Journal of Electrical Engineering and Automation (EEA) (2021)
Vol.03/ No.03
Pages: 169-183
https://www.irojournals.com/iroeea
DOI: https://doi.org/10.36548/jeea.2021.3.002

An efficient Capacitor Bank Operating System for Single Phase Power Factor Correction using Neural Network Estimations

Subarna Shakya

Professor, Department of Electronics and Computer Engineering, Central Campus, Institute of Engineering, Pulchowk, Tribhuvan University, Pulchowk, Lalitpur, Nepal

E-mail: drss@ioe.edu.np

Abstract

Wastage of electricity occurs in all places starting from a small house electrical loading to a heavy industrial electrical loading. KiloVolt-Ampere Reactive (KVAR) power metering devices are employed in industrial applications for measuring the energy utilization which measure the energy wastage along with it. This urges a consumer to pay for the unutilized or wasted energy as well. To avoid this, certain capacitor bank units are connected to the industrial application motor units. The right choice of capacitor rating are helpful in minimizing the wasted power observation in the KVAR meters. The selection of capacitor rating is analysed with respect to the power factor calculation. The power factor is a derivation of working power to the apparent power in an electrical system. An optimum power factor to be maintained in an electrical system is 1. The motive of the proposed work is to maintain the power factor by selecting an optimum capacitor bank on the operation of an electrical system at various load conditions. The requirement of capacitor bank values get changed with respect to the load given to an electrical system. A neural network based prediction model is employed in the work for estimating the right choice of capacitor bank. The efficiency of the proposed work is verified and found satisfied with a traditional capacitor bank operating system.

Keywords: Capacitor bank control, power factor correction, neural network estimations, single phase power, apparent power, reactive power

ISSN: 2582-3051
Submitted: 14.09.2021
Revised: 18.10.2021
Accepted: 29.10.2021
Published: 08.11.2021

Journal of Electrical Engineering and Automation (EEA) (2021)
Vol.03/ No.03
Pages: 169-183
https://www.irojournals.com/iroeea
DOI: https://doi.org/10.36548/jeea.2021.3.002

1. Introduction

Work done per unit time of electrical energy is represented as power in watts. In other terms, the power is represented as electric current with charge of Q coulombs passing through a voltage source of a closed electric circuit. Power can be calculated directly by multiplying the current flow value in a circuit with the voltage given across the circuit element. In some unknown condition of current value, the power can calculated with the known resistive value of the circuit. In the same way, the power can also be analysed when the current and resistive values are known without the supply source voltage. The power is also called as true power or real power. Figure 1 represents the various format for observing the power value. The analysis of power in an electrical circuit is an essential attribute for observing heat dissipation in an individual electrical component and to calculate the required power source in many applications [1-3].

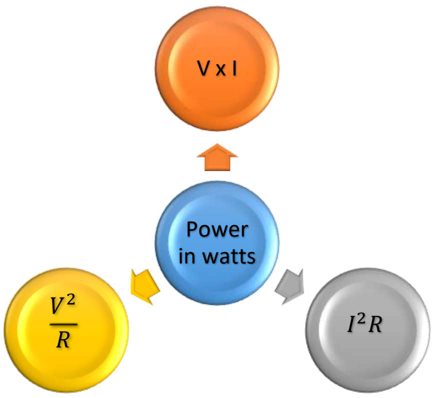

Figure 1. Different ways of analysing power in an electrical circuit

An Alternating Current (AC) system, changes its current value from minimum to its peak at regular intervals on opposite directions. Therefore the AC supply have a frequency and phase to its current and voltage waveforms. Hence the AC power is sub-divided into three types namely,

- Active power or real power

ISSN: 2582-3051
Submitted: 14.09.2021
Revised: 18.10.2021
Accepted: 29.10.2021
Published: 08.11.2021

Journal of Electrical Engineering and Automation (EEA) (2021)
Vol.03/ No.03
Pages: 169-183
https://www.irojournals.com/iroeea
DOI: https://doi.org/10.36548/jeea.2021.3.002

- Apparent power
- Reactive power

1.1 Active power

The power, which is utilized by an electric circuit and its load, is represented as active power. The active power is also represented as average power, real power and true power in many applications [4, 5]. The active power of an AC circuit is denoted as P in the following equation.

