International Journal of Engineering and Information Systems (IJEAIS)
ISSN: 2643-640X
Vol. 7 Issue 10, October - 2023, Pages: 7-13

Streamlined Book Rating Prediction with Neural Networks

Lana Aarra, Mohammed S. Abu Nasser, Mohammed A. Hasaballah, Samy S. Abu-Naser

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

Abstract: *Online book review platforms generate vast user data, making accurate rating prediction crucial for personalized recommendations. This research explores neural networks as simple models for predicting book ratings without complex algorithms. Our novel approach uses neural networks to predict ratings solely from user-book interactions, eliminating manual feature engineering. The model processes data, learns patterns, and predicts ratings. We discuss data preprocessing, neural network design, and training techniques. Real-world data experiments show the model's effectiveness, surpassing traditional methods. This research can enhance user experience, book catalog organization, and aid publishers, simplifying recommendation processes and providing tailored suggestions based on user preferences.*

Keywords: Book, rating, prediction, JNN

Introduction

In today's digital age, where an abundance of books is just a click away, choosing the next captivating read can be both exciting and overwhelming. Book enthusiasts heavily rely on ratings and reviews to navigate this vast literary landscape. These ratings provide valuable guidance, offering insights into a book's quality and appeal.

Predicting a book's rating can benefit both readers and authors. It helps readers make informed choices that align with their preferences and expectations. For authors and publishers, it offers crucial feedback for improving future works and marketing strategies.

Traditionally, human readers determined book ratings, which could be subjective and diverse, leading to inconsistency and bias. However, with the emergence of machine learning and neural networks, we now have the opportunity to develop models that can estimate book ratings based solely on the book's content, metadata, or a combination of both.

This project explores the use of machine learning and neural networks to predict book ratings based solely on the book's inherent information. We analyze factors like genre, author, book length, language complexity, and more to create a model for quantitative rating predictions.

In the following sections, we will outline our project's objectives and methodologies, discuss its significance, and explore potential applications in the world of literature. Our ultimate goal is to leverage the power of neural networks to revolutionize book rating predictions, making the quest for the perfect read even more enjoyable for book enthusiasts.

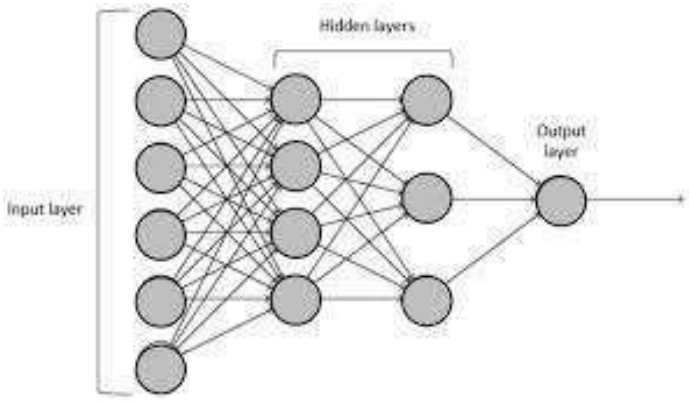

Figure 1: ANN Architecture

1. Literature Review

Artificial Neural Networks (ANNs) find applications in various domains:

In Education:
- Predicting Student Performance in the Faculty of Engineering and Information Technology [5]
- Predicting Academic Warning of Students in the Faculty of Engineering and Information Technology at Al-Azhar University-Gaza [5]
- Arabic Text Summarization Using AraBERT Model with Extractive Text Summarization Approach [6]

In Health:
- Parkinson's Disease Prediction [7]
- Classification Prediction of SBRCTs Cancers [7]
- Predicting Medical Expenses [8]
- Predicting Antibiotic Susceptibility [8]
- Predicting Liver Patients [7]
- Blood Donation Prediction [9]
- Predicting DNA Lung Cancer [10]
- Diagnosis of Hepatitis Virus [10]
- COVID-19 Detection [11]

In Agriculture:
- Plant Seedlings Classification Using Deep Learning [12]
- Predicting Edibility of Mushrooms Using Back-propagation Neural Network [15]
- Analyzing Types of Cherry Using Deep Learning [21]
- Banana Classification Using Deep Learning [13]
- Mango Classification Using Deep Learning [14]
- Grapefruit Type Classification Using Deep Learning [7]
- Grape Type Classification Using Deep Learning [3]
- Classifying Nuts Types Using Convolutional Neural Network [2]
- Potato Classification Using Deep Learning [3]
- Age and Gender Prediction Through Single User Images Using CNN [5]

