International Journal of Academic Pedagogical Research (IJAPR)
ISSN: 2000-004X
Vol. 2 Issue 11, November – 2018, Pages: 8-14

English Alphabet Prediction Using Artificial Neural Networks

Hazem Hatem Heriz, Hamza Mohammed Salah, Sharief Bashir Abu Abdu, Mohammad M. El Sbihi, and Samy S. Abu-Naser

Department of Information Technology,
Faculty of Engineering & Information Technology,
Al-Azhar University - Gaza, Palestine

Abstract: *In this paper an Artificial Neural Network (ANN) model, for predicting the Letters from twenty dissimilar fonts for each letter. The character images were, initially, based on twenty dissimilar fonts and each letter inside these twenty fonts was arbitrarily distorted to yield a file of 20,000 distinctive stimuli. Every stimulus was transformed into 16 simple numerical attributes (arithmetical moments and edge amounts) which were then ascended to be suitable into a range of numeral values from 0 to 15. We naturally chose, arbitrarily, 1,000 distinctive stimuli for this research. We made certain that the scattering remnants the similar after selecting the one thousand stimuli. In this research, a neural network tool (Just NN) was used for the purpose of predicting to classify every of a huge number of black and white four-sided pixel displays as one of the 26 capital letters in the English language.*

Keywords*:* Letter Recognition, Alphabet, Artificial Neural network, Back-Propagation Neural Network, Prediction.

1. INTRODUCTION

Letter Image Recognition Data was initially invented by David Slate in 1991. In the beginning, he produced these data to examine the capability of numerous variations of Holland-style adaptive classifier systems to acquire and properly predict the letter classes related with vectors of 16 numeral attributes extracted from raster scan images of the letters. Research consequences and practice worldwide offers clear indication is to classify every one of the huge number of black-and-white rectangular pixel displays as one of the 26 capital letters in the English alphabet, this is very significant for each one who use English language.

The attributes are:

x-box: horizontal position of box,
y-box: vertical position of box,
width: width of box,
high: height of box,
onpix: total # on pixels,
x-bar: mean x of on pixels in box,
y-bar: mean y of on pixels in box,
x2bar: mean x variance,
y2bar: mean y variance,
xybar: mean x y correlation,
x2ybr: mean of x * x * y,
xy2br: mean of x * y * y,
x-ege: mean edge count left to right,
xegvy: correlation of x-ege with y,
y-ege: mean edge count bottom to top,
yegvx: correlation of y-ege with x.

For instance, the horizontal position, together with pixels starting from the left edge of the image, of the midpoint of the least rectangular box that can be drawn with all on pixels inside the box while the vertical position, counting pixels from the bottom, of the box. All features values are numeric (1-15). The letters interval is (1-26 values) which means letter A to letter Z.
Therefore, in this research, a neural network tool was used for the purpose of predicting to recognize each of a huge number of black and white four-sided pixel displays as one of the 26 capital letters in the English alphabet language.

2. LITERATURE REVIEW

Abu Naser employed Artificial Neural Networks [1] and expert systems [2-3] to obtain knowledge for the learner model in the Linear Programming Intelligent Tutoring System to be able to determine the academic performance level of the learners in order to offer the learner the suitable difficulty level of linear programming problems to solve. Feed forward Back-propagation algorithm was trained with a group of learner's data to predict their academic performance. The accuracy of predicting the performance of the learners was very high and thus states that the Artificial Neural Network is skilled enough to make suitable predictions.

3. ARTIFICIAL NEURAL NETWORKS

DARPA Neural Network Study (1988) define a Neural Network (NN) as: "a neural network is a system composed of many simple processing elements operating in parallel whose function is determined by network structure, connection strengths, and the processing performed at computing elements or nodes.", NN technique are consists from three layers, input layer, hidden layer and output layer, see Figure 1[4-24].

