International Journal of Academic Information Systems Research (IJAISR)
ISSN: 2643-9026
Vol. 9 Issue 6 June - 2025, Pages: 51-55

Identifying Images of Chess Pieces Using Deep Learning

Ahmed I. O. Alghalban, Samy S. Abu-Naser

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

***Abstract**: This research investigates the application of Convolutional Neural Networks (CNNs) for classifying chess pieces from image data. Using a balanced dataset comprising 10,000 labeled images across five chess piece categories—Queen, Rook, Bishop, Knight, and Pawn—we adapt a CNN model architecture initially developed for fruit classification and retrain it on chess piece data. Our approach incorporates data analysis techniques such as brightness distribution, RGB color histograms, and model interpretation through edge-based feature maps. Experimental results confirm that CNNs offer high accuracy and class-level differentiation when applied to structured visual objects like chess pieces.*

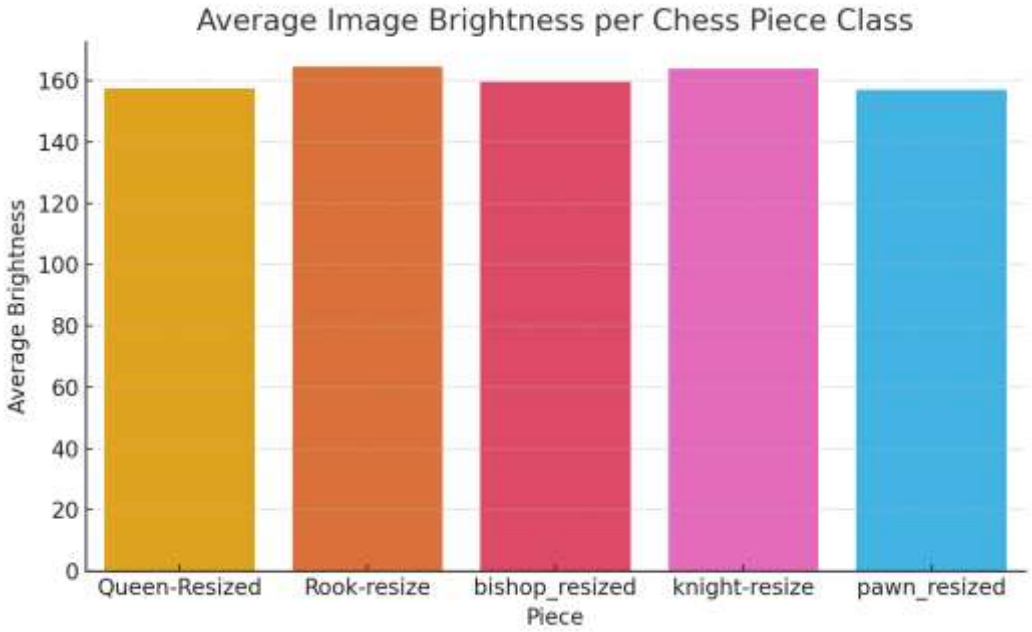
Keywords: Deep Learning, CNN, Image Classification, Chess Piece Recognition, Visual Analytics

1. Introduction

Chess piece classification using image recognition is a growing area of interest in the intersection of computer vision and artificial intelligence. Reliable classification of individual chess pieces enables downstream applications such as board reconstruction, game analysis, and AR/VR chess systems. Given the consistent geometry of chess pieces, CNNs offer a promising avenue for learning class-specific features from labeled images.

2. Dataset and Visual Characteristics

The dataset used in this research consists of 10,000 RGB images distributed equally among five chess piece classes. Each image was resized to 150x150 pixels to standardize input dimensions. Instead of showing a basic count distribution, Figure 1 displays the average brightness per class to highlight intrinsic visual differences in grayscale intensity. This can affect early convolutional filters in the CNN model.



To further understand visual characteristics, Figure 2 shows RGB color histograms per class. While all pieces are similar in material, differences in background, shadow, and illumination create color biases that can impact the learning process.