In Other Fields:
- Predicting Software Analysis Process Risks Using Linear Stepwise Discriminant Analysis [14]
- Predicting Overall Car Performance [8]
- Glass Classification [9]
- Tic-Tac-Toe Learning [14]
- Energy Efficiency Prediction [15]
- Predicting Titanic Survivors [14]
- Classification of Software Risks in Software Planning Development Process [13]
- Handwritten Signature Verification [12]
- Email Classification [14]
- Predicting Temperature and Humidity in the Surrounding Environment [12]
- English Alphabet Prediction [9]

2. Methodology

We downloaded a data set from *kaggle* that contains books information from *goodreads* application/website. This dataset created by the user *Soumik* [19]. We did some preprocessing on the data, and then we trained our ANN model and validated it.

3. Original Dataset Description

Table 1: Original Dataset Description

#	Attribute	Description	Type

1.	bookID	A unique Identification number for each book.	Integer
2.	title	The name under which the book was published.	String
3.	authors	Names of the authors of the book. Multiple authors are delimited with -.	String
4.	average_rating	The average rating of the book received in total.	Real
5.	isbn	Another unique number to identify the book, the International Standard Book Number.	Long
6.	language_code	Helps understand what is the primary language of the book. For instance, eng is standard for English.	String
7.	isbn13	A 13-digit ISBN to identify the book, instead of the standard 11-digit ISBN.	Long
8.	# num_pages	Number of pages the book contains.	Integer
9.	ratings_count	Total number of ratings the book received.	Integer
10.	text_reviews_count	Total number of written text reviews the book received.	Integer

3.1 Dataset Preprocessing

We wanted to use this dataset to build an ANN model to predict the overall rating of the books (attribute number 4).
The first thing we had to do, is choose a suitable factors for this prediction, and delete the unnecessary ones, we chose these factorsto be our input to the predictive model: #num_pages, rating_count, text_reviews_count, language_code.
Moreover, the dataset contain 11128 instances. After preprocessing it becomes 11122 which is a large a number to a neuralnetwork to deal with, so, we divided these samples to 7451 training instances, and 3670 validation instances.
In addition, because of the integer numbers of the inputs are too large comparing with the real rate values, we did a normalizationto them so all the data are real.

Normalization formula was:

$$\text{Normalized value (xi)} = \frac{\text{Xi}-\text{Xmin}}{(\text{Xmax}-\text{Xmin})}.$$

While checking the instances, it has been noticed that there are a conflict between some instances; which means, there at least two books with the same input values but different rates, we excluded for the secondary ones. Moreover, there were validation instances that are out of range, we converted them to training. Now, the dataset is ready for training and validation.

3.2 Our ANN Model

The resulted predictive ANN model is shown in Figure 2 and Figure 6.

