Industrial Engineering Using IBM SPSS Statistics

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Abstract. *Industrial Engineering, Most historians agree that the Industrial Revolution is when the profession of industrial engineering had its start. The invention, the spinning jenny, and—possibly most significantly—the steam engine were among the innovations that helped mechanize traditional manual tasks in the textile industry. These innovations also created scale savings that for the first time that made commercial production in centralized facilities appealing. The factories built as a result of these developments are where the idea of something like the production system originated. Also, it has been proposed that Leonardo Vinci may have been the first manufacturing engineer as there is proof that he used science to analyze human labor by observing how quickly a laborer could shovel soil approximately in 1500.Both the producers and the final consumers of a product value industrial engineering. To improve efficiency, industrial engineers enhance designs and procedures. This benefits businesses since it conserves people, raw materials, time, and money. IBM SPSS Statistics Your firm can easily derive useful insights from your data because to its user-friendly interface and extensive feature set. High accuracy and good decision-making are ensured by advanced statistical techniques. The entire analytics lifecycle is covered, from data administration and preparation to reporting and analysis. Perceived quality, Customer expectations, Perceived value, Customer satisfaction, Customer complaints, and Customer loyalty. The Cronbach's Alpha Reliability result. The overall Cronbach's Alpha value for the model is .581 which indicates 58% reliability. From the literature review, the above 46% Cronbach's Alpha value model can be considered for analysis. the outcome of Cronbach's Alpha Reliability. The model's total Cronbach's Alpha score is .581, which denotes a 58% dependability level. The 46% Cronbach's Alpha value model mentioned above from the literature review may be used for analysis.*
Keywords: *Customer expectations, Perceived value, Customer satisfaction, Customer complaints.*

1. INTRODUCTION

The research of people, materials, equipment, and energy design, as well as the creation of integrated systems, is known as industrial engineering. It is specialized in methodologies and has areas of expertise in mathematics, physics, the social sciences, design engineering analysis, and results. The Center's Office of Evaluation and Training Support, which is committed to improving teaching and learning, is Number one for the growth of engineering education. Material industry, manufacture, logistics, finance/banking, health, and technology industry were chosen as engineering professions in the study of work areas because they have a variety of work areas; thus, it provides a lot of workplaces for students. The demand for industrial engineers in the service industry as well as the manufacturing sector has lately been noted. All integrated systems, including those involving people, machines, and materials, should be optimized. Increase the efficient utilization of resources. Describe your knowledge and abilities in the fields of arithmetic, physics, the social sciences, and engineering design concepts. You should also be able to forecast and assess findings using appropriate techniques. Settings. teaching approach known as the inverted classroom, used in the Commercial Engineering course. Industrial engineers frequently struggle with ambiguous information and are insufficient within those types of systems. Early findings in engineering education in the classroom How to make this technology better How to Improve This Technology offers suggestions and insights into potential methods for addressing these issues, and for System Improvement we recommend the language SOFL Several undergraduate and graduate industrial engineering courses cover the theory and application of ambiguous packages. It naturally incorporates courses in research. This specialized journal covers a wide range of representative packaging applications in the market. It includes utility documentation and five original studies covering various industrial engineering topics. This section will examine the efficiency of the suggested SOA method in solving problem and other tasks using seven real-world controlled optimizations. Compared to cutting-edge algorithms. There are numerous issues