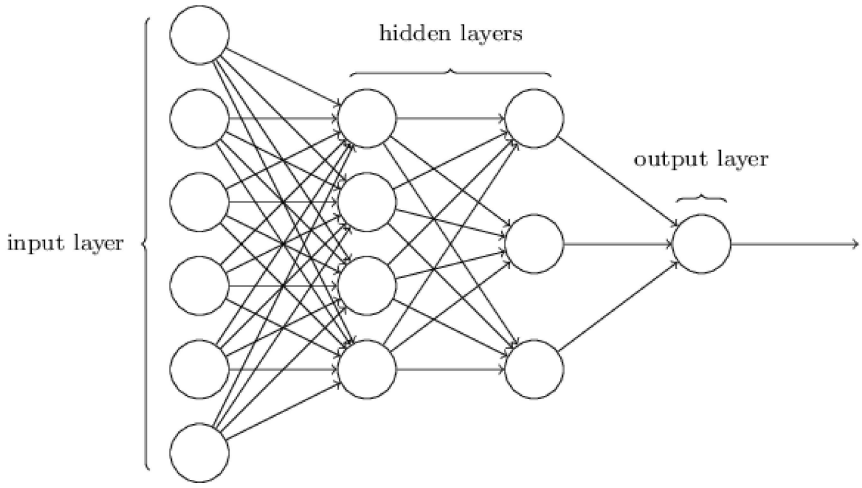

Figure1: Example of Neural Network architecture

The input and output layers must be numeric values preferred to contemplate compelling to (0-1) range. Therefore if we have definite input format, we must transform it to numerical values and gauge it to (0-1) range. Additionally the Weight is performance parameters of the feed-forward neural network in hidden layer. The training algorithm of the Artificial Neural Net (ANN) is exaggerated by, starting with random weights, bestowing the data, instance by instance, adjusting the weights conferring the error for each instance, and repeating until the error become very small[4]. The backpropagation algorithm adujust the weights using the variance of actual output and the function output for each instance.
Neural Networks are networks of neurons, for example, as found in real (i.e. biological) brains [5, 41-46].

In this study, a neural network tool, Just Neural Network (JNN), was used for the determination of predicting and identifying each of a huge number of black and white rectangular pixel displays as one of the 26 capital letters in the English alphabet. The system incorporates Neural Network with Backpropagation[25-30] learning algorithm to inaugurate a prediction model to be useful in predicting Letter Recognition choice that employ Neural Network with Feedforward algorithm [31-40,48-54].

4. METHODOLOGY

4.1 The Input Variables

To construct a prediction model, a data set containing 1000 of records were trained. The data was taken from Odesta Corporation; 1890 Maple Ave; Suite 115; Evanston, IL 60201 David J. Slate (January, 1991) The samples character images were based on 20 different fonts and each letter within these 20 fonts was arbitrarily distorted to yield a file of 20,000 matchless stimuli. Every stimulus was transformed into 16 basic numerical attributes (statistical moments and edge counts) which were then scaled to fit into a range of numeric values from 0 to 15 (As shown in table 1).

Table1: Input variables, their meaning, and Range

S.	Input Variable	Meaning	Value Range
1	x-box	horizontal position of box	0-15
2	y-box	vertical position of box	0-15
3	width	width of box	0-15
4	high	height of box	0-15
5	onpix	number of on pixels	0-15
6	x-bar	mean number of on pixels in x-direction	0-15
7	y-bar	mean number of on pixels in y-direction	0-15
8	x2bar	mean x variance	0-15
9	y2bar	mean y variance	0-15
10	xybar	mean x-y correlation	0-15

11	x2ybar	mean of x*x*y	0-15
12	xy2bar	mean of x*y*y	0-15
13	x-ege	mean edge count left to right	0-15
14	xegvy	correlation of x-ege and y	0-15
15	y-ege	mean edge count top to bottom	0-15
16	yegvx	correlation of y-ege and x	0-15

4.2 The Output Variables

Table 2 shows the output variable (Letter), its meaning, and its value rage ('A'..'Z').

Table 2: Output variable, its meaning, and Range

S.	Output Variable	Meaning	Value Range
1	letter	Capital Letter	'A'-'Z'

5. Design of the Neural Networks

5.1 Network Architecture

The network is a multilayer perceptron neural network using the linear sigmoid activation function with 16 input for the first layer, 11 input for first hidden layer and 1 input for the second layer, and 1 input for the output layer(as seen in Figure 2).

