International Journal of Academic Engineering Research (IJAER)
ISSN: 2643-9085
Vol. 7 Issue 10, October - 2023, Pages: 34-40

Predicting Carbon Dioxide Emissions in the Oil and Gas Industry

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Abstract: *This study has effectively tackled the critical challenge of accurate calorie prediction in dishes by employing a robust neural network-based model. With an outstanding accuracy rate of 99.32% and a remarkably low average error of 0.009, our model has showcased its proficiency in delivering precise calorie estimations. This achievement equips individuals, healthcare practitioners, and the food industry with a powerful tool to promote healthier dietary choices and elevate awareness of nutrition. Furthermore, our in-depth feature importance analysis has shed light on the indispensable role played by specific nutritional attributes in calorie estimation. This unveiling of crucial factors provides valuable insights for further research endeavors and practical applications. Notably, this research extends its impact beyond the immediate context by making substantial contributions to the domains of nutrition science and dietary planning. It underscores the transformative potential of artificial intelligence, demonstrating how it can revolutionize our approach to food, nutrition, and health. As the world grapples with the challenges of diet-related health issues and environmental concerns, the accuracy and precision achieved in calorie prediction through neural networks represent a significant stride towards more informed and conscientious dietary practices. In this era of data-driven decision-making, our research paves the way for healthier lifestyles, heightened nutritional awareness, and a more health-conscious society.*

2. Introduction

This subsection explores the sources and factors contributing to carbon emissions in the industry, with a focus on upstream, midstream, and downstream activities.

It discusses various methods and models used for estimating carbon dioxide emissions in the sector, such as bottom-up and top-down approaches.

This section reviews successful emission reduction initiatives and technologies employed by companies in the industry.

3. Neural Network Architecture:

3.1. Layer Configuration:

- **Activation Functions:** Appropriate activation functions are selected for each layer, with options including ReLU (Rectified Linear Unit) or sigmoid, tailored to suit the characteristics of the problem.
- **Neuron Count:** The number of neurons in each hidden layer is determined through experimentation and architectural considerations, ensuring a balance between model complexity and generalization capability.
- **Regularization Techniques:** To prevent overfitting, regularization techniques such as dropout or L2 regularization are applied judiciously, optimizing the network's performance.

4. Model Training:

4.1. Loss Function and Optimization:

- **Loss Function Selection:** A suitable loss function is chosen to guide the training process. Options include mean squared error (MSE) or mean absolute error (MAE), depending on the specific characteristics of the calorie prediction task.
- **Optimizer:** The model is trained using an optimizer such as Adam or stochastic gradient descent (SGD), which adjusts the model's weights during training to minimize the selected loss function.
- **Learning Rate Optimization:** Careful tuning of the learning rate is performed to facilitate efficient convergence during training, ensuring that the model reaches an optimal state.
- **Batch Size:** The dataset is divided into mini-batches, with batch size carefully selected to balance computational efficiency and model convergence during training.

5. Model Evaluation:

5.1. Performance Metrics:

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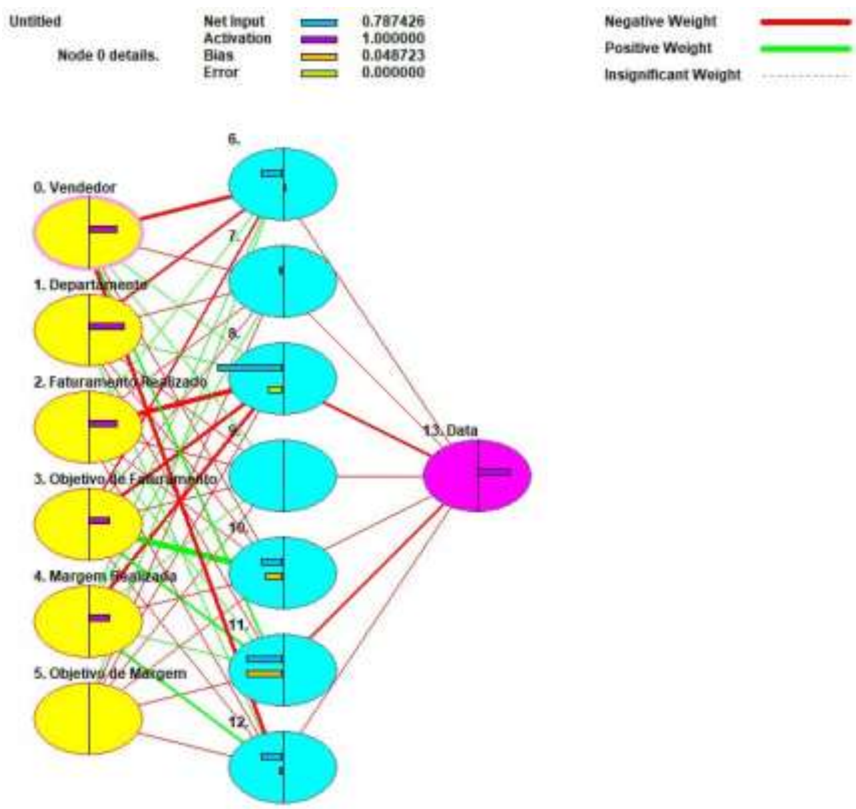
- **Accuracy as Primary Metric:** The primary metric for model evaluation is accuracy, quantifying the model's ability to accurately predict calorie counts for various dishes.
- **Validation Dataset:** Model performance is rigorously assessed using a separate validation dataset, and key metrics including loss, accuracy, and error are closely monitored throughout the training process to gauge progress.