with this. Equality and inequality restrictions. According to experimental findings, the suggested approach is difficult to implement on a broad scale but is best for resolving regulated problems. When opposed to doctrinal engineering, in is a relatively competitive methodology; its first issue was released in 1976. Among publications. The goal terms of impact, themes, universities, and nations. It does this by analyzing bibliographic data using the Science Web Common forms database, which is more challenging to quantify quality functions due to its complexity. This essay examines such collaborations with industry professors of manufacturing engineering. Examples of quality measures include efficient risk management, supplier performance, customer happiness, adaptability, and information and material integration in transactions. This achievement focuses on the key periodical patterns of the time that sparked interest in broad archaeological analysis. The parties involved agree on the amount of money to be exchanged for money, products, or services at a fair price. Whether a worker works or not, or whether they desire supervision or not, their job satisfaction—also referred to as worker satisfaction or job satisfaction—is a measure of their level of happiness. Opportunities for your career are those that are nearing your career goals. More productive people are also better at solving problems. They produce creative solutions and perform their task quickly. Establishing goals will encourage new behaviours, direct your attention, and help you keep that speed in life. A person's connection with one or the other, particularly in terms of their social or professional status, can be described as their status. Every time you alter the bandage or rinse the saliva (salt) solution, you are watering open sores. The idea that people have varied chances depending on the broader setting is typically referred to as "social opportunity" in the social sciences by persons their social networking sites and where they live. When costs outweigh revenues the number of applications in a rule's representation of a calculation determines how long it takes to complete. Your prom dress' simplicity will make you stand out in a sea of frills and sequins. Calculating simple mathematical facts, functions, and objects is known as mathematical calculation. Collection and computation. Understanding numbers and basic math concepts and actions starts early. A huge amount of resistance from people and emotions is found in consistency. Not prone to fluctuations. Stability might be expressed by a calm, clear space for you. Daily routine. Information entry is the foundation for creativity based on titles. The practise of classifying topic categories using personal data such information includes basics and ideas, tasks, and references. In an effort to increase the tight quality of published papers by appointment, area professors who specialize in those fields will be handled by the press around the same time. Technical administration and two conceptions of industrial structure, in our opinion, should be merged in order to comprehend Korea's alluring forms. While being treated similarly, Taiwan and Korea have different industrial frameworks that reflect different evolutionary tendencies. Lean manufacturing at conferences has continued unabatedly to this day, according to the "International on Computing & Engineering/ conferences (ICC & IEs)". Today's CIE, one of the top engineering publications, shows significant progress in computer science and industry. The top nations and corporations featured in this analysis are those of the journal. The business sector is in charge of due to the commercial scarcity of energy resources. Natural resources needed for energy generation. GDP between the years of 2000 and 2011 Research indicate that the production share is no higher than 5%. The publication adhered to a strict double-blind review procedure from the beginning. We have to start figuring out how to create the addax system to use the built-in approach mostly in beginning stages of its creation because it promotes the notion that it can be created, and then use element method in advanced stages, in integrating the most important methods of active education in designing, well how find text and content that demands open class time. The most effective use of systematic methodologies is made throughout the whole system. A monitoring system is capable of detecting a wide range of signals, many of which contain important information along with irrelevant data and noise. If each message is viewed as a feature, "Feature Extraction" is used to select the most pertinent signals. There are 1567 example offers in the open - sourced UCI SECOM database; 104 of them lack the quality guarantee. The features in the collection are extracted, and signals that are pertinent to further research are taken into account. The signal output then forecasts whether popular machine learning techniques were utilized to pass or fail. The best prediction algorithm was chosen based on the ML model's accuracy and loss. Quality and quantity metrics can both be emphasized depending on the sort of performance of the supply chain measurements used. Specific this article highlights the numerous industries (garments, fabrics, jute mills, cement plants, etc.) where industrial engineering approaches are desperately needed. Exploring potential applications is the main goal of the research's conclusion, which focuses on industrial engineering for connected industries. At the conclusion of this piece, it will be evident how the industry is utilizing this technology and its advantages. Interactions between qualities lead to the structure of various patterns in national capture. In addition, it is particularly challenging and tough to power arbitrary power in unique facilities such relatively small isolated temperature readings, lights, border protection stations, fisheries management, etc. Health, financial, production, technology, logistics, software/informatics, and academics are presented as alternatives in this context. Remuneration, job happiness, and career prospects are included in evaluation.

2. MATERIALS & METHODS

2.1. Evaluation parameters: Perceived quality, Customer expectations, Perceived value, Customer satisfaction, Customer complaints, and Customer loyalty.

2.2. Perceived quality: A customer's assessment of if the services received met their expectations is referred to as perceived quality. It is based on how well the client has used the services and how other customers' opinions have influenced them. Consequently, customers' perceptions of a product's or services total performance can be used to determine perceived quality. Three factors are used to measure perceived excellence in higher education: the library software application (x4), management service quality (x5), as well as what is current and popular for facilities (x6). The idea of worth is frequently tied to the perception of quality. As a consequence of the perceived levels comparable with other options, perceived value of services can be considered as the customer's overall satisfaction in maintaining a long-term connection to the vendor.

2.3. Customer expectations: Ciavolino and colleagues used multivariate statistical techniques like principal component analysis as well as multiple regression analysis, as well as structural equation modeling, to investigate the ECSI model. Three fundamental variables were employed as independent variables in the ESCI model: image, consumer expectations, and perceived quality. As dependent variables, perceived value, customer happiness, and loyalty were listed. Conceptually, perceived quality was composed of two components: "hardware," which referred to the attributes of the product or service's quality, and "software/human ware," which represented the related customer-interactive elements in the provision of the service.

2.4. Perceived value: Two key portions made up the survey questionnaires: (1) functional-dysfunctional comments for the Kano model, and (2) statements focusing on student perceptions of quality, potential value, marketing strategy, satisfaction, and popularity at private universities. The Kano model was used to classify the service features and measure student impression using two different types of questionnaires. Five-point Liker-type measures were used in the perception survey. The functional-dysfunctional questionnaire was created using the method suggested by for categorizing Kano categories. A sample group of 160 students enrolled received the surveys, and 120 legitimate questionnaires were collected. All information was gathered over the course of two months. The following examples show how the conceptual model is implemented step-by-step.