International Journal of Academic Information Systems Research (IJAISR)
ISSN: 2643-9026
Vol. 9 Issue 6 June - 2025, Pages: 51-55

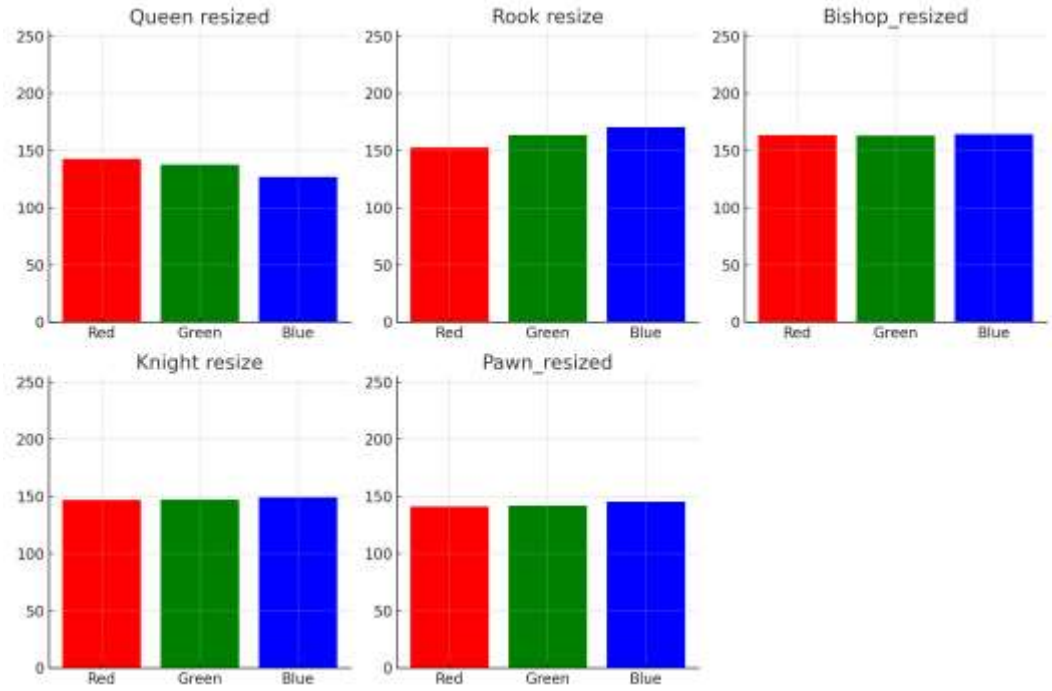


Figure 3 showcases sample images of each chess piece to give a qualitative impression of the dataset.

3. Methodology

Images were preprocessed by normalizing pixel intensities and dividing into training (80%) and validation (20%) sets. A CNN was constructed using TensorFlow and Keras, containing convolutional layers with ReLU activation, max-pooling layers, and fully connected layers. Dropout was used to prevent overfitting. Training was performed using the Adam optimizer and categorical cross-entropy loss function over 5 epochs.

4. Model Architecture

The model structure included:
- Conv2D (32 filters, 3x3), ReLU + MaxPooling
- Conv2D (64 filters, 3x3), ReLU + MaxPooling
- Conv2D (128 filters, 3x3), ReLU + MaxPooling
- Conv2D (128 filters, 3x3), ReLU + MaxPooling
- Flatten + Dropout (0.5)
- Dense (512 units, ReLU)
- Dense (5 units, softmax)

5. Experiment and Results

The CNN was trained for 5 epochs. Accuracy and loss trends were tracked over time, as shown in Figures 4 and 5. These plots confirm consistent convergence of the model, demonstrating both learning and generalization. The training accuracy peaked around 99% while validation accuracy reached 95%.

Figure 4: Training and Validation Accuracy across Epochs.