5.2 The Back-propagation

Here is the back-progration algorithm which wa used in training the ANN model [11-12]:

Initialize each wi to some small random value

Until the termination condition is met, Do

For each training example <(x1,…xn),t> Do

Input the instance (x1,…,xn) to the network and compute the network outputs ok

For each output unit k: $\delta k=ok(1-ok)(tk-ok)$

For each hidden unit h: $\delta h=oh(1-oh)\ \Sigma k\ wh,k\ \delta k$

For each network weight wj Do

$wi,j=wi,j+\Delta wi,j$,where $\Delta wi,j=\eta\ \delta j\ xi,j$ and η is the learning rate.

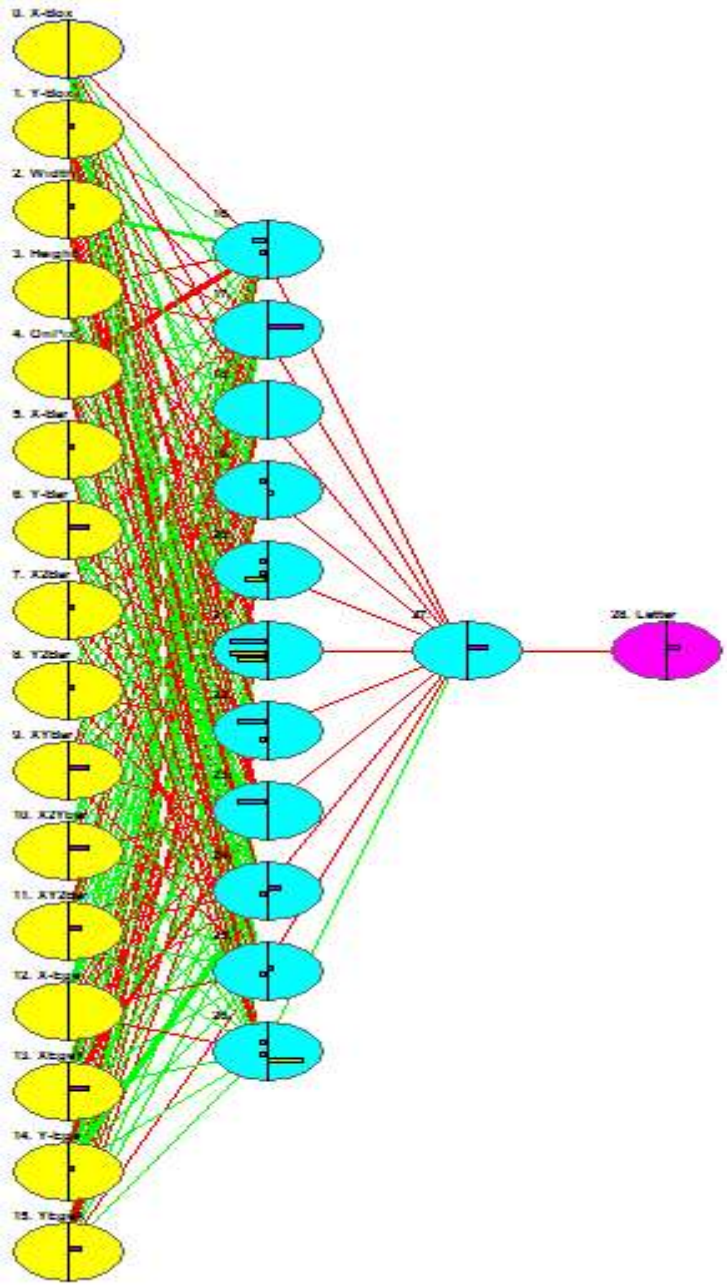

Figure 2: ANN final Architecture

6. Evaluation of Artificial Neural Network

The Dataset of Alphabet Letters consists of 19,990 samples. We divided it into a training set which consists of 14,900 with percentage of (75%) and a validating set which consists of 4999 with percentage of (25%). We have trained the ANN model using Just Neural Network (JNN) environment. Before training the ANN model with the training dataset, we prepared the data set by normalizing it using min-max normalization method. Then we trained the ANN model using the training dataset and validating it using the validation dataset. We determined the most important factors affecting the ANN model (as seen in Figure 3) and we got accuracy of 85.08% (as shown in Figure 4). The number of cycles for the training was 2836.