2.5. Customer satisfaction: The theoretical framework's initial step is to theoretically define the constructions that have been chosen in order to create the customer-oriented model. This model was adapted from the ECSI happiness model suggested by Ciavolino as well as Dahlgaard and the ACSI contentment model put forth by Levin - lin et al. We altered both ACSI but also ECSI models for examining customer satisfaction but also reputation in order to construct the model. This step involved defining the predictor variables and putting forth hypotheses based on prior research.

2.6. Customer complaints: This is an essential initial step in creating a theory of complaint management that could later serve as the foundation for managerial action. Current study in this area is being driven by the significance of correlating complaint management or organizational responses to consumer complaints with future market performance. The field of client devotion and client retention will be significantly impacted by the capacity to precisely calculate the expenses and advantages of managing consumer complaints. This article will provide a framework-based summary of the available literature on complaint management and contextualize each component of the organizational reaction along with the pertinent research hypotheses. By focusing on the satisfaction with complaint handling and post-complaint customer behavior as dependent variables, and each component.

2.7. Customer loyalty: Based on a thorough analysis, the goal of this essay is to create an integrated conceptual framework for increasing and maintaining both customer loyalty and profitability. Review of relevant academic literature and market conditions. This conceptual framework, in our opinion, may serve as a foundation for understanding the new, prevailing logic of managing client loyalty in the twenty-first century. The structure of this article is as follows: We start by reading research articles on patronage. We follow up by outlining a theoretical framework for creating and maintaining profitable client loyalty.

2.8. Methods: IBM SPSS Statistics is a reliable statistical package. Because of its user-friendly design and rich feature set, your company can quickly and simply generate important insights from your data. Advanced statistical techniques enable high precision and sound decision-making. Everything from data management and preparation to analysis and reporting is handled across the whole analytics lifecycle. SPSS offers data analysis for descriptions and vicariate statistics, as well as projections for monetary outcomes and forecasts for group identification. The programmed also has charting, direct-mail, and data-transformation features. The software interface displays open data in its main view in a way analogous to a spreadsheet. SPSS syntax refers to a

programming language designed specifically for SPSS. You can write commands that run SPSS operations instead of using the graphical user interface. Users can perform tasks that would take too much time or be too difficult to finish using drop-down lists by using syntax.

3. RESULT AND DISCUSSION

TABLE 1.Reliability Statistics

Reliability Statistics		
Cronbach's Alpha	Cronbach's Alpha Based on Standardized Items	N of Items
.581	.468	6

Table 1 shows Cronbach's Alpha Reliability result. The overall Cronbach's Alpha value for the model is .581 which indicates 58% reliability. From the literature review, the above 46% Cronbach's Alpha value model can be considered for analysis.

TABLE 2. Reliability Statistic individual

	Cronbach's Alpha if Item Deleted
Perceived quality	0.117
Customer expectations	0.247
Perceived value	0.008
Customer satisfaction	0.154
Customer complaints	0.229
Customer loyalty	0.134

Table 2 Shows the Reliability Statistic individual parameter Cronbach's Alpha Reliability results in Perceived quality 0.117, Customer expectations 0.247, Perceived value 0.008, Customer satisfaction 0.154, Customer complaints 0.229, and Customer loyalty 0.134.

TABLE 3. Descriptive Statistics

Descriptive Statistics													
	N	Range	Minimum	Maximum	Sum	Mean		Std. Deviation	Variance	Skewness		Kurtosis	
	Statistic	Statistic	Statistic	Statistic	Statistic	Statistic	Std. Error	Statistic	Statistic	Statistic	Std. Error	Statistic	Std. Error
Perceived quality	33	4	1	5	98	2.97	0.166	0.951	0.905	0.169	0.409	0.345	0.798
Customer expectations	33	4	1	5	108	3.27	0.176	1.008	1.017	0.01	0.409	0.365	0.798
Perceived value	33	4	1	5	102	3.09	0.236	1.355	1.835	0.174	0.409	1.01	0.798
Customer satisfaction	33	4	1	5	107	3.24	0.23	1.324	1.752	0.133	0.409	0.956	0.798
Customer complaints	33	4	1	5	100	3.03	0.206	1.185	1.405	0.058	0.409	0.852	0.798
Customer loyalty	33	4	1	5	113	3.42	0.185	1.062	1.127	0.123	0.409	0.528	0.798

Valid N (listwise)	33												

Table 3 shows the descriptive statistics values for analysis N, range, minimum, maximum, mean, standard deviation, Variance, Skewness, and Kurtosis. Perceived quality, Customer expectations, Perceived value, Customer satisfaction, Customer complaints, Customer loyalty, this also using.