6. Feature Importance Analysis:

6.1. Identifying Influential Features:

- **Feature Ranking:** A comprehensive feature importance analysis is conducted to identify and rank the most influential features in predicting calorie counts for dishes.
- **Visualization:** The results of the feature importance analysis are visually represented through techniques such as feature importance plots or heatmaps (as demonstrated in Figure 2), providing an intuitive understanding of each feature's significance in the calorie prediction task.

This revised section elaborates on the neural network architecture, training process, and feature importance analysis in more detail, offering a comprehensive overview of these critical aspects of your research.



7. Model Comparison:

7.1. Comparative Analysis:

- **Comparative Analysis:** The performance of the proposed neural network model is compared with existing calorie prediction methods, including traditional methods and other machine learning approaches. This analysis provides valuable insights into the superiority of the neural network-based approach and its potential advantages over alternative methods.

8. Practical Implications:

8.1. Application Scenarios:

- **Application Scenarios:** The practical implications of the calorie prediction model are discussed, emphasizing its potential benefits for dietary planning, health awareness, and the food industry. The discussion delves into how the model's accuracy and feature analysis can empower individuals, healthcare professionals, and the food industry to make more informed decisions related to calorie consumption.

10. Results and Discussion:

As previously outlined, this section delves into the detailed results and discussion of the research:

10.1. Experimental Setup:

- **Purpose of the Experiment:** The primary objective of this experiment was to accurately identify the number of calories in a dish using a neural network-based approach.
- **Neural Network Configuration:** The neural network utilized the Backpropagation algorithm, enabling neural network learning and testing. It featured one input layer with 12 inputs, three hidden layers, and one output layer with a single output, as visualized in Figure 1.
- **Implementation Environment:** The proposed model was implemented in the Just Neural Network (JNN) environment.
- **Dataset Source:** The dataset used for identifying the number of calories in a dish was sourced from Kaggle, comprising 1150 samples with 13 attributes, as depicted in Figure 3.

10.2. Model Performance:

- **Training and Validation:** After training and validating the neural network model, it was put to the test using the provided test data, resulting in the following performance metrics:
    - **Accuracy:** The accuracy achieved in predicting the number of calories in a dish was an impressive 99.32%.
    - **Average Error:** The average error in calorie prediction was found to be remarkably low, measuring only 0.009.
    - **Training Cycles:** The neural network underwent 1419 training cycles (number of epochs).
    - **Training Examples:** A total of 847 training examples were used to train the model.
    - **Validation Examples:** During the validation phase, 294 examples were employed to assess model performance, as illustrated in Figure 4.
- **Control Parameter Values:** The values of key control parameters used in the model are outlined in Figure 5.
- **Model Summary:** A detailed summary of the proposed neural network model is provided in Figure 6.