$$P = V_{rms} I_{rms} Cos\emptyset \quad (1)$$

Where

V_{rms} = Voltage root mean square value = $\frac{V_{Peak}}{\sqrt{2}}$

I_{rms} = Current root mean square value = $\frac{I_{Peak}}{\sqrt{2}}$

$\emptyset$ = Impedance phase or phase angle between the voltage and current

1.2 Apparent power

The apparent power is the actual power produced by a voltage source to its connected circuit. Mathematically, the apparent power can also be calculated with a combination of real power and reactive power. The unit of apparent power is S and it is represented by equation 2. The apparent power of an electrical circuit is same as that of active power when it is connected with just the resistive load and the value of apparent power becomes larger to the active power when the circuit is connected with an inductive or capacitive load [6, 7].

$$S = V_{rms} I_{rms} \quad (2)$$

ISSN: 2582-3051
Submitted: 14.09.2021
Revised: 18.10.2021
Accepted: 29.10.2021
Published: 08.11.2021

Journal of Electrical Engineering and Automation (EEA) (2021)
Vol.03/ No.03
Pages: 169-183
https://www.irojournals.com/iroeea
DOI: https://doi.org/10.36548/jeea.2021.3.002

1.3 Reactive power

The reactive power is a power generated by a closed electric circuit with its reactance. In other terms, the reactive power is also represented as wasted power in a circuit as heat and line loss. The reactive power is only applicable to the circuit with inductive and capacitive load [8, 9], where the energy is stored and dissipated in its operation. In general the reactive power is represented with letter Q and it is expressed as in equation 3.

$$Q = V_{rms} I_{rms} Sin\emptyset = \sqrt{(S^2) - (P^2)} \quad (3)$$

1.4 Power factor

Power factor is represented as a ratio of the active power to the apparent power. Therefore the power factor is expressed as in equation 4.

$$\text{Power factor (PF)} = \frac{P}{S} = \frac{V_{rms} I_{rms} Cos\emptyset}{V_{rms} I_{rms}} = Cos\emptyset \quad (4)$$

Therefore the value of power factor ranges from 0 to 1. In most case of electrical circuits with AC motors, the power factor is found to be lagging, as it is an inductive load. To match up the lagging power factor, a capacitive load is attached to the circuit in parallel [10, 11]. The amount of capacitance to be added in the circuit is calculated by the following equation.

$$C = \frac{1}{2\pi f X_c} \quad (5)$$

Where

f = Frequency of the given power supply

$X_c = \frac{E^2}{Q}$

E = Supply voltage

ISSN: 2582-3051
Submitted: 14.09.2021
Revised: 18.10.2021
Accepted: 29.10.2021
Published: 08.11.2021

Therefore the value of capacitance needed to be connected in an inductive load, changes time to time with respect to the supply voltage, frequency, real power and apparent power. The following section explores the present research growth of power factor corrections in various applications.

2. Related work

An auto-regressive forecast system was developed to observe and forecast uncertainties in an electrical power supply. The system was implemented in a real time application for performing the power factor correction process. The experiment was equipped with a battery storage device instead of utilising a capacitive load [12]. The most challenging part in the power factor correction is the addition of right choice of capacitive load to a non-uniform electricity supply. In recent years, certain neural network algorithms were developed to predict lot of information for various applications. The capsule networks are one among them employed for various applications like font style prediction to medical image segmentation.

The capsule networks are widely employed into an application where the number of training information are very limited. However, the performances of the capsule networks are comparatively better in all the applications over the traditional convolution neural network and artificial neural network [13, 14]. The power factor correction system was also employed based on a dynamic model FPGA device with a three phase Vienna rectifier. The system was developed with a hardware in the loop with a test rig for compensating the performance of a power converter. The performance of the FPGA device specifies a better accuracy compared to that with a full hardware experiment setup [15].

A deep Q-learning based decision making system was developed to find out the originality of a given testing data. The performances of the developed system was compared over the CNN and naïve bayes algorithm and found satisfied with an overall accuracy and very good precision [16]. A single-stage ac-dc converter model was developed to perform power factor correction in a low power application. The developed converter system was controlled

ISSN: 2582-3051
Submitted: 14.09.2021
Revised: 18.10.2021
Accepted: 29.10.2021
Published: 08.11.2021

Journal of Electrical Engineering and Automation (EEA) (2021)
Vol.03/ No.03
Pages: 169-183
https://www.irojournals.com/iroeea
DOI: https://doi.org/10.36548/jeea.2021.3.002

magnetically by implementing a sharing switch across the LLC converter. The highest efficiency of operation was achieved by making the LLC converter to be operated with series resonant frequency [17]. A deep convolution neural network algorithm was proposed to make alert signal to the user when a credit card is identified with a fraud transaction. An experiment was conducted with the developed algorithm on a real time dataset with a preprocessing step and a feature selection process. The results indicates that the accuracy attainment was around 99% with a computational speed of 45 seconds per transaction [18].