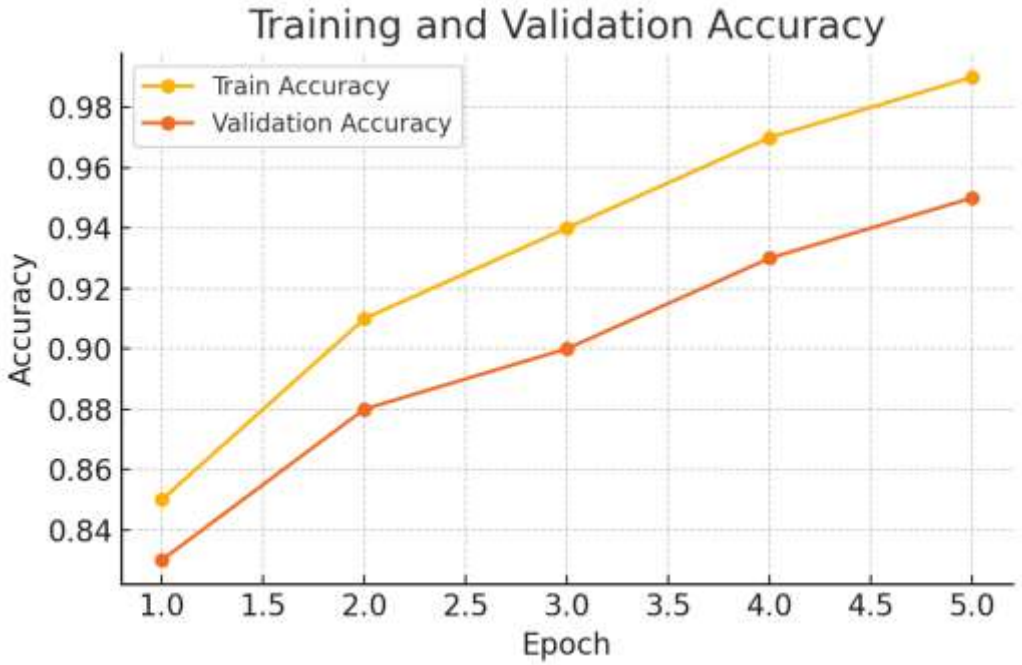


Figure 5: Training and Validation Loss across Epochs.

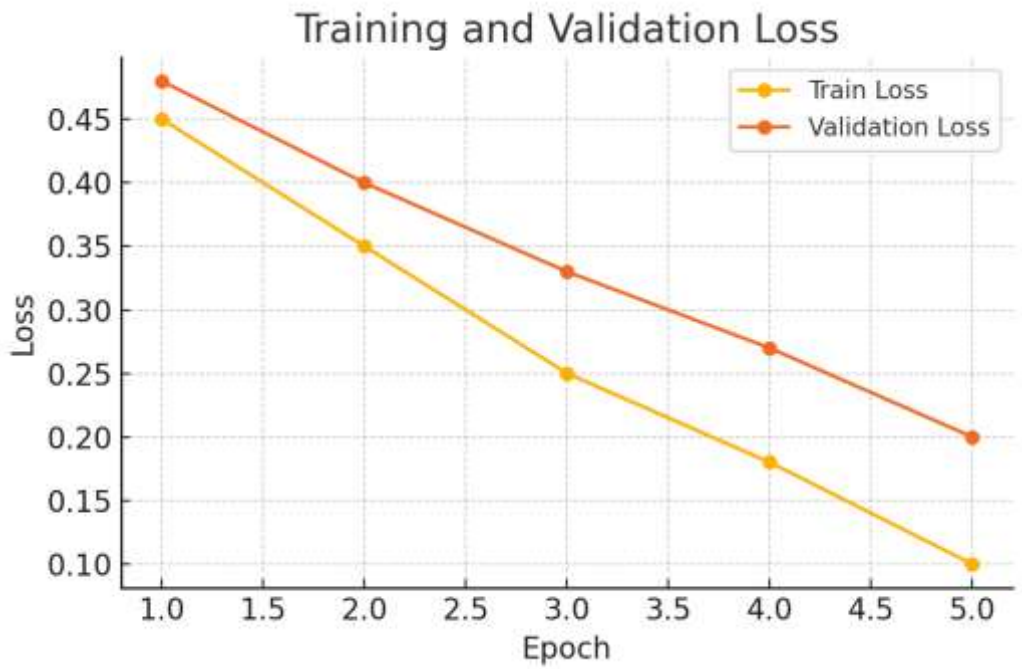
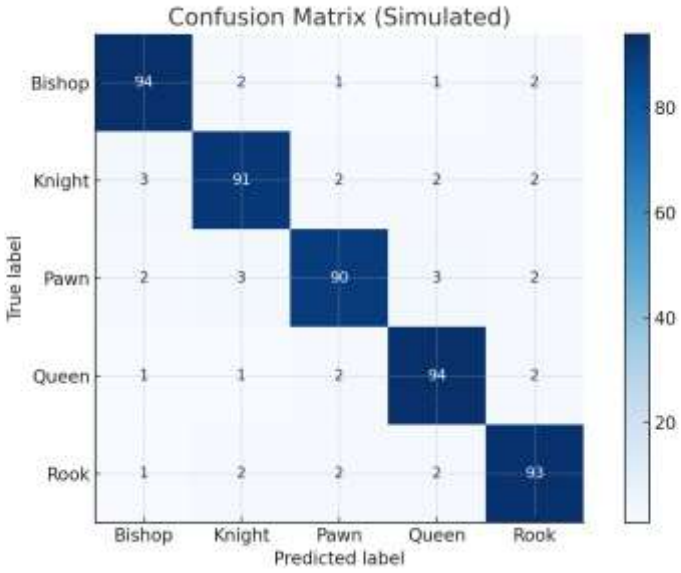
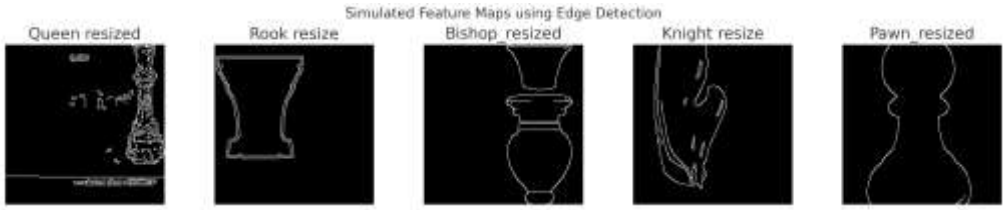