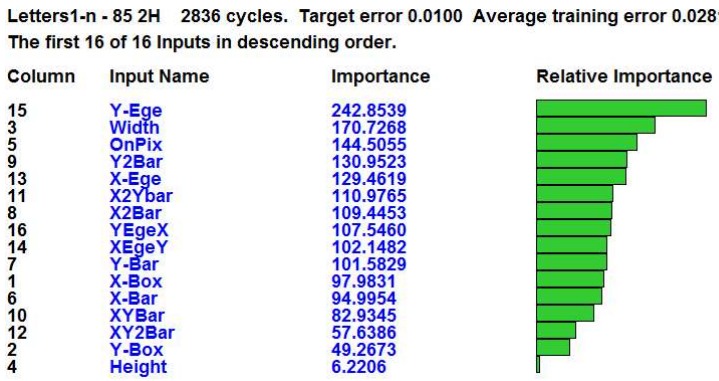

Figure 3: Most Influential factors in the ANN model

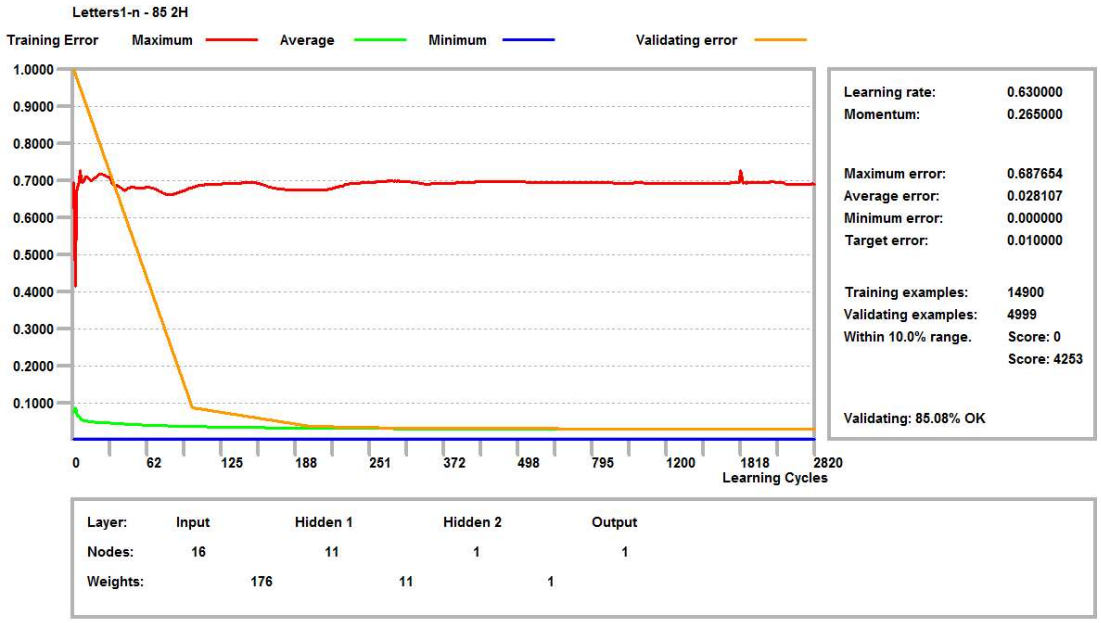

Figure 4: Training and validating of the ANN model

7. Conclusion

In this study, a neural network model was developed for the purpose of predicting the 26 alphabet letters. Hence, the result shows that the developed system can be used as a tool to assist in identifying each of a large number of black-and-white rectangular pixel displays as one of the 26 capital letters in the English alphabet. All 26 classes have almost the same number of samples. The accuracy of the evaluation of the model was 85.08%.