A regression tree based data mining algorithm was employed in an application to predict the demand of electronic goods in an Indian market. The experimental flow consists of data categorization, model creation and holdout cross validation in its operation. The primary data required for the training process were collected using a web crawler on electronic product sales web page. A count of 15,323 data were considered in the work for analysis, from that 60% of data were taken for the training and remaining 40% were taken for the testing process. However, the experimental analysis showed a prediction accuracy of 30 to 57% only [19].

An Artificial Neural Network (ANN) based technique was developed to maintain the power quality in a PV based AC microgrid with respect to the IEEE and IEC standards. The technique was employed to maintain the power factor on various conditions like unbalanced voltage, frequency deviations and on harmonic distortions. The developed technique was employed in a simulation environment with a regular Proportional–Integral (PI) and fuzzy PI systems [20]. The performances of the deep learning algorithms are quite acceptable when compared to the traditional controlling methods. The deep learning algorithms are widely employed in industrial, medical and defence applications too [21].

A transfer learning technique was combined with a convolution neural network algorithm for estimating the traffic conditions in a given video frame. An experiment was conducted based on the developed model with an Indian Driving Dataset (IDD) consisting of 34 classes of images. The experimental projection indicated a better accuracy in the combined algorithms over the traditional approaches [22]. An efficient non-linear prediction system was

ISSN: 2582-3051
Submitted: 14.09.2021
Revised: 18.10.2021
Accepted: 29.10.2021
Published: 08.11.2021

Journal of Electrical Engineering and Automation (EEA) (2021)
Vol.03/ No.03
Pages: 169-183
https://www.irojournals.com/iroeea
DOI: https://doi.org/10.36548/jeea.2021.3.002

designed by merging the Support Vector Machines (SVM) with the Recurrent Neural Network (RNN). The analysis report indicated that the system provided better accuracy in the prediction process, when it was trained with more number of data samples [23]. A semi-supervised classification process was performed with a MNIST dataset for comparing the performance changes among the capsule Generative Adversarial Network (GAN) and the traditional GAN. The analysis results indicated that the error rate of capsule GAN was reduced to certain extent compared to the traditional GAN [24].

Thyristor rectifiers are widely employed in an AC grid system for its power quality management. The thyristor bridge generates power fluctuation to the electrolytic cells when there is a huge change in current values. Therefore the reactive power generated in an electrical circuit is differentiated as distortion components and phase shifts [25]. The major challenge in employing a neural network algorithm to the instant prediction process are their computational speed. In order to improve the computational efficiency of a feed forward neural network algorithm, the weight and bias parameters of the neural network architecture are fine tuned. The experimental performances of the fine-tuned networks are comparatively better in nature than the deep belief network and the other intelligent learning methods [26].

A comparative study on various deep learning algorithms was performed to predict the coronary artery diseases. The analysis report showed that a change in attribute selection from the dataset indicated a drastic change in the prediction accuracy of various deep learning algorithms [27]. A distributed static compensator system was employed in a photovoltaic (PV) as a control device for maintaining the power quality. The system acts like a feed forward control loop for operating such as an active current control device. The performance results indicate a stable and efficient output over the traditional control units [28]. Therefore a strong control structure with an efficient neural network algorithm is the primary requirement for making an efficient power quality maintenance system. The upcoming section explores a neural network based control strategy for maintaining the power factor in single phase loading system.

ISSN: 2582-3051
Submitted: 14.09.2021
Revised: 18.10.2021
Accepted: 29.10.2021
Published: 08.11.2021

Journal of Electrical Engineering and Automation (EEA) (2021)
Vol.03/ No.03
Pages: 169-183
https://www.irojournals.com/iroeea
DOI: https://doi.org/10.36548/jeea.2021.3.002

3. Proposed method

The architectural view of the proposed capacitor bank operating system is shown in Figure 2. Here the inclusion of capacitor block to the electricity load is controlled and operated through a neural network algorithm. The proposed system is employed with a Convolution Neural Network (CNN) algorithm trained with a self-made dataset of power ranging from 51KW to 60KW on power factor changing from 0.6 to 1. As the proposed model is employed with a self-made dataset, there is no need for employing a preprocessing step to its workflow. The trained neural network algorithm is directly connected to the physical load at the time of testing, where the observed power factor readings are transmitted to a microcontroller unit for storage purpose. Similarly, the observed readings are forwarded to the neural network algorithm through the same microcontroller unit.