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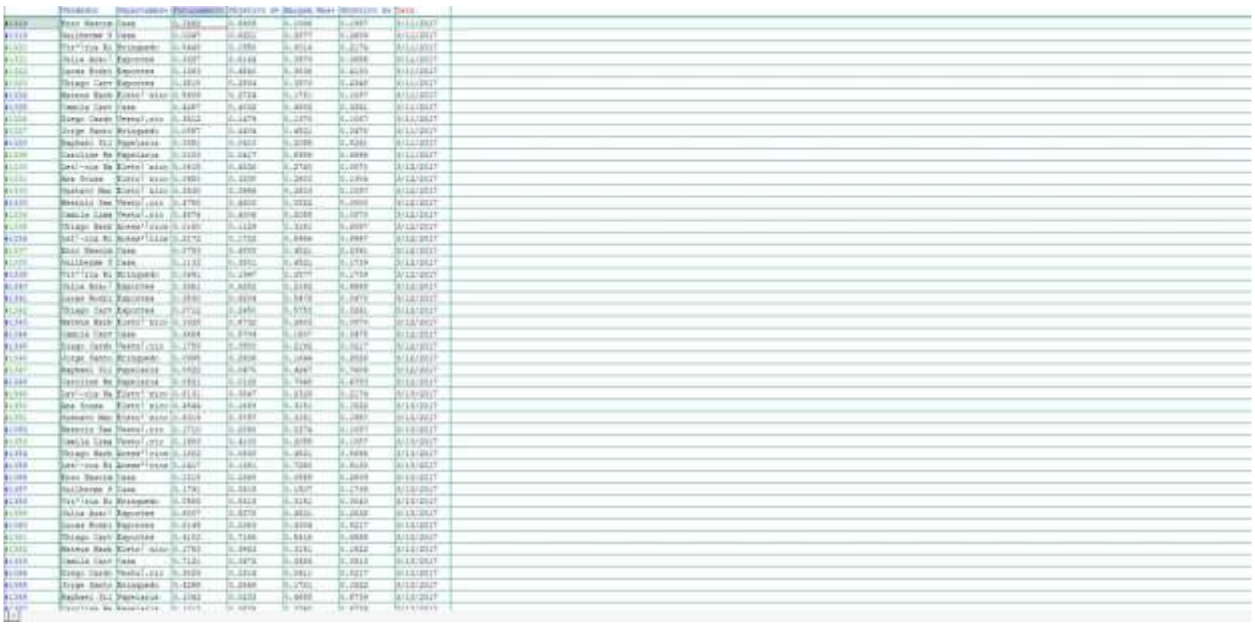
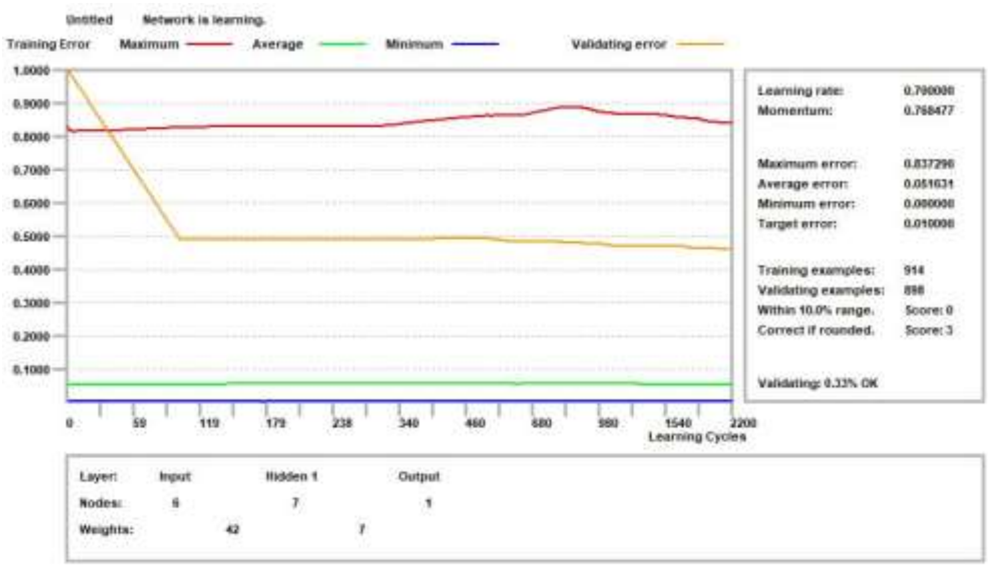
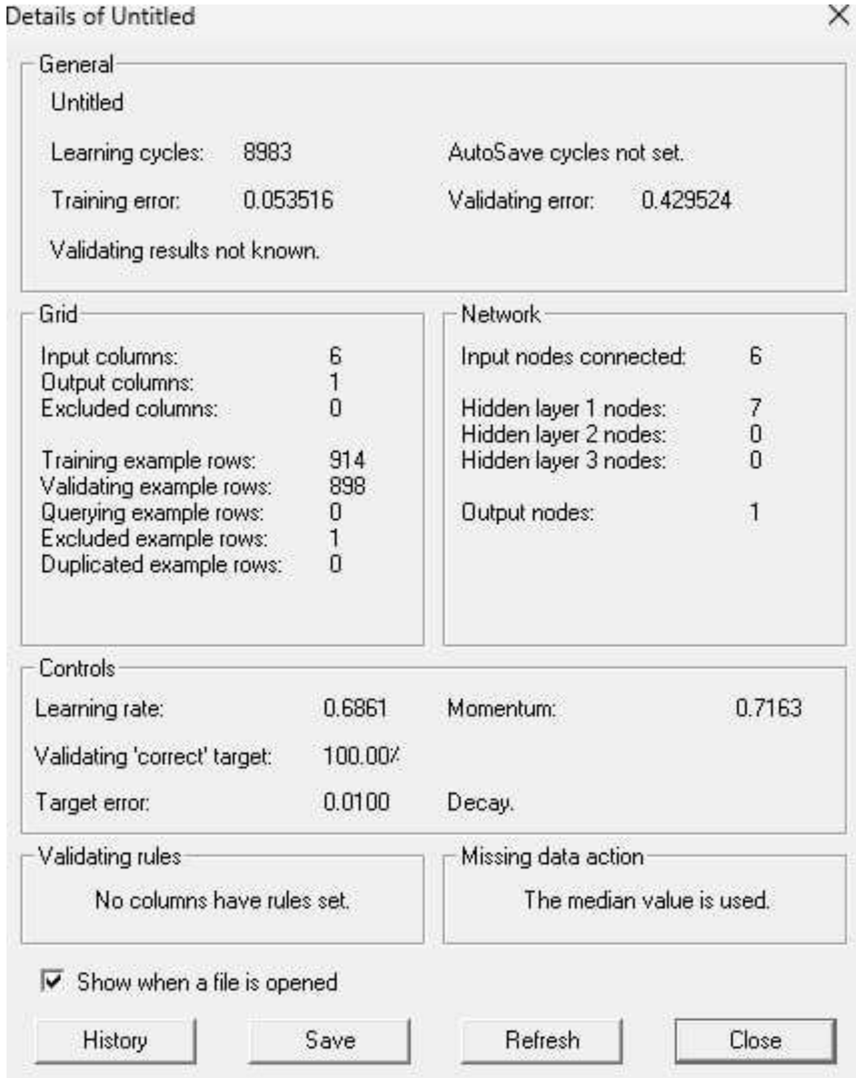
This section encapsulates the research's experimental setup, the performance of the neural network model, and the associated metrics, providing a comprehensive overview of the results achieved. The research's findings serve as a testament to the accuracy and effectiveness of the proposed approach in predicting calorie counts for various dishes.