TABLE 4. Frequency Statistics

Statistics							
		Perceived quality	Customer expectations	Perceived value	Customer satisfaction	Customer complaints	Customer loyalty
N	Valid	33	33	33	33	33	33
	Missing	7	7	7	7	7	7
Mean		2.97	3.27	3.09	3.24	3.03	3.42
Std. Error of Mean		0.166	0.176	0.236	0.23	0.206	0.185
Median		3.00	3.27	3.18	3.25	3.00	3.43
Mode		3	3	3	3	2	3
Std. Deviation		0.951	1.008	1.355	1.324	1.185	1.062
Variance		0.905	1.017	1.835	1.752	1.405	1.127
Skewness		0.169	0.01	0.174	0.133	0.058	0.123
Std. Error of Skewness		0.409	0.409	0.409	0.409	0.409	0.409
Kurtosis		0.345	0.365	1.01	0.956	0.852	0.528
Std. Error of Kurtosis		0.798	0.798	0.798	0.798	0.798	0.798
Range		4	4	4	4	4	4
Minimum		1	1	1	1	1	1
Maximum		5	5	5	5	5	5
Sum		98	108	102	107	100	113

Table 4 shows the Frequency Statistics in Solar photovoltaic technology is Perceived quality, Customer expectations, Perceived value, and Customer satisfaction, Customer complaints, Customer loyalty curve values are given. Valid 33, Missing value 7, Median value 3.00, Mode value 3.

Histogram Plot:

FIGURE 1. Perceived quality

Figure 1 shows the histogram plot for Perceived quality from the figure it is clearly seen that the data are slightly Left skewed due to more respondents choosing 3 for Perceived quality except for the 3 values all other values are under the normal curve shows model is significantly following a normal distribution.
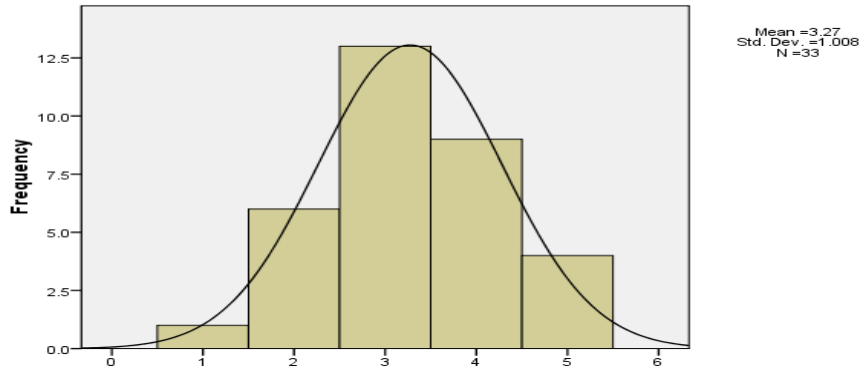
FIGURE 2. Customer expectations

Figure 2 shows the histogram plot for Customer expectations from the figure it is clearly seen that the data are slightly Left skewed due to more respondents choosing 3 for Customer expectations except for the 3 values all other values are under the normal curve shows model is significantly following a normal distribution.
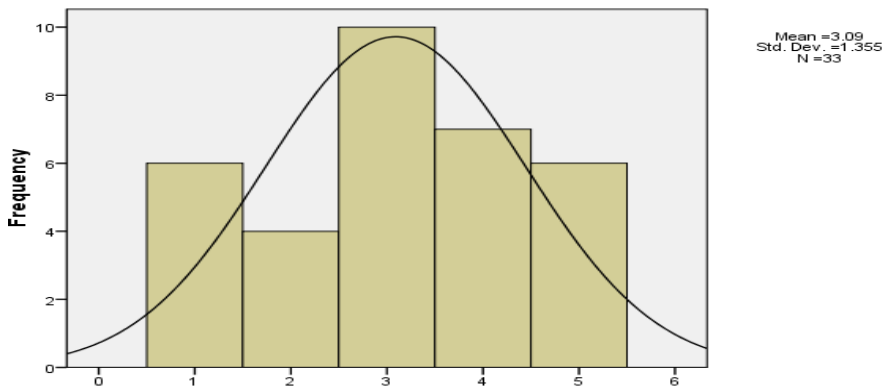