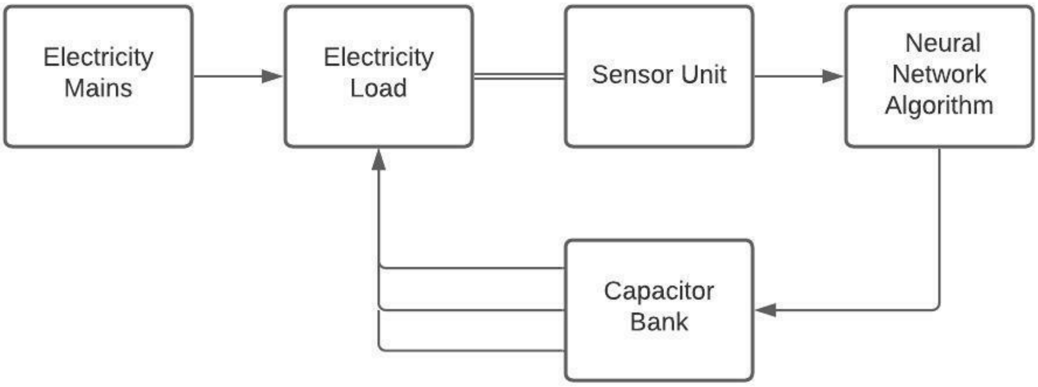

Figure 2. Architectural view of the proposed system

The neural network algorithm has been designed to predict the required reactive power to be added in the electricity load as shown below.

$$\text{Required reactive power in KVAR} = P\,[\tan(\cos^{-1}(pfa) - \cos^{-1}(pfr))] \qquad (6)$$

Where,

P = Actual power measured in KW

ISSN: 2582-3051
Submitted: 14.09.2021
Revised: 18.10.2021
Accepted: 29.10.2021
Published: 08.11.2021

Journal of Electrical Engineering and Automation (EEA) (2021)
Vol.03/ No.03
Pages: 169-183
https://www.irojournals.com/iroeea
DOI: https://doi.org/10.36548/jeea.2021.3.002

pfa = Actual power factor

pfr = Required power factor (always 1)

The proposed work has a sensor unit comprising of acs712 current sensor with a voltage sensor and voltage divider circuit. The circuit observes the power factor from the electricity load by finding the change in difference among the current and voltage wave forms. Table 1 indicates few data samples available in the dataset.

Table 1. Sample training data

Power KW	Actual PF	PF to be obtained	Required Capacitor (Reactive Power KVAR)
60	0.7	1	61.21
59	0.7	1	60.19
58	0.7	1	59.17
57	0.7	1	58.15
56	0.7	1	57.13
55	0.7	1	56.11
54	0.7	1	55.09
53	0.7	1	54.07
52	0.7	1	53.05
51	0.7	1	52.03
:	:	:	:
:	:	:	:
:	:	:	:
60	0.6	1	80.00
60	0.65	1	70.15
60	0.7	1	61.21
60	0.75	1	52.92
60	0.8	1	45.00
60	0.85	1	37.18
60	0.9	1	29.06
60	0.95	1	19.72
60	1	1	0.00

ISSN: 2582-3051
Submitted: 14.09.2021
Revised: 18.10.2021
Accepted: 29.10.2021
Published: 08.11.2021

Journal of Electrical Engineering and Automation (EEA) (2021)
Vol.03/ No.03
Pages: 169-183
https://www.irojournals.com/iroeea
DOI: https://doi.org/10.36548/jeea.2021.3.002

The capacitor units are usually available in many ranges. In the proposed work, the capacitor banks connected in the work ranges from 1KVAR to 50KVAR, which can give maximum reactive power of 132KVAR.