REFERENCES

1. Abu-Naser, S., Al-Masri, A., Sultan, Y. A., & Zaqout, I. (2011). A prototype decision support system for optimizing the effectiveness of elearning in educational institutions. International Journal of Data Mining & Knowledge Management Process (IJDKP), 1, 1-13.
2. Al-Sheakh H. (2013). Letter Recognition Data Using Neural Network, International Journal of Scientific and Engineering Research, May 2013
3. Abu Naser, S., Zaqout, I., Ghosh, M. A., Atallah, R., & Alajrami, E. (2015). Predicting Student Performance Using Artificial Neural Network: in the Faculty of Engineering and Information Technology. International Journal of Hybrid Information Technology, 8(2), 221-228.
4. Elzamly, A., Abu Naser, S. S., Hussin, B., & Doheir, M. (2015). Predicting Software Analysis Process Risks Using Linear Stepwise Discriminant Analysis: Statistical Methods. Int. J. Adv. Inf. Sci. Technol, 38(38), 108-115.
5. Abu Naser, S. S. (2012). Predicting learners performance using artificial neural networks in linear programming intelligent tutoring system. International Journal of Artificial Intelligence & Applications, 3(2), 65.
6. Elzamly, A., Hussin, B., Abu Naser, S. S., Shibutani, T., & Doheir, M. (2017). Predicting Critical Cloud Computing Security Issues using Artificial Neural Network (ANNs) Algorithms in Banking Organizations.