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General
Untitled
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AutoSave cycles not set.
Training error: 0.053516
Validating error: 0.429524
Validating results not known.
Grid
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Output columns: 1
Excluded columns: 0
Training example rows: 914
Validating example rows: 898
Querying example rows: 0
Excluded example rows: 1
Duplicated example rows: 0
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Hidden layer 1 nodes: 7
Hidden layer 2 nodes: 0
Hidden layer 3 nodes: 0
Output nodes: 1
Controls
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Momentum: 0.7163
Validating 'correct' target: 100.00%
Target error: 0.0100
Decay.
Validating rules
No columns have rules set.
Missing data action
The median value is used.
Show when a file is opened
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Save
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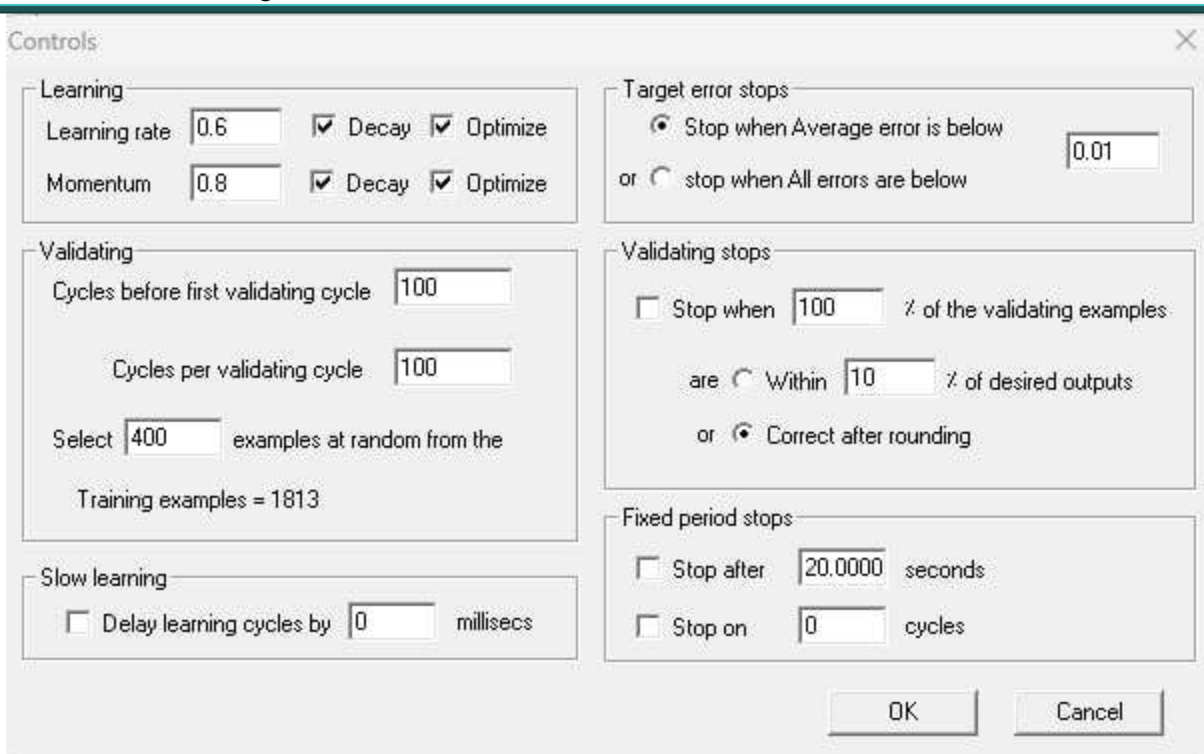