FIGURE 3. Perceived value

Figure 3 shows the histogram plot for Perceived value from the figure it is clearly seen that the data are slightly Left skewed due to more respondents choosing 3 for Perceived value except for the 3 values all other values are under the normal curve shows model is significantly following a normal distribution.
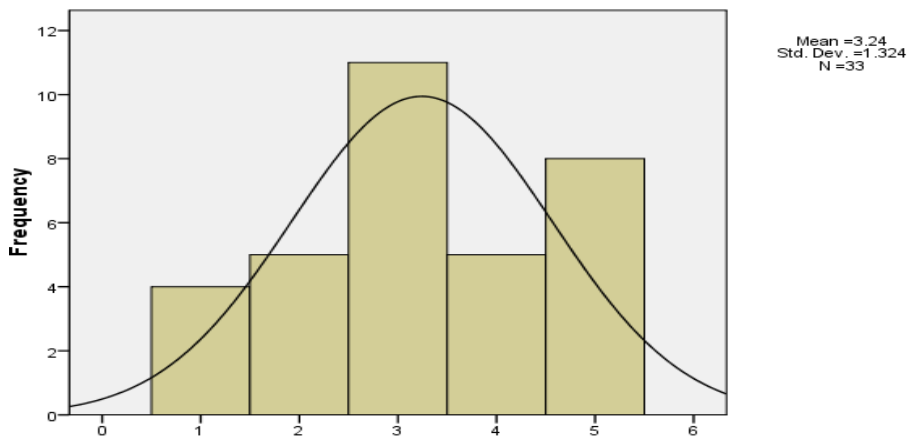

FIGURE 4. Customer satisfaction

Figure 4 shows the histogram plot for Customer satisfaction from the figure it is clearly seen that the data are slightly Left skewed due to more respondents choosing 3 for Customer satisfaction except for the 3 values all other values are under the normal curve shows model is significantly following a normal distribution.
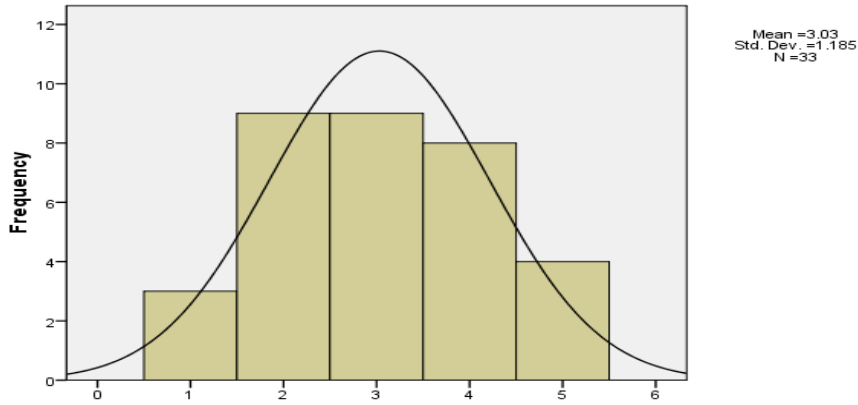
FIGURE 5. Customer complaints

Figure 5 shows the histogram plot for Customer complaints from the figure it is clearly seen that the data are slightly Left skewed due to more respondents choosing 2,3 for Customer complaints except for the 2,3 values all other values are under the normal curve shows model is significantly following a normal distribution.
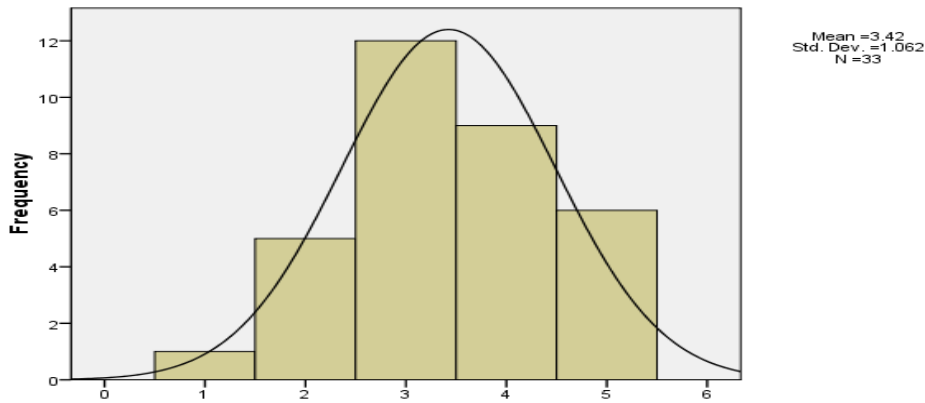

FIGURE 6. Customer loyalty

Figure 6 shows the histogram plot for Customer loyalty from the figure it is clearly seen that the data are slightly Left skewed due to more respondents choosing 3 for Customer loyalty except for the 3 values all other values are under the normal curve shows model is significantly following a normal distribution.

