); in-time completion of task, duty punctuality, optimal interaction with staff, high maintenance culture, minima dissension with staff and Improved technical, business and people knowledge and extra secular activities is high,while other P is Low or exempted THEN Productive Worker
12. Else
13. End If
14. End

Figure 1 : Worker productivity: A Fuzzy Supervised Neural Training Algorithm Approach

V. Implementation and Discussion

The implementation of our result was dual fold; the neural training dataset was handled conveniently utilizing Matrix Laboratory (MATLAB) which serves as our simulation tool in achieving the our results because of its interactive environment for algorithm development, data visualization, data analysis, and numerical approach which was relevant to our numerical dataset which was more appropriate than with spreadsheets or traditional programming languages, such as C/C++ or Java. After pruning the dataset utilizing MATLAB, the algorithm was fully implemented utilizing Hypertext Preprocessor (PHP), which served as the language of implementation.

VI. Discussion

The implemented algorithm provides an interactive base in determining varied worker productivity objectively as opposed to the subjective approach which is achievable utilizing otherapproaches. The result was satisfactory having been able to distinctly determine worker productivity.

VII. Conclusions

This paper has demonstrates the practical application of fuzzy supervised training algorithm for worker productivityin various organization.

References Références Referencias

1. Ahmad H. (2011), *Fuzzy Approach to Likert Spectrum in Classified levels in Surveying Researches,* retrieved http://www.tjmcs.com.
2. Andersson, L. (1996), *Employee Cynicism: An Examination Using a Contract Violation Framework, Human Relations,* Retrieved from http://hum.sagepub.com.
3. Angel C. and Rocio R. (2011), *Documentation Management with Ant Colony Optimization Meta-*

heuristic: A Fuzzy Text Clustering Approach Using Pheromone trails, retrieved from soft computing in Industrial applications, Advances in intelligent and soft Computing, vol. 96, 2011, 261-70, DOI: 10.1007/978-3-642-20505-1_23

4. Benedetti S., Saverio M., Anna G. S. and Gian L.M. (2005), *Electronic Nose and Neural Network use for the Classification of Honeypot,* retrieved from *citeseerx.ist.psu.Edu/viewdoc /download?doi=10.1.1.128.pdf.*
5. Beale R. and Jackson I. (1990), *Neural Computing: An Introduction,* dl.acm.org/citation.cfm?id=121342.
6. Chakraborty R.C. (2010), *Soft computing-Introduction: Soft-computing Lecture 1-6, notes,* retrieved fromhttp://myreaders.inro.
7. Christos S. and Dimitros S. (2008), *Neural Network,* retrieved from http://www.docstoc.com/docs/15050/ neural-networks.
8. Dayhoff, J.E. (1990), *Neural Network Architecture: An Introduction,* retrieved from https://catalyst. library.jhu.edu/?q=%22Dayhoff%2C+Judith.
9. Diogo F. P., Flávio R.S. O. and Fernando B. L. N (2008), *Multi-objective Abilities in the Hybrid Intelligent Suite for Decision Support,* retrieved from http://ieeexplore. ieee.org/xpl/freeabs_all.
10. Evans D.J. (1996), *Parallel Simulation of Character Recognition Problems using NEUCOMP2,* International Journal of Parallel Emergent and Distributed Systems.
11. Gerard Y. and Bart V. A. (2009), *Employment and Hours Worked in National Accounts: a Producer's View on Methods and a User's View on Applicability,* Groningen Growth and Development Centre, University of Groningen and The Conference Board.
12. Gutiérrez P.A. (2011), *Hybrid Artificial Neural Networks: Models,* retrieved online from http:// *dl.acm.org/citation.cfm?id=20233.*
13. Imianvan A.A. and Obi J.C. (2013), *Application of Data Clustering Embedded in Fuzzy Classifier Expert System for water Quality Recognition,* World Bank Assisted National Agricultural Research Project, Port Harcourt, Nigeria
14. Kuan C. M. and White H. (1994), *Artificial Neural Networks: An Econometric Perspective,* Econometric Reviews, Vol.13, Pp.1-91 and Pp.139-143.
15. Kuang Y. H.; Ting-H. C. and Ting-Cheng Chang (2011), *Determination of the Threshold Value* β *of Variable Precision Rough Set By Fuzzy Algorithms* retrieved from http://www.sciencedirect.com/ science/article/pii/S0888613X11000831.
16. OECD Manual (2002), *Measuring Productivity; Measurement of Aggregate and Industry-Level Productivity Growth.*
17. Richard S. S. and Andrew G. B. (2011), *Reinforcement Learning: an Introduction,* retrieved from http://books.google.com/books/about/Reinforcement_I.
18. Robert F. (2000), *Introduction to Neuro-Fuzzy Systems: Advances in Soft Computing Serie,* Springer-Verlag, Berlin/Heidelberg, Germany.
19. Sun C.T. and Jang J.S. (1993), *A Neuro-Fuzzy Classifier and its applications,* in: Proc. IEEE Int. Conference on Neural Networks, San Francisco, pp.94–98.
20. Susan F. (2009), *International Comparisons Of Hours Worked: An Assessment Of The Statistics.* Monthly Labor Review,
21. Zadeh L.A. (1965), "Fuzzy Sets. Information and Control, Vol.8, pp.338-353.

This page is intentionally left blank