4. Experimental Analysis

The trained neural network model has been included in a Raspberry Pi microcontroller with a relay based peripheral control for capacitor bank operations and power factor measurements. The connected load values has been changed from 51KW to 60KW with a regular interval of 3minutes to observe the change in actual power factor and reactive power analysis. Table 2 indicates the experimental observations of the proposed method and Figure 3 explores the change in power factor observation on the proposed work over the estimated value and the actual value.

Table 2. Experimental observation of the proposed method

Power KW	Actual PF	PF to be obtained	Required Capacitor, Reactive Power KVAR	Practically added Capacitor, Reactive Power KVAR	Achieved Power Factor
60	0.8	1	45	45	0.99
59	0.81	1	42.72	42	0.98
58	0.8	1	43.50	43	0.99
57	0.85	1	35.33	35	1
56	0.86	1	33.23	33	0.97
55	0.78	1	44.13	44	0.99
54	0.77	1	44.75	44	0.98
53	0.83	1	35.62	35	0.99
52	0.8	1	39	39	1
51	0.74	1	46.36	46	0.99

ISSN: 2582-3051
Submitted: 14.09.2021
Revised: 18.10.2021
Accepted: 29.10.2021
Published: 08.11.2021

Journal of Electrical Engineering and Automation (EEA) (2021)
Vol.03/ No.03
Pages: 169-183
https://www.irojournals.com/iroeea
DOI: https://doi.org/10.36548/jeea.2021.3.002

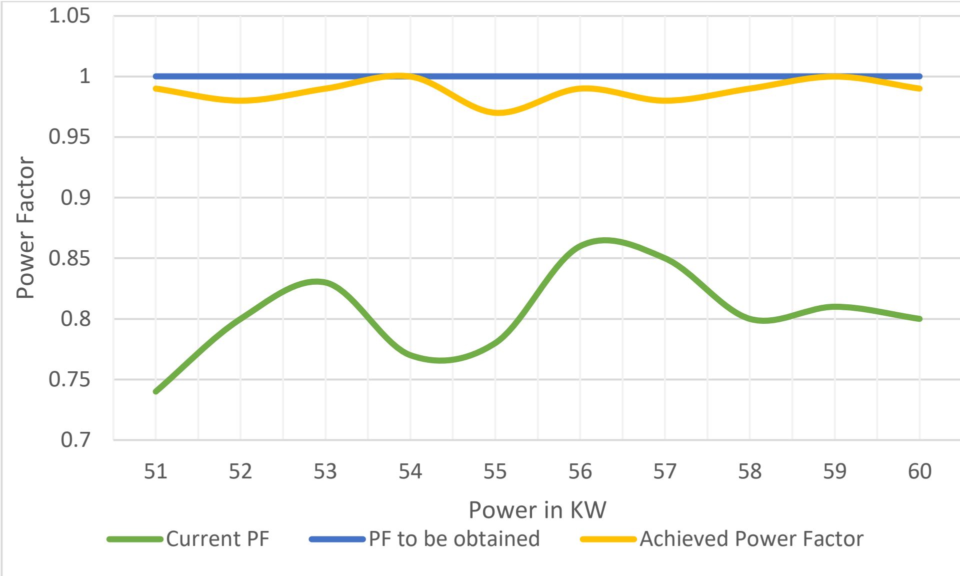

Figure 3. Change in power factor correction on various loads

The required reactive power to be added in the circuit is also shown in the table, where the analysed calculations are explored with 2 decimal values. However in practical, the capacitor banks cannot be made with such perfection. Therefore the decimal values have been removed in the practical analysis. The values of decimal have not been rounded off in usual method beyond 0.5, as it may result in the leading power factor, which is not acceptable by the electricity supplier. Due to such decimal value correction and real time loss of electrical power, a slight power factor change is observed in the practical values.

5. Conclusion

Maintaining unity power factor is a primary necessity for an industrial consumer. Therefore an efficient capacitor bank operating system is developed in the proposed work with a CNN algorithm. The algorithm was trained with a self-made dataset of power values ranges from 51KW to 60KW with power factor values changes from 0.6 power factor to 1. The experimental result indicates a better computational speed in the proposed work over the traditional methods and the average power factor maintained by the proposed work is 0.988.

ISSN: 2582-3051
Submitted: 14.09.2021
Revised: 18.10.2021
Accepted: 29.10.2021
Published: 08.11.2021

Journal of Electrical Engineering and Automation (EEA) (2021)
Vol.03/ No.03
Pages: 169-183
https://www.irojournals.com/iroeea
DOI: https://doi.org/10.36548/jeea.2021.3.002

The implementation of neural network algorithm to the capacitor bank unit also reduces the heat dissipation from the traditional control units to a certain extent. In the future, the performance of the power factor achievement system can be improved by having a feedback to the neural network model from the estimated output.