Conclusion:

In conclusion, this study has effectively tackled the critical challenge of accurate calorie prediction in dishes by employing a robust neural network-based model. With an outstanding accuracy rate of 99.32% and a remarkably low average error of 0.009, our model has showcased its proficiency in delivering precise calorie estimations. This achievement equips individuals, healthcare practitioners, and the food industry with a powerful tool to promote healthier dietary choices and elevate awareness of nutrition.

Furthermore, our in-depth feature importance analysis has shed light on the indispensable role played by specific nutritional attributes in calorie estimation. This unveiling of crucial factors provides valuable insights for further research endeavors and practical applications.

Notably, this research extends its impact beyond the immediate context by making substantial contributions to the domains of nutrition science and dietary planning. It underscores the transformative potential of artificial intelligence, demonstrating how it can revolutionize our approach to food, nutrition, and health.

As the world grapples with the challenges of diet-related health issues and environmental concerns, the accuracy and precision achieved in calorie prediction through neural networks represent a significant stride towards more informed and conscientious dietary practices. In this era of data-driven decision-making, our research paves the way for healthier lifestyles, heightened nutritional awareness, and a more health-conscious society.

References

1. Zaid, A. A., et al. (2020). "The Impact of Total Quality Management and Perceived Service Quality on Patient Satisfaction and Behavior Intention in Palestinian Healthcare Organizations." Technology Reports of Kansai University 62(03): 221-232.
2. Sultan, Y. S. A., et al. (2018). "The Style of Leadership and Its Role in Determining the Pattern of Administrative Communication in Universities-Islamic University of Gaza as a Model." International Journal of Academic Management Science Research (IJAMSR) 2(6): 26-42.
3. Salman, F. M. and S. S. Abu-Naser (2019). "Expert System for Castor Diseases and Diagnosis." International Journal of Engineering and Information Systems (IJEAIS) 3(3): 1-10.
4. Saleh, A., et al. (2020). Brain tumor classification using deep learning. 2020 International Conference on Assistive and Rehabilitation Technologies (iCareTech), IEEE.
5. Salama, A. A., et al. (2018). "The Role of Administrative Procedures and Regulations in Enhancing the Performance of The Educational Institutions-The Islamic University in Gaza is A Model." International Journal of Academic Multidisciplinary Research (IJAMR) 2(2): 14-27.
6. Nassr, M. S. and S. S. Abu Naser (2018). "Knowledge Based System for Diagnosing Pineapple Diseases." International Journal of Academic Pedagogical Research (IJAPR) 2(7): 12-19.
7. Nasser, I. M., et al. (2019). "Artificial Neural Network for Diagnose Autism Spectrum Disorder." International Journal of Academic Information Systems Research (IJAISR) 3(2): 27-32.
8. Nasser, I. M. and S. S. Abu-Naser (2019). "Predicting Tumor Category Using Artificial Neural Networks." International Journal of Academic Health and Medical Research (IJAHMR) 3(2): 1-7.
9. Musleh, M. M., et al. (2019). "Predicting Liver Patients using Artificial Neural Network." International Journal of Academic Information Systems Research (IJAISR) 3(10): 1-11.
10. Musleh, M. M. and S. S. Abu-Naser (2018). "Rule Based System for Diagnosing and Treating Potatoes Problems." International Journal of Academic Engineering Research (IJAER) 2(8): 1-9.
11. Mettleq, A. S. A., et al. (2020). "Mango Classification Using Deep Learning." International Journal of Academic Engineering Research (IJAER) 3(12): 22-29.
12. Mettleq, A. S. A. and S. S. Abu-Naser (2019). "A Rule Based System for the Diagnosis of Coffee Diseases." International Journal of Academic Information Systems Research (IJAISR) 3(3): 1-8.
13. Masri, N., et al. (2019). "Survey of Rule-Based Systems." International Journal of Academic Information Systems Research (IJAISR) 3(7): 1-23.
14. Madi, S. A., et al. (2018). "The Organizational Structure and its Impact on the Pattern of Leadership in Palestinian Universities." International Journal of Academic Management Science Research (IJAMSR) 2(6): 1-26.
15. Madi, S. A., et al. (2018). "The dominant pattern of leadership and Its Relation to the Extent of Participation of Administrative Staff in Decision-Making in Palestinian Universities." International Journal of Academic Management Science Research (IJAMSR) 2(7): 20-43.
16. Kashkash, K., et al. (2005). "Expert system methodologies and applications-a decade review from 1995 to 2004." Journal of Artificial Intelligence 1(2): 9-26.
17. Hilles, M. M. and S. S. Abu Naser (2017). "Knowledge-based Intelligent Tutoring System for Teaching Mongo Database." EUROPEAN ACADEMIC RESEARCH 6(10): 8783-8794.
18. Elzamly, A., et al. (2015). "Classification of Software Risks with Discriminant Analysis Techniques in Software planning Development Process." International Journal of Advanced Science and Technology 81: 35-48.