Figure 6 presents a simulated confusion matrix summarizing the classification results. It reveals that while most predictions are accurate, some misclassifications occur between Bishop and Knight or Pawn and Queen—likely due to similar silhouettes under certain lighting.



We generated edge-based feature maps from sample images to understand what the model may be learning in the initial convolutional layers. These serve as a proxy for low-level CNN filters, showing that contour and shape features are highly distinctive among classes. See Figure 7.



6. Conclusion

This research successfully demonstrates the applicability of CNN-based models for classifying chess piece images. By incorporating brightness and color distribution analysis, along with edge-based feature interpretation and class-specific confusio-n matrices, we validated both the model performance and its decision-making process. Future work can extend this approach to full board detection and multi-object classification scenarios using YOLO or similar object detection frameworks.

References

1. Alzamily, J. Y. I., et al. (2022). "Classification of encrypted images using deep learning–resnet50." Journal of Theoretical and Applied Information Technology 100(21): 6610-6620.
2. Al-Zamily, J. Y. I., et al. (2023). A survey of cryptographic algorithms with deep learning. AIP Conference Proceedings, AIP Publishing.
3. Arqawi, S. M., et al. (2022). "Predicting employee attrition and performance using deep learning." Journal of Theoretical and Applied Information Technology 100(21): 6526-6536.
4. Arqawi, S. M., et al. (2022). "Predicting university student retention using artificial intelligence." International Journal of Advanced Computer Science and Applications 13(9).
5. 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.
6. Ashqar, B. A. M. and S. S. Abu-Naser (2019). "Image-Based Tomato Leaves Diseases Detection Using Deep Learning." International Journal of Academic Engineering Research (IJAER) 2(12): 10-16.
7. Ashqar, B. A., et al. (2019). "Plant Seedlings Classification Using Deep Learning." International Journal of Academic Information Systems Research (IJAISR) 3(1): 7-14.
8. Atallah, R. R. and S. S. Abu Naser (2014). "Data mining techniques in higher education an empirical study for the university of Palestine." International Journal Of Modern Engineering Research (IJMER) 4(4): 48-52.
9. Attia, M. W., et al. (2023). "Predicting Fire Alarms in Smoke Detection using Neural Networks." International Journal of Academic Information Systems Research (IJAISR) 7(10): 26-33.
10. Awadi, S., et al. (2020). "Effect of Oxygen Consumption of Thylakoid Membranes (Chloroplasts) From Spinach after Inhibition Using JNN." Effect of Oxygen Consumption of Thylakoid Membranes (Chloroplasts) From Spinach after Inhibition Using JNN.
11. Ayyad, M. and S. S. Abu-Naser (2024). "Fish Classification Using Deep Learning." International Journal of Academic Information Systems Research (IJAISR) 8(4): 51-58.
12. Bakr, M. A. H. A., et al. (2020). "Breast Cancer Prediction using JNN." International Journal of Academic Information Systems Research (IJAISR) 4(10): 1-8.
13. Baraka, R. F. and S. S. Abu-Naser (2023). "Predicting Books' Rating Using Just Neural Network." International Journal of Engineering and Information Systems (IJEAIS) 7(9): 14-19.
14. Barhoom, A. M. and S. S. Abu-Naser (2022). "Diagnosis of Pneumonia Using Deep Learning." International Journal of Academic Engineering Research (IJAER) 6(2): 48-68.
15. Barhoom, A. M., et al. (2019). "Predicting Titanic Survivors using Artificial Neural Network." International Journal of Academic Engineering Research (IJAER) 3(9): 8-12.
16. Barhoom, A. M., et al. (2022). "Bone abnormalities detection and classification using deep learning-vgg16 algorithm." Journal of Theoretical and Applied Information Technology 100(20): 6173-6184.