International Journal of Information Technology and Electrical Engineering, 6(2), 40-45.
7. Abu Naser, S. S., & Al-Bayed, M. H. (2016). Detecting Health Problems Related to Addiction of Video Game Playing Using an Expert System. World Wide Journal of Multidisciplinary Research and Development, 2(9), 7-12.
8. Abu Ghali, M. J., Mukhaimer, M. N., Abu Yousef, M. K., & Abu Naser, S. S. (2017). Expert System for Problems of Teeth and Gums. International Journal of Engineering and Information Systems (IJEAIS), 1(4), 198-206.
9. Abu Naser, S., & Akkila, A. N. (2008). A Proposed Expert System for Skin Diseases Diagnosis. INSInet Publication. Journal of Applied Sciences Research, 4(12), 1682-1693.
10. El Agha, M., Jarghon, A., & Abu Naser, S. S. (2017). Polymyalgia Rheumatic Expert System. International Journal of Engineering and Information Systems (IJEAIS), 1(4), 125-137.
11. Abu Naser, S., Al-Dahdooh, R., Mushtaha, A., & El-Naffar, M. (2010). Knowledge management in ESMDA: expert system for medical diagnostic assistance. AIML Journal, 10(1), 31-40.
12. Almurshidi, S. H., & Abu-Naser, S. S. (2018). EXPERT SYSTEM FOR DIAGNOSING BREAST CANCER. Al-Azhar University, Gaza, Palestine.
13. Abu Naser, S. S., & Alawar, M. W. (2016). An expert system for feeding problems in infants and children. International Journal of Medicine Research, 1(2), 79-82.
14. Al Rekhawi, H. A., Ayyad, A. A., & Abu Naser, S. S. (2017). Rickets Expert System Diagnoses and Treatment. International Journal of Engineering and Information Systems (IJEAIS), 1(4), 149-159.
15. Abu Naser, S. S., & AlDahdooh, R. M. (2016). Lower Back Pain Expert System Diagnosis and Treatment. Journal of Multidisciplinary Engineering Science Studies (JMESS), 2(4), 441-446.
16. Nabahin, A., Abou Eloun, A., & Abu Naser, S. S. (2017). Expert System for Hair Loss Diagnosis and Treatment. International Journal of Engineering and Information Systems (IJEAIS), 1(4), 160-169.
17. Abu Naser, S. S., & Alhabbash, M. I. (2016). Male Infertility Expert system Diagnoses and Treatment. American Journal of Innovative Research and Applied Sciences, 2(4).
18. Qwaider, S. R., & Abu Naser, S. S. (2017). Expert System for Diagnosing Ankle Diseases. International Journal of Engineering and Information Systems (IJEAIS), 1(4), 89-101.
19. Abu Naser, S. S., & Al-Hanjori, M. M. (2016). An expert system for men genital problems diagnosis and treatment. International Journal of Medicine Research, 1(2), 83-86.
20. Naser, S. S. A., & Hasanein, H. A. A. (2016). Ear Diseases Diagnosis Expert System Using SL5 Object. World Wide Journal of Multidisciplinary Research and Development, 2(4), 41-47.
21. Nassr, M. S., & Abu Naser, S. S. (2018). Knowledge Based System for Diagnosing Pineapple Diseases. International Journal of Academic Pedagogical Research (IJAPR), 2(7), 12-19.
22. Abu Naser, S. S., & El-Najjar, A. E. A. (2016). An expert system for nausea and vomiting problems in infants and children. International Journal of Medicine Research, 1(2), 114-117.
23. Elqassas, R.,& Abu-Naser, S. S. (2018). Expert System for the Diagnosis of Mango Diseases. International Journal of Academic Engineering Research (IJAER) 2 (8), 10-18.
24. Naser, S. S. A., & Hilles, M. M. (2016). An expert system for shoulder problems using CLIPS. World Wide Journal of Multidisciplinary Research and Development, 2(5), 1-8.
25. Musleh, M. M., & Abu-Naser, S. S. (2018). Rule Based System for Diagnosing and Treating Potatoes Problems. International Journal of Academic Engineering Research (IJAER) 2 (8), 1-9.
26. Abu Naser, S. S., & Hamed, M. A. (2016). An Expert System for Mouth Problems in Infants and Children. Journal of Multidisciplinary Engineering Science Studies (JMESS), 2(4), 468-476.
27. Almadhoun, H., & Abu-Naser, S. (2017). Banana Knowledge Based System Diagnosis and Treatment. International Journal of Academic Pedagogical Research (IJAPR), 2(7), 1-11.
28. Abu Naser, S. S., & Mahdi, A. O. (2016). A proposed Expert System for Foot Diseases Diagnosis. American Journal of Innovative Research and Applied Sciences, 2(4), 155-168.
29. Dahouk, A. W., & Abu-Naser, S. S. (2018). A Proposed Knowledge Based System for Desktop PC Troubleshooting. International Journal of Academic Pedagogical Research (IJAPR) 2 (6), 1-8
30. Abu Naser, S. S., & Ola, A. Z. A. (2008). AN EXPERT SYSTEM FOR DIAGNOSING EYE DISEASES USING CLIPS. Journal of Theoretical & Applied Information Technology, 4(10).
31. Bakeer, H., & Abu-Naser, S. S. (2017). Photo Copier Maintenance Expert System V. 01 Using SL5 Object Language. International Journal of Engineering and Information Systems (IJEAIS) 1 (4), 116-124.
32. Abu Naser, S. S., & Shaath, M. Z. (2016). Expert system urination problems diagnosis. World Wide Journal of Multidisciplinary Research and Development, 2(5), 9-19.
33. Khella, R., & Abu-Naser, S. S. (2017). Rule Based System for Chest Pain in Infants and Children. International Journal of Engineering and Information Systems 1 (4), 138-148.
34. Abu-Naser, S. S., El-Hissi, H., Abu-Rass, M., & El-Khozondar, N. (2010). An expert system for endocrine