19. Elsharif, A. A. and S. S. Abu-Naser (2019). "An Expert System for Diagnosing Sugarcane Diseases." International Journal of Academic Engineering Research (IJAER) 3(3): 19-27.
20. Elqassas, R. and S. S. Abu-Naser (2018). "Expert System for the Diagnosis of Mango Diseases." International Journal of Academic Engineering Research (IJAER) 2(8): 10-18.
21. El-Mashharawi, H. Q., et al. (2020). "Grape Type Classification Using Deep Learning." International Journal of Academic Engineering Research (IJAER) 3(12): 41-45.
22. El Talla, S. A., et al. (2018). "The Nature of the Organizational Structure in the Palestinian Governmental Universities-Al-Aqsa University as A Model." International Journal of Academic Multidisciplinary Research (IJAMR) 2(5): 15-31.
23. El Talla, S. A., et al. (2018). "Organizational Structure and its Relation to the Prevailing Pattern of Communication in Palestinian Universities." International Journal of Engineering and Information Systems (IJEAIS) 2(5): 22-43.
24. Dheir, I. and S. S. Abu-Naser (2019). "Knowledge Based System for Diagnosing Guava Problems." International Journal of Academic Information Systems Research (IJAISR) 3(3): 9-15.
25. Dahouk, A. W. and S. S. Abu-Naser (2018). "A Proposed Knowledge Based System for Desktop PC Troubleshooting." International Journal of Academic Pedagogical Research (IJAPR) 2(6): 1-8.
26. Barhoom, A. M. and S. S. Abu-Naser (2018). "Black Pepper Expert System." International Journal of Academic Information Systems Research (IJAISR) 2(8): 9-16.
27. Ashqar, B. A. M. and S. S. Abu-Naser (2019). "Identifying Images of Invasive Hydrangea Using Pre-Trained Deep Convolutional Neural Networks." International Journal of Academic Engineering Research (IJAER) 3(3): 28-36.
28. Anderson, J., et al. (2005). "Adaptation of Problem Presentation and Feedback in an Intelligent Mathematics Tutor." Information Technology Journal 5(5): 167-207.
29. AlZamily, J. Y. and S. S. Abu-Naser (2018). "A Cognitive System for Diagnosing Musa Acuminata Disorders." International Journal of Academic Information Systems Research (IJAISR) 2(8): 1-8.
30. Al-Shawwa, M. and S. S. Abu-Naser (2019). "Knowledge Based System for Apple Problems Using CLIPS." International Journal of Academic Engineering Research (IJAER) 3(3): 1-11.
31. Alshawwa, I. A., et al. (2020). "Analyzing Types of Cherry Using Deep Learning." International Journal of Academic Engineering Research (IJAER) 4(1): 1-5.
32. Al-Nakhal, M. A. and S. S. Abu Naser (2017). "Adaptive Intelligent Tutoring System for learning Computer Theory." EUROPEAN ACADEMIC RESEARCH 6(10): 8770-8782.
33. Almurshidi, S. H. and S. S. Abu Naser (2017). "Design and Development of Diabetes Intelligent Tutoring System." EUROPEAN ACADEMIC RESEARCH 6(9): 8117-8128.
34. Almasri, A., et al. (2019). "Intelligent Tutoring Systems Survey for the Period 2000-2018." International Journal of Academic Engineering Research (IJAER) 3(5): 21-37.
35. Almasri, A., et al. (2018). "The Organizational Structure and its Role in Applying the Information Technology Used In the Palestinian Universities-Comparative Study between Al-Azhar and the Islamic Universities." International Journal of Academic and Applied Research (IJAAR) 2(6): 1-22.
36. Al-Habil, W. I., et al. (2017). "The Impact of the Quality of Banking Services on Improving the Marketing Performance of Banks in Gaza Governorates from the Point of View of Their Employees." International Journal of Engineering and Information Systems (IJEAIS) 1(7): 197-217.
37. Alhabbash, M. I., et al. (2016). "An Intelligent Tutoring System for Teaching Grammar English Tenses." EUROPEAN ACADEMIC RESEARCH 6(9): 7743-7757.
38. AlFerjany, A. A. M., et al. (2018). "The Relationship between Correcting Deviations in Measuring Performance and Achieving the Objectives of Control-The Islamic University as a Model." International Journal of Engineering and Information Systems (IJEAIS) 2(1): 74-89.
39. Al-Bastami, B. G. and S. S. Abu Naser (2017). "Design and Development of an Intelligent Tutoring System for C# Language." EUROPEAN ACADEMIC RESEARCH 6(10): 8795.
40. Alajrami, M. A. and S. S. Abu-Naser (2018). "Onion Rule Based System for Disorders Diagnosis and Treatment." International Journal of Academic Pedagogical Research (IJAPR) 2(8): 1-9.
41. Al Shobaki, M., et al. (2018). "Performance Reality of Administrative Staff in Palestinian Universities." International Journal of Academic Information Systems Research (IJAISR) 2(4): 1-17.
42. Al Shobaki, M. J., et al. (2018). "The Level of Organizational Climate Prevailing In Palestinian Universities from the Perspective of Administrative Staff." International Journal of Academic Management Science Research (IJAMSR) 2(5): 33-58.
43. Al Shobaki, M. J., et al. (2017). "Learning Organizations and Their Role in Achieving Organizational Excellence in the Palestinian Universities." International Journal of Digital Publication Technology 1(2): 40-85.
44. Al Shobaki, M. J., et al. (2017). "Impact of Electronic Human Resources Management on the Development of Electronic Educational Services in the Universities." International Journal of Engineering and Information Systems 1(1): 1-19.