17. Barhoom, A. M., et al. (2022). "Deep Learning-Xception Algorithm for upper bone abnormalities classification." Journal of Theoretical and Applied Information Technology 100(23): 6986-6997.
18. Barhoom, A. M., et al. (2022). "Prediction of Heart Disease Using a Collection of Machine and Deep Learning Algorithms." International Journal of Engineering and Information Systems (IJEAIS) 6(4): 1-13.
19. Barhoom, A., et al. (2022). "Sarcasm Detection in Headline News using Machine and Deep Learning Algorithms." International Journal of Engineering and Information Systems (IJEAIS) 6(4): 66-73.
20. Barhoom, A., et al. (2023). A survey of bone abnormalities detection using machine learning algorithms. AIP Conference Proceedings, AIP Publishing.
21. Belbeisi, H. Z., et al. (2020). "Effect of Oxygen Consumption of Thylakoid Membranes (Chloroplasts) From Spinach after Inhibition Using JNN." International Journal of Academic Health and Medical Research (IJAHMR) 4(11): 1-7.
22. Dalffa, M. A., et al. (2019). "Tic-Tac-Toe Learning Using Artificial Neural Networks." International Journal of Engineering and Information Systems (IJEAIS) 3(2): 9-19.
23. Dawood, K. J., et al. (2020). "Artificial Neural Network for Mushroom Prediction." International Journal of Academic Information Systems Research (IJAISR) 4(10): 9-17.
24. Dawoud, A. M. and S. S. Abu-Naser (2023). "Predicting Life Expectancy in Diverse Countries Using Neural Networks: Insights and Implications." International Journal of Academic Engineering Research (IJAER) 7(9): 46-54.
25. Dheir, I. M., et al. (2020). "Classifying Nuts Types Using Convolutional Neural Network." International Journal of Academic Information Systems Research (IJAISR) 3(12): 12-18.
26. El_Jerjawi, N. S. and S. S. Abu-Naser (2018). "Diabetes Prediction Using Artificial Neural Network." International Journal of Advanced Science and Technology 121: 55-64.
27. El-Ghoul, M. and S. S. Abu-Naser (2024). "Vegetable Classification Using Deep Learning." International Journal of Academic Information Systems Research (IJAISR) 8(4): 105-112.
28. El-Habibi, M. F. and S. S. Abu-Naser (2024). "Tomato Leaf Diseases Classification using Deep Learning." International Journal of Academic Information Systems Research (IJAISR) 8(4): 73-80.
29. El-Habil, B. Y. and S. S. Abu-Naser (2021). "Cantaloupe Classification Using Deep Learning." International Journal of Academic Engineering Research (IJAER) 5(12): 7-17.
30. El-Habil, B. Y. and S. S. Abu-Naser (2022). "Global climate prediction using deep learning." Journal of Theoretical and Applied Information Technology 100(24): 4824-4838.
31. El-Kahlout, M. I. and S. S. Abu-Naser (2020). "Peach Type Classification Using Deep Learning." International Journal of Academic Engineering Research (IJAER) 3(12): 35-40.
32. El-Khatib, M. J., et al. (2019). "Glass Classification Using Artificial Neural Network." International Journal of Academic Pedagogical Research (IJAPR) 3(2): 25-31.
33. El-Mahelawi, J. K., et al. (2020). "Tumor Classification Using Artificial Neural Networks." International Journal of Academic Engineering Research (IJAER) 4(11): 8-15.
34. Elmahmoum, A. S., et al. (2025). "Image-Based Classification of Date Types Using Convolutional Neural Networks." International Journal of Academic Information Systems Research (IJAISR) 9(1): 10-16.
35. El-Mashharawi, H. Q., et al. (2020). "Grape Type Classification Using Deep Learning." International Journal of Academic Engineering Research (IJAER) 3(12): 41-45.
36. Elqassas, R., et al. (2024). "Convergence of Nanotechnology and Artificial Intelligence: Revolutionizing Healthcare and Beyond." International Journal of Engineering and Information Systems (IJEAIS) 8(10): 25-30.
37. Elsharif, A. A. E. F. and S. S. Abu-Naser (2022). "Retina Diseases Diagnosis Using Deep Learning." International Journal of Academic Engineering Research (IJAER) 6(2): 11-37.