TABLE 5. Correlations

Correlations						
	A1	A2	A3	A4	A5	A6
Perceived quality	1	0.056	0.245	0.044	0.082	0.23
Customer expectations	0.056	1	0.042	0.019	0.007	0.053
Perceived value	0.245	0.042	1	0.074	0.037	0.168
Customer satisfaction	0.044	0.019	0.074	1	0.095	0.013
Customer complaints	0.082	0.007	0.037	0.095	1	0.11
Customer loyalty	0.23	0.053	0.168	0.013	0.11	1

Table 5 shows the correlation between motivation parameters for Perceived quality for Perceived value is having the highest correlation with Customer loyalty is having lowest correlation. Next, the correlation between motivation parameters for Customer expectations for Perceived quality is having the highest correlation with

Customer complaints having the lowest correlation. Next, the correlation between motivation parameters for Perceived value for Perceived quality is having the highest correlation with Customer complaints having the lowest correlation. Next, the correlation between motivation parameters for Customer satisfaction for Customer complaints is having the highest correlation with Customer loyalty having the lowest correlation. Next, the correlation between motivation parameters for Customer complaints for Customer satisfaction is having the highest correlation with Customer expectations having the lowest correlation. Next, the correlation between motivation parameters for Customer loyalty for Perceived value is having the highest correlation with Customer complaints having the lowest correlation.

4. CONCLUSION

This achievement focuses on the key periodical patterns of the time that sparked interest in broad archaeological analysis. The parties involved agree on the amount of money to be exchanged for money, products, or services at a fair price. Whether a worker works or not or whether they desire supervision or not, their job satisfaction—also referred to as worker satisfaction or job satisfactions a measure of their level of happiness. Opportunities for your career are those that are nearing your career goals. More productive people are also better at solving problems. They produce creative solutions and perform their task quickly. Establishing goals will encourage new behaviours, direct your attention, and help you keep that speed in life. A person's connection with one or the other, particularly in terms of their social or professional status, can be described as their status. Every time you alter the bandage or rinse the saliva (salt) solution, you are watering open sores. The idea that people have varied chances depending on the broader setting is typically referred to as "social opportunity" in the social sciences by persons their social networking sites and where they live. When costs outweigh revenues the number of applications in a rule's representation of a calculation determines how long it takes to complete. Your prom dress' simplicity will make you stand out in a sea of frills and sequins. Calculating simple mathematical facts, functions, and objects is known as mathematical calculation. Collection and computation. Understanding numbers and basic math concepts and actions starts early. A huge amount of resistance from people and emotions is found in consistency. The Cronbach's Alpha Reliability result. The overall Cronbach's Alpha value for the model is .581 which indicates 58% reliability. From the literature review, the above 46% Cronbach's Alpha value model can be considered for analysis.

REFERENCES

[1] Arya, Alka, and Shiv Prasad Yadav. "Development of intuitionistic fuzzy super-efficiency slack based measure with an application to health sector." *Computers & Industrial Engineering* 115 (2018): 368-380.

[2] da Silva, Cleriston Fritsch Damasio, André Philippi Gonzaga de Albuquerque, Fagner José Coutinho de Melo, Felipe Alves Calábria, and Denise Dumke de Medeiros. "A fuzzy approach to the strategic development of human capital in the electric sector." *Computers & Industrial Engineering* 149 (2020): 106787.

[3] Wang, Chao, Ming K. Lim, and Andrew Lyons. "Twenty years of the International Journal of Logistics Research and Applications: a bibliometric overview." *International Journal of Logistics Research and Applications* 22, no. 3 (2019): 304-323.

[4] Al-Refaie, Abbas, Mohammad Hammad, and Ming-Hsien Li. "DEA window analysis and Malmquist index to assess energy efficiency and productivity in Jordanian industrial sector." *Energy Efficiency* 9, no. 6 (2016): 1299-1313.

[5] Sukwadi, Ronald, Ching-Chow Yang, and Liu Fan. "Determining the priority of critical service attributes: An integrated model and an empirical case study in the higher education sector." *Service Science* 4, no. 4 (2012): 308-319.

[6] Lorenzi, Clarice Inês, and Joao Carlos Espindola Ferreira. "Failure mapping using FMEA and A3 in engineering to order product development: a case study in the industrial automation sector." *International Journal of Quality & Reliability Management* (2018).

[7] Choung, JaeYong, H. R. Hwang, and T. Hameed. "Patterns of technology catch-up in Korean private sector." In *2009 IEEE International Conference on Industrial Engineering and Engineering Management*, pp. 93-99. IEEE, 2009.

[8] White, Richard E., John N. Pearson, and Jeffrey R. Wilson. "JIT manufacturing: a survey of implementations in small and large US manufacturers." *Management science* 45, no. 1 (1999): 1-15.

[9] Minin, V. A., and A. I. Furtaev. "Prospects for the development of wind energy resources in the western sector of the Arctic zone of Russia." In *2018 International Multi-Conference on Industrial Engineering and Modern Technologies (FarEastCon)*, pp. 1-4. IEEE, 2018.