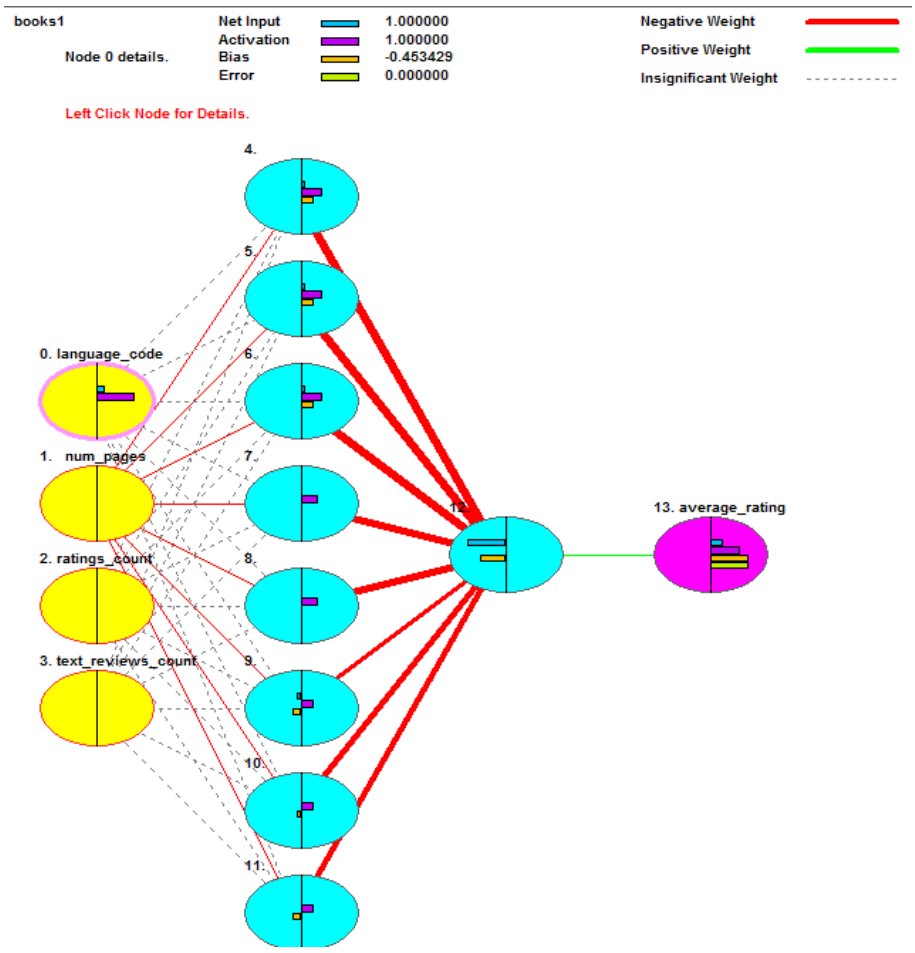

Figure 2: Our ANN Model

3.3 Validation

Our ANN model was able to predict the books' overall rate with 99.78% accuracy, with about 0.005 errors as seen in figure (3). Furthermore, The Model showed that the most effective factor in a book's rate is the rating_count. More details are shown in figure (4).

Figure 3: Validation and Errors

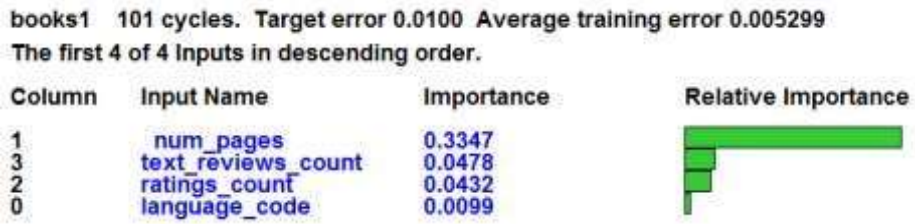

Figure 4: Attributes Importance

International Journal of Engineering and Information Systems (IJEAIS)
ISSN: 2643-640X
Vol. 7 Issue 10, October - 2023, Pages: 7-13

books1

	language_c+	num_pages	ratings_co+	text_revie+	average_ra+
#0	0.0000	0.0374	0.0011	0.0054	0.8420
#1	0.0000	0.0414	0.0014	0.0049	0.7960
#2	0.0000	0.0243	0.0009	0.0037	0.8100
#3	0.0000	0.0389	0.0005	0.0019	0.7880
#4	0.0000	0.0318	0.0002	0.0011	0.8340
#5	0.0000	0.0590	0.0010	0.0055	0.7320
#6	0.0000	0.0354	0.0011	0.0016	0.8340
#7	0.0476	0.0991	0.4558	0.2927	0.9140
#8	0.0476	0.1323	0.4683	0.3100	0.8980
#9	0.0476	0.0535	0.0014	0.0026	0.8840
#10	0.0476	0.0661	0.5089	0.3853	0.9120
#11	0.0476	0.4091	0.0090	0.0017	0.9560
#12	0.0476	0.5062	0.0061	0.0086	0.9460
#13	0.0476	0.1239	0.0008	0.0027	0.8760
#14	0.0476	0.1239	0.0543	0.0433	0.8760
#15	0.0476	0.0327	0.0011	0.0049	0.8440
#16	0.0476	0.0009	0.0003	0.0027	0.8440
#17	0.0476	0.1239	0.0006	0.0021	0.8760
#18	0.0476	0.0627	0.0541	0.0997	0.8420
#19	0.0476	0.0084	0.0016	0.0053	0.6880
#20	0.0476	0.0389	0.0005	0.0014	0.7740
#21	0.0476	0.0509	0.0158	0.0450	0.8140
#22	0.0476	0.0462	0.0107	0.0235	0.7800
#23	0.0476	0.0455	0.0099	0.0239	0.7660
#24	0.0476	0.0386	0.0106	0.0237	0.7720
#25	0.0476	0.0493	0.0175	0.0350	0.7820
#26	0.0476	0.0411	0.0062	0.0221	0.7860
#27	0.0476	0.2628	0.0220	0.0164	0.9180
#28	0.0476	0.1600	0.0004	0.0010	0.9000
#29	0.0476	0.0605	0.4630	0.1450	0.8720
#30	0.0476	0.0332	0.0043	0.0005	0.9060