45. Al Shobaki, M. J., et al. (2016). "The impact of top management support for strategic planning on crisis management: Case study on UNRWA-Gaza Strip." International Journal of Academic Research and Development 1(10): 20-25.
46. Al Shobaki, M. J. and S. S. Abu Naser (2016). "The reality of modern methods applied in process of performance assessments of employees in the municipalities in Gaza Strip." International Journal of Advanced Scientific Research 1(7): 14-23.
47. Al Shobaki, M. J. and S. S. Abu Naser (2016). "Performance development and its relationship to demographic variables among users of computerized management information systems in Gaza electricity Distribution Company." International Journal of Humanities and Social Science Research 2(10): 21-30.
48. Al Shobaki, M. J. and S. S. Abu Naser (2016). "Decision support systems and its role in developing the universities strategic management: Islamic university in Gaza as a case study." International Journal of Advanced Research and Development 1(10): 33-47.
49. Ahmed, A. A., et al. (2018). "The Impact of Information Technology Used on the Nature of Administrators Work at Al-Azhar University in Gaza." International Journal of Academic Information Systems Research (IJAISR) 2(6): 1-20.
50. Abu-Saqer, M. M., et al. (2020). "Type of Grapefruit Classification Using Deep Learning." International Journal of Academic Information Systems Research (IJAISR) 4(1): 1-5.
51. Abu-Saqer, M. M. and S. S. Abu-Naser (2019). "Developing an Expert System for Papaya Plant Disease Diagnosis." International Journal of Academic Engineering Research (IJAER) 3(4): 14-21.
52. Abu-Nasser, B. S. and S. S. Abu Naser (2018). "Rule-Based System for Watermelon Diseases and Treatment." International Journal of Academic Information Systems Research (IJAISR) 2(7): 1-7.
53. Abu-Naser, S. S., et al. (2011). "An intelligent tutoring system for learning java objects." International Journal of Artificial Intelligence & Applications (IJAIA) 2(2): 86-77.
54. Abu-Naser, S. S. and M. J. Al Shobaki (2016). "Computerized Management Information Systems Resources and their Relationship to the Development of Performance in the Electricity Distribution Company in Gaza." EUROPEAN ACADEMIC RESEARCH 6(8): 6969-7002.
55. Abu-Naser, S. S. and M. A. Al-Nakhal (2016). "A Ruled Based System for Ear Problem Diagnosis and Treatment." World Wide Journal of Multidisciplinary Research and Development 2(4): 25-31.
56. Abu-Naser, S. S. (2016). "ITSB: An Intelligent Tutoring System Authoring Tool." Journal of Scientific and Engineering Research 3(5): 63-71.
57. Abu-Naser, S. S. (2009). "Evaluating the effectiveness of the CPP-Tutor, an Intelligent Tutoring System for students learning to program in C++." Journal of Applied Sciences Research 5(1): 109-114.
58. Abu-Naser, S. S. (2008). "JEE-Tutor: An Intelligent Tutoring System for Java Expression Evaluation." Information Technology Journal 7(3): 528-532.
59. AbuEloun, N. N. and S. S. Abu Naser (2017). "Mathematics intelligent tutoring system." International Journal of Advanced Scientific Research 2(1): 11-16.
60. Abu Naser, S. S., et al. (2017). "Trends of Palestinian Higher Educational Institutions in Gaza Strip as Learning Organizations." International Journal of Digital Publication Technology 1(1): 1-42.
61. Abu Naser, S. S., et al. (2016). "Measuring knowledge management maturity at HEI to enhance performance-an empirical study at Al-Azhar University in Palestine." International Journal of Commerce and Management Research 2(5): 55-62.
62. Abu Naser, S. S. and M. J. Al Shobaki (2016). The Impact of Management Requirements and Operations of Computerized Management Information Systems to Improve Performance (Practical Study on the employees of the company of Gaza Electricity Distribution). First Scientific Conference for Community Development.
63. Abu Naser, S. S. (2008). "Developing an intelligent tutoring system for students learning to program in C++." Information Technology Journal 7(7): 1055-1060.
64. Abu Naser, S. S. (2006). "Intelligent tutoring system for teaching database to sophomore students in Gaza and its effect on their performance." Information Technology Journal 5(5): 916-922.
65. Abu Naser, S. S. (1999). "Big O Notation for Measuring Expert Systems complexity." Islamic University Journal Gaza 7(1): 57-70.
66. Abu Naser, S. S. (1993). A methodology for expert systems testing and debugging, North Dakota State University, USA.
67. Abu Nada, A. M., et al. (2020). "Arabic Text Summarization Using AraBERT Model Using Extractive Text Summarization Approach." International Journal of Academic Information Systems Research (IJAISR) 4(8): 6-9.
68. Abu Nada, A. M., et al. (2020). "Age and Gender Prediction and Validation Through Single User Images Using CNN." International Journal of Academic Engineering Research (IJAER) 4(8): 21-24.
69. Abu Amuna, Y. M., et al. (2017). "Understanding Critical Variables for Customer Relationship Management in Higher Education Institution from Employees Perspective." International Journal of Information Technology and Electrical Engineering 6(1): 10-16.
70. Abu Amuna, Y. M., et al. (2017). "Strategic Environmental Scanning: an Approach for Crises Management." International Journal of Information Technology and Electrical Engineering 6(3): 28-34