References

[1] Cao, Yan, Qiangfeng Wang, Qingming Fan, Sayyad Nojavan, and Kittisak Jermsittiparsert. "Risk-constrained stochastic power procurement of storage-based large electricity consumer." Journal of Energy Storage 28 (2020): 101183.

[2] Xu, Hanchen, Yuzhang Lin, Xiangyu Zhang, and Fei Wang. "Power system parameter attack for financial profits in electricity markets." *IEEE Transactions on Smart Grid* 11, no. 4 (2020): 3438-3446.

[3] Agarwal, Priyanka, Ashish Pratap, and M. Shukla. "ber analysis of power rotational interleaver on OFDM-IDMA system over powerline." In *Intelligent Data Communication Technologies and Internet of Things*, pp. 819-830. Springer, Singapore, 2021.

[4] El-Fergany, Attia A., and Hany M. Hasanien. "Salp swarm optimizer to solve optimal power flow comprising voltage stability analysis." *Neural Computing and Applications* 32, no. 9 (2020): 5267-5283.

[5] Akhtar, Iram, Mohammed Asim, Raj Kumar Yadav, Piyush Agarwal, and Sheeraz Kirmani. "Design of Effective Grid-Connected Solar System." In *International Conference on Inventive Computation Technologies*, pp. 606-614. Springer, Cham, 2019.

[6] Yan, Ziming, and Yan Xu. "Real-time optimal power flow: A lagrangian based deep reinforcement learning approach." *IEEE Transactions on Power Systems* 35, no. 4 (2020): 3270-3273.

[7] Dilhani, MHMR Shyamali, N. M. Wagarachchi, and Kudabadu JC Kumara. "Electricity Load Forecasting Using Optimized Artificial Neural Network." In *Inventive Computation and Information Technologies*, pp. 665-676. Springer, Singapore, 2021.

ISSN: 2582-3051
Submitted: 14.09.2021
Revised: 18.10.2021
Accepted: 29.10.2021
Published: 08.11.2021

Journal of Electrical Engineering and Automation (EEA) (2021)
Vol.03/ No.03
Pages: 169-183
https://www.irojournals.com/iroeea
DOI: https://doi.org/10.36548/jeea.2021.3.002

[8] Kanavaros, Dimitrios, Giovanna Oriti, and Alexander L. Julian. "Novel implementation and comparison of active and reactive power flow control methods in a single phase grid-connected microgrid." *IEEE Transactions on Industry Applications* 56, no. 2 (2020): 1631-1639.

[9] Kunaraj, A., J. Joy Mathavan, and K. G. D. R. Jayasekara. "Hardware Implementation of Automatic Power Source Controller Cum Power Optimizer." (2021).

[10] Kolhe, Mohan Lal, and M. J. M. A. Rasul. "3-Phase grid-connected building integrated photovoltaic system with reactive power control capability." *Renewable Energy* 154 (2020): 1065-1075.

[11] Raj, K. Vivek, K. Namana Shenoy, L. Dhanalakshmi, and Drishya Jayan. "Hybrid Clean Energy Harvesting for Low Power Devices." In *International Conference on Intelligent Data Communication Technologies and Internet of Things*, pp. 191-199. Springer, Cham, 2018.

[12] Hashmi, Md Umar, Deepjyoti Deka, Ana Bušić, Lucas Pereira, and Scott Backhaus. "Arbitrage with power factor correction using energy storage." *IEEE Transactions on Power Systems* 35, no. 4 (2020): 2693-2703.

[13] Vijayakumar, T., and Mr R. Vinothkanna. "Capsule Network on Font Style Classification." Journal of Artificial Intelligence 2, no. 02 (2020): 64-76.

[14] Koresh, H. James Deva, Shanty Chacko, and M. Periyanayagi. "A modified capsule network algorithm for oct corneal image segmentation." *Pattern Recognition Letters* 143 (2021): 104-112.

[15] Aiello, G., M. Cacciato, G. Scarcella, G. Scelba, F. Gennaro, and N. Aiello. "Real-time emulation of a three-phase Vienna rectifier with DC voltage control and power factor correction." *Electrical Engineering* 102, no. 1 (2020): 97-106.