Figure 5: imported pre-processed Dataset

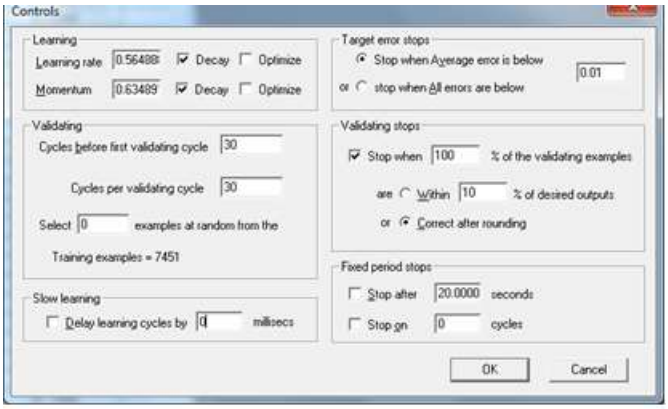

Figure 6: Parameter values of the ANN Model

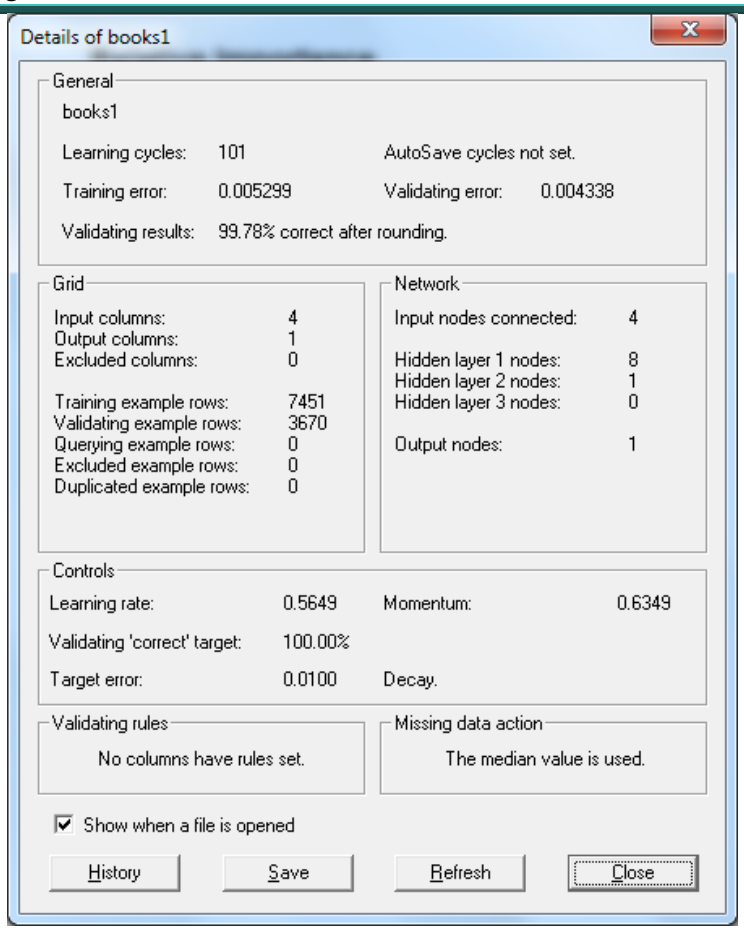

Figure 7: Details of our ANN Model

4. Conclusion

A predictive Artificial Neural Network Model for predicting books' rating was developed. The Model trained and validated using a dataset from the goodreads application/ website. We did some preprocessing on the dataset to make it suitable as input to our ANN model. Validation showed that the model is 99.78% accurate.

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