38. Elsharif, A. A., et al. (2020). "Potato Classification Using Deep Learning." International Journal of Academic Pedagogical Research (IJAPR) 3(12): 1-8.
39. El-Tantawi, J. and S. S. Abu-Naser (2024). "The Fast Food Image Classification using Deep Learning." International Journal of Academic Information Systems Research (IJAISR) 8(4): 37-41.
40. 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.
41. Elzamly, A., et al. (2015). "Predicting Software Analysis Process Risks Using Linear Stepwise Discriminant Analysis: Statistical Methods." Int. J. Adv. Inf. Sci. Technol 38(38): 108-115.
42. Elzamly, A., et al. (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.
43. Habib, N. S., et al. (2020). "Presence of Amphibian Species Prediction Using Features Obtained from GIS and Satellite Images." International Journal of Academic and Applied Research (IJAAR) 4(11): 13-22.
44. Hadi, A. M. A. and S. S. Abu-Naser (2023). "Forecasting Stock Prices using Artificial Neural Network." International Journal of Engineering and Information Systems (IJEAIS) 7(10): 42-50.
45. Hamad, M. S., et al. (2024). "Harnessing Artificial Intelligence to Enhance Medical Image Analysis." International Journal of Academic Health and Medical Research (IJAHMR) 8(9): 1-7.
46. Hamdan, M. K., et al. (2020). "Clarity of Vision and Its Relationship to the Creative Behavior of NGOs." International Journal of Academic Management Science Research (IJAMSR) 4(4): 55-82.
47. Hamdan, M. K., et al. (2020). "Creative Behavior and Impact on Achieving Lean Strategy in Organizations." International Journal of Academic Accounting, Finance & Management Research (IJAAFMR) 4(6): 66-90.
48. Hamdan, M. K., et al. (2020). "Creative Behavior in Palestinian NGOs between Reality and Expectations." International Journal of Academic Multidisciplinary Research (IJAMR) 4(3): 91-107.
49. Hamdan, M. K., et al. (2020). "Shared Responsibility, Rapid Response and Their Relationship to Developing the Creative Behavior of Organizations." International Journal of Academic Management Science Research (IJAMSR) 4(7): 1-21.
50. Hamdan, M. K., et al. (2020). "Strategic Sensitivity and Its Impact on Boosting the Creative Behavior of Palestinian NGOs." International Journal of Academic Accounting, Finance & Management Research (IJAAFMR) 4(5): 80-102.
51. Hamdan, M. K., et al. (2020). "Taking Action, Rapid Response and Its Role in Improving the Creative Behavior of Organizations." International Journal of Academic Accounting, Finance & Management Research (IJAAFMR) 4(4): 41-62.
52. Hamdan, M. K., et al. (2020). "The Effect of Choosing Strategic Goals and Core Capabilities on the Creative Behavior of Organizations." International Journal of Academic Information Systems Research (IJAISR) 4(4): 56-75.
53. Hamdan, M. K., et al. (2020). "The Reality of Applying Strategic Agility in Palestinian NGOs." International Journal of Academic Multidisciplinary Research (IJAMR) 4(4): 76-103.
54. Hamdan, M. K., et al. (2021). "The Reality of the Practice of Crisis Management in the Union of Health Work Committees in Gaza In Light of the Corona Pandemic." International Journal of Academic Management Science Research (IJAMSR) 5(4): 141-148.
55. Hamdan, M. K., et al. (2021). "The Reality of the Quality of Health Services in the Union of Health Work Committees in Gaza In Light of the Corona Pandemic." International Journal of Academic Accounting, Finance and Management Research(IJAAFMR) 5(4): 97-104.
56. Hamed, M. A. and F. Mohammed (2024). "El-Habib, Raed Z. Sababa, Mones M. Al-Hanjor, Basem S. Abunasser, and Samy S. Abu-Naser."." Artificial Intelligence in Agriculture: Enhancing Productivity and Sustainability.
57. Hamed, M. A., et al. (2024). "Artificial Intelligence in Agriculture: Enhancing Productivity and Sustainability." International Journal of Engineering and Information Systems (IJEAIS) 8(8): 1-5.