[10] Helm, Sabrina, Ludger Rolfes, and Bernd Günter. "Suppliers' willingness to end unprofitable customer relationships: An exploratory investigation in the German mechanical engineering sector." *European Journal of Marketing* (2006).

[11] Biryulin, V. I., A. N. Gorlov, and D. V. Kudelina. "Fuzzy modeling of efficiency of energy and fuel resource use at regional level." In *2017 International Conference on Industrial Engineering, Applications and Manufacturing (ICIEAM)*, pp. 1-4. IEEE, 2017.

[12] Lemghari, R., D. Sarsri, C. Okar, and A. Es-satty. "Supply chain performance measurement in the automotive sector: A structured content analysis." *Uncertain Supply Chain Management* 7, no. 4 (2019): 567-588.

[13] Al-Ghandoor, A., I. Al-Hinti, A. Mukattash, and Y. Al-Abdallat. "Decomposition analysis of electricity use in the Jordanian industrial sector." *International Journal of Sustainable Energy* 29, no. 4 (2010): 233-244.

[14] Huang, Chun-Che, Tzu-Liang Bill Tseng, and Chia-Ying Tang. "Feature extraction using rough set theory in service sector application from incremental perspective." *Computers & Industrial Engineering* 91 (2016): 30-41.

[15] Manavalan, Ethirajan, and Kandasamy Jayakrishna. "A review of Internet of Things (IoT) embedded sustainable supply chain for industry 4.0 requirements." *Computers & Industrial Engineering* 127 (2019): 925-953.

[16] Davidow, Moshe. "Organizational responses to customer complaints: What works and what doesn't." *Journal of service research* 5, no. 3 (2003): 225-250.

[17] Kumar, V. I. S. W. A. N. A. T. H. A. N., and Denish Shah. "Building and sustaining profitable customer loyalty for the 21st century." *Journal of retailing* 80, no. 4 (2004): 317-329.

[18] Churchill Jr, Gilbert A., and Carol Surprenant. "An investigation into the determinants of customer satisfaction." *Journal of marketing research* 19, no. 4 (1982): 491-504.

[19] Sánchez-Fernández, Raquel, and M. Ángeles Iniesta-Bonillo. "The concept of perceived value: a systematic review of the research." *Marketing theory* 7, no. 4 (2007): 427-451.

[20] Parasuraman, Arun, Leonard L. Berry, and Valarie A. Zeithaml. "Understanding customer expectations of service." *MIT sloan management review* (1991).

[21] Aaker, David A., and Robert Jacobson. "The financial information content of perceived quality." *Journal of marketing research* 31, no. 2 (1994): 191-201.

[22] Kumar, Kaushal, Monika Khatkar, Kriti Sharma, Ruchika Bhakhar, Prashant Chaudhary, N. Sateesh, G. Ramesh, Soosan Chhabra, and K. Maithili. "Optimizations of Process Parameter for Erosion Wear Using Sustainable Machine Learning Approach." In *E3S Web of Conferences*, vol. 430, p. 01178. EDP Sciences, 2023.

[23] Thanuja, R., E. Sri Ram, and A. Umamakeswari. "A linear time approach to detect wormhole tunnels in mobile adhoc networks using 3PAT and transmission radius (3PAT w)." In *2018 2nd International Conference on Inventive Systems and Control (ICISC)*, pp. 837-843. IEEE, 2018.

[24] Sujatha, K., and V. Ceronmani Sharmila. "Enhanced Mutual Authentication Technique using Id (Matid) in Fog Computing."

[25] Ayushree, and G. N. Balaji. "Comparative analysis of Coherent routing using machine learning approach in MANET." In *Smart Computing and Informatics: Proceedings of the First International Conference on SCI 2016, Volume 1*, pp. 731-741. Springer Singapore, 2018.

[26] Sims, B. G., C. Thierfelder, J. Kienzle, T. Friedrich, and A. Kassam. "Development of the conservation agriculture equipment industry in sub-Saharan Africa." *Applied Engineering in Agriculture* 28, no. 6 (2012): 813-823.

[27] Maithili, K., SM Naveen Raja, RP Ram Kumar, and Sakshi Koli. "A Survey (NLP) Natural Language Processing and Transactions on (NNL) Neural Networks and learning Systems." In *E3S Web of Conferences*, vol. 430, p. 01148. EDP Sciences, 2023.

[28] Anand, L., Mahesh Maurya, J. Seetha, D. Nagaraju, Ananda Ravuri, and R. G. Vidhya. "An intelligent approach to segment the liver cancer using Machine Learning Method." In *2023 4th International Conference on Electronics and Sustainable Communication Systems (ICESC)*, pp. 1488-1493. IEEE, 2023.