diagnosis and treatments using JESS. Journal of Artificial Intelligence; Scialert, 3(4), 239-251.
35. Mrouf, A., Albatish, I., Mosa, M., & Abu Naser, S. S. (2017). Knowledge Based System for Long-term Abdominal Pain (Stomach Pain) Diagnosis and Treatment. International Journal of Engineering and Information Systems (IJEAIS) 1 (4), 71-88.
36. Abu Naser, S. S., Baraka, M. H.,& Baraka, A. R. (2008). A Proposed Expert System For Guiding Freshman Students In Selecting A Major In Al-Azhar University, Gaza.Journal of Theoretical & Applied Information Technology 4(9).
37. Abu-Nasser, B. S., & Abu-Naser, S. S. (2018). Cognitive System for Helping Farmers in Diagnosing Watermelon Diseases. International Journal of Academic Information Systems Research (IJAISR) 2 (7), 1-7.
38. Abu Naser, S. S., Alamawi, W. W., & Alfarra, M. F. (2016). Rule Based System for Diagnosing Wireless Connection Problems Using SL5 Object. International Journal of Information Technology and Electrical Engineering 5(6), 26-33.
39. Akkila, A. N., & Abu Naser, S. S. (2016). Proposed Expert System for Calculating Inheritance in Islam. World Wide Journal of Multidisciplinary Research and Development 2 (9), 38-48.
40. Abu Naser, S. S., & Zaqout, I. S. (2016). Knowledge-based systems that determine the appropriate students major: In the faculty of engineering and information technology, World Wide Journal of Multidisciplinary Research and Development 2 (10), 26-34.
41. AbuEl-Reesh, J. Y., & Abu Naser, S. S. (2017). A Knowledge Based System for Diagnosing Shortness of Breath in Infants and Children. International Journal of Engineering and Information Systems (IJEAIS) 1 (4), 102-115.
42. Abu Naser, S. S., & Bastami, B. G. (2016). A proposed rule based system for breasts cancer diagnosis. World Wide Journal of Multidisciplinary Research and Development 2 (5), 27-33.
43. Abu-Nasser, B. S. (2017). Medical Expert Systems Survey. International Journal of Engineering and Information Systems, 1(7), 218-224.
44. Abu Naser, S. S., & ALmursheidi, S. H. (2016). A Knowledge Based System for Neck Pain Diagnosis. World Wide Journal of Multidisciplinary Research and Development (WWJMRD), 2(4), 12-18.
45. Azaab, S., Abu Naser, S., & Sulisel, O. (2000). A proposed expert system for selecting exploratory factor analysis procedures. Journal of the College of Education 4 (2), 9-26.
46. Abu-Naser, S. S., Kashkash, K. A., & Fayyad, M. (2010). Developing an expert system for plant disease diagnosis. Journal of Artificial Intelligence, 3 (4), 269-276.
47. Barhoom, A. M., & Abu-Naser, S. S. (2018). Black Pepper Expert System. International Journal of Academic Information Systems Research, (IJAISR) 2 (8), 9-16.
48. AlZamily, J. Y., & Abu-Naser, S. S. (2018). A Cognitive System for Diagnosing Musa Acuminata Disorders. International Journal of Academic Information Systems Research, (IJAISR) 2 (8), 1-8.
49. Alajrami, M. A., & Abu-Naser, S. S. (2018). Onion Rule Based System for Disorders Diagnosis and Treatment. International Journal of Academic Pedagogical Research (IJAPR), 2 (8), 1-9.
50. Al-Shawwa, M., Al-Absi, A., Abu Hassanein, S., Abu Baraka, K., & Abu-Naser, S. S. (2018). Predicting Temperature and Humidity in the Surrounding Environment Using Artificial Neural Network. International Journal of Academic Pedagogical Research (IJAPR), 2(9), 1-6.
51. Salah, M., Altalla, K., Salah, A., & Abu-Naser, S. S. (2018). Predicting Medical Expenses Using Artificial Neural Network. International Journal of Engineering and Information Systems (IJEAIS), 2(20), 11-17.
52. Marouf, A., & Abu-Naser, S. S. (2018). Predicting Antibiotic Susceptibility Using Artificial Neural Network. International Journal of Academic Pedagogical Research (IJAPR), 2(10), 1-5.
53. Jamala, M. N., & Abu-Naser, S. S. (2018). Predicting MPG for Automobile Using Artificial Neural Network Analysis. International Journal of Academic Information Systems Research (IJAISR), 2(10), 5-21.
54. Kashf, D. W. A., Okasha, A. N., Sahyoun, N. A., El-Rabi, R. E., & Abu-Naser, S. S. (2018). Predicting DNA Lung Cancer using Artificial Neural Network. International Journal of Academic Pedagogical Research (IJAPR), 2(10), 6-13.