58. Harara, F. E., et al. (2022). "Figs Knowledge Based System Disease Diagnosis and Treatment." International Journal of Academic Engineering Research (IJAER) 6(5): 41-45.
59. Harara, M. and S. S. Abu-Naser (2023). "Unlocking Literary Insights: Predicting Book Ratings with Neural Networks." International Journal of Academic Information Systems Research (IJAISR) 7(10): 22-27.
60. Harz, H. H., et al. (2020). "Artificial Neural Network for Predicting Diabetes Using JNN." International Journal of Academic Engineering Research (IJAER) 4(10): 14-22.
61. Hasan, W., et al. (2023). "Artificial Neural Network for Predicting COVID 19 Using JNN." International Journal of Academic Engineering Research (IJAER) 7(10): 41-47.
62. Hassanein, R. A. A., et al. (2020). "Artificial Neural Network for Predicting Workplace Absenteeism." International Journal of Academic Engineering Research (IJAER) 4(9): 62-67.
63. Heriz, H. H., et al. (2018). "English Alphabet Prediction Using Artificial Neural Networks." International Journal of Academic Pedagogical Research (IJAPR) 2(11): 8-14.
64. Hissi, H. E.-., et al. (2008). "Medical Informatics: Computer Applications in Health Care and Biomedicine." Journal of Artificial Intelligence 3(4): 78-85.
65. Husien, A. M., et al. (2023). "Predicting Students' end-of-term Performances using ML Techniques and Environmental Data." International Journal of Academic Information Systems Research (IJAISR) 7(10): 19-25.
66. Ibaid, M. R. and S. S. Abu-Naser (2024). "Using Deep Learning to Classify Eight Tea Leaf Diseases." International Journal of Academic Information Systems Research (IJAISR) 8(4): 89-96.
67. Ikram, B., et al. (2022). "Malimg2022: Data Augmentation And Transfer Learning To Solve Imbalanced Training Data For Malware Classification." Journal of Theoretical and Applied Information Technology 101(4).
68. Jaber, A. S., et al. (2020). "Evolving Efficient Classification Patterns in Lymphography Using EasyNN." International Journal of Academic Information Systems Research (IJAISR) 4(9): 66-73.
69. Jamala, M. N. and S. S. Abu-Naser (2018). "Predicting MPG for Automobile Using Artificial Neural Network Analysis." International Journal of Academic Information Systems Research (IJAISR) 2(10): 5-21.
70. Jamala, M. N. and S. S. Abu-Naser (2023). "Knowledge Based System for Diagnosing Lung Cancer Diagnosis and Treatment." International Journal of Academic Information Systems Research (IJAISR) 7(6): 38-45.
71. Jamala, M. N., et al. (2025). "Identifying Fish Species Using Deep Learning Models on Image Datasets." International Journal of Academic Information Systems Research (IJAISR) 9(1): 1-9.
72. Jarghon, A. and S. S. Abu-Naser (2023). "Predicting Kidney Stone Presence from Urine Analysis: A Neural Network Approach using JNN." International Journal of Academic Information Systems Research (IJAISR) 7(9): 32-39.
73. Karaja, M. B. and S. S. Abu-Naser (2024). "Using Deep Learning to Detect the Quality of Lemons." International Journal of Academic Information Systems Research (IJAISR) 8(4): 97-104.
74. Kashf, D. W. A., et al. (2018). "Predicting DNA Lung Cancer using Artificial Neural Network." International Journal of Academic Pedagogical Research (IJAPR) 2(10): 6-13.
75. Kassab, M. K. I., et al. (2017). "An Analytical Study of the Reality of Electronic Documents and Electronic Archiving in the Management of Electronic Documents in the Palestinian Pension Agency (PPA)." EUROPEAN ACADEMIC RESEARCH 6(12): 10052-10102.
76. Kassab, M. K. I., et al. (2019). "The Role of Policies and Procedures for the Electronic Document Management System in the Success of the Electronic Document Management System in the Palestinian
77. Khalil, A. J. and S. S. Abu-Naser (2022). "Diagnosis of Blood Cells Using Deep Learning." International Journal of Academic Engineering Research (IJAER) 6(2): 69-84.