[16] Hamdan, Yasir Babiker. "Faultless Decision Making for False Information in Online: A Systematic Approach." Journal of Soft Computing Paradigm (JSCP) 2, no. 04 (2020): 226-235

ISSN: 2582-3051
Submitted: 14.09.2021
Revised: 18.10.2021
Accepted: 29.10.2021
Published: 08.11.2021

Journal of Electrical Engineering and Automation (EEA) (2021)
Vol.03/ No.03
Pages: 169-183
https://www.irojournals.com/iroeea
DOI: https://doi.org/10.36548/jeea.2021.3.002

[17] Wei, Yuqi, Quanming Luo, J. Marcos Alonso, and Alan Mantooth. "A magnetically controlled single-stage AC–DC converter." *IEEE Transactions on Power Electronics* 35, no. 9 (2020): 8872-8877.

[18] Chen, Joy Iong-Zong, and Kong-Long Lai. "Deep Convolution Neural Network Model for Credit-Card Fraud Detection and Alert." *Journal of Artificial Intelligence* 3, no. 02 (2021): 101-112.

[19] Suma, V., and Shavige Malleshwara Hills. "Data Mining based Prediction of Demand in Indian Market for Refurbished Electronics." Journal of Soft Computing Paradigm (JSCP) 2, no. 02 (2020): 101-110.

[20] Kaushal, Jitender, and Prasenjit Basak. "Power quality control based on voltage sag/swell, unbalancing, frequency, THD and power factor using artificial neural network in PV integrated AC microgrid." Sustainable Energy, Grids and Networks 23 (2020): 100365.

[21] Bashar, Abul. "Survey on evolving deep learning neural network architectures." Journal of Artificial Intelligence 1, no. 02 (2019): 73-82.

[22] Kumar, T. Senthil. "Video based Traffic Forecasting using Convolution Neural Network Model and Transfer Learning Techniques." Journal of Innovative Image Processing (JIIP) 2, no. 03 (2020): 128-134.

[23] Raj, Jennifer S., and J. Vijitha Ananthi. "Recurrent neural networks and nonlinear prediction in support vector machines." Journal of Soft Computing Paradigm (JSCP) 1, no. 01 (2019): 33-40.

[24] Vijayakumar, T. "Comparative study of capsule neural network in various applications." Journal of Artificial Intelligence 1, no. 01 (2019): 19-27.

[25] Ruuskanen, Vesa, Joonas Koponen, Antti Kosonen, Markku Niemelä, Jero Ahola, and Aki Hämäläinen. "Power quality and reactive power of water electrolyzers supplied with thyristor converters." Journal of Power Sources 459 (2020): 228075.

ISSN: 2582-3051
Submitted: 14.09.2021
Revised: 18.10.2021
Accepted: 29.10.2021
Published: 08.11.2021

[26] Manoharan, J. Samuel. "Study of Variants of Extreme Learning Machine (ELM) Brands and its Performance Measure on Classification Algorithm." Journal of Soft Computing Paradigm (JSCP) 3, no. 02 (2021): 83-95.

[27] Chen, Joy Iong Zong, and P. Hengjinda. "Early Prediction of Coronary Artery Disease (CAD) by Machine Learning Method-A Comparative Study." Journal of Artificial Intelligence 3, no. 01 (2021): 17-33.

[28] Patel, Nirav, Nitin Gupta, and B. Chitti Babu. "Photovoltaic system operation as DSTATCOM for power quality improvement employing active current control." IET Generation, Transmission & Distribution 14, no. 17 (2020): 3518-3529.

Author's biography

Subarna Shakya is currently a Professor of Computer Engineering, Department of Electronics and Computer Engineering, Central Campus, Institute of Engineering, Pulchowk, Tribhuvan University, Coordinator (IOE) , LEADER Project (Links in Europe and Asia for engineering, education, Enterprise and Research exchanges), ERASMUS MUNDUS. He received MSc and PhD degrees in Computer Engineering from the Lviv Polytechnic National University, Ukraine, 1996 and 2000 respectively. His research area includes E-Government system, Computer Systems & Simulation, Distributed & Cloud computing, Software Engineering & Information System, Computer Architecture, Information Security for E-Government, and Multimedia systems.

ISSN: 2582-3051
Submitted: 14.09.2021
Revised: 18.10.2021
Accepted: 29.10.2021
Published: 08.11.2021