[29] Rathor, Ketan. "AN INNOVATIVE METHOD FOR ENHANCED COMMUNICATION PROTOCOLS FOR DISTRIBUTED PROJECT MANAGEMENT USING SAP, SALESFORCE AND MICROSOFT TOOLS BASED ON SLIDING WINDOW CNN APPROACH."

[30] Thanuja, R., and A. Umamakeswari. "Unethical network attack detection and prevention using fuzzy based decision system in mobile ad-hoc networks." *Journal of Electrical Engineering & Technology* 13, no. 5 (2018): 2086-2098.

[31] Nagesh, A. Seetharam, and G. N. Balaji. "Deep Learning Approach for Recognition and Classification of Tomato Fruit Diseases." In *2022 International Conference on Data Science, Agents & Artificial Intelligence (ICDSAAI)*, vol. 1, pp. 1-6. IEEE, 2022.

[32] Hartwell, Robert. "A revolution in the Chinese iron and coal industries during the Northern Sung, 960–1126 AD." *The Journal of Asian Studies* 21, no. 2 (1962): 153-162.

[33] Deeptha, R., K. Sujatha, D. Sasireka, R. Neelaveni, and R. Pavithra Guru. "Website Vulnerability Scanner." *Journal of Population Therapeutics and Clinical Pharmacology* 30, no. 15 (2023): 43-53.

[34] Tholkapiyan, M., Sudhir Ramadass, J. Seetha, Ananda Ravuri, Pellakuri Vidyullatha, S. Siva Shankar, and Santosh Gore. "Examining the Impacts of Climate Variability on Agricultural Phenology: A Comprehensive Approach Integrating Geoinformatics, Satellite Agrometeorology, and Artificial Intelligence." *International Journal of Intelligent Systems and Applications in Engineering* 11, no. 6s (2023): 592-598.

[35] Shanmugam, Gowri, Deepa Rajendran, Tamilvizhi Thanarajan, Sadish Sendil Murugaraj, and Surendran Rajendran. "Artificial Intelligence as a Catalyst in Digital Marketing: Enhancing Profitability and Market Potential." *Ingénierie des Systèmes d'Information* 28, no. 6 (2023).

[36] Syamala, Maganti, R. Anusuya, Sanjay Kumar Sonkar, Chandrashekhar Goswami, Satish Salunkhe, and Muniyandy Elangovan. "Big data analytics for dynamic network slicing in 5G and beyond with dynamic user preferences." *Optical and Quantum Electronics* 56, no. 1 (2024): 61.

[37] Palanimuthu, Kogila, Eshetu Fikadu Hamba Yigazu, Gemechu Gelalcha, Yirgalem Bekele, Getachew Birhanu, and Birhanu Gutu. "Assessment of Stress, Fear, Anxiety and Depression on COVID-19 Outbreak among Adults in South-Western Ethiopia." *Prof.(Dr) RK Sharma* 21, no. 1 (2021): 440.

[38] SUJATHA, K., and V. CERONMANI SHARMILA. "EFFICIENT MUTUAL USER AUTHENTICATION PROTOCOL TO SHARE FILES USING ID IN CLOUD STORAGE." *Journal of Theoretical and Applied Information Technology* 98, no. 20 (2020).

[39] Dara, Suresh, C. H. Srinivasulu, CH Madhu Babu, Ananda Ravuri, Tirumala Paruchuri, Abhishek Singh Kilak, and Ankit Vidyarthi. "Context-Aware auto-encoded graph neural model for dynamic question generation using NLP." *ACM transactions on asian and low-resource language information processing* (2023).

[40] Sendil, M. Sadish, and N. Nagarajan. "Enhancing peer to peer performance using sandwich methodology." *Int. J. Network. Commun. Eng* 2, no. 9 (2010): 355-358.

[41] Ali, Syed Muqthadar, N. Kumaran, and G. N. Balaji. "A hybrid elephant herding optimization and harmony search algorithm for potential load balancing in cloud environments." *International Journal of Modeling, Simulation, and Scientific Computing* 13, no. 05 (2022): 2250042.

[42] Shankar, S. Siva, K. Maithili, K. Madhavi, and Yashwant Singh Bisht. "Evaluating Clustering Algorithms: An Analysis using the EDAS Method." In *E3S Web of Conferences*, vol. 430, p. 01161. EDP Sciences, 2023.

[43] Yün, Hua. "Implement the policy of taking agriculture as the foundation and industry as the leading factor." *Chinese Economic Studies* 9, no. 4 (1976): 28-38.

[44] Thanuja, R., and A. Umamakeswari. "Black hole detection using evolutionary algorithm for IDS/IPS in MANETs." *cluster computing* 22, no. Suppl 2 (2019): 3131-3143.

[45] Maithili, K., T. Prabhakara Rao, C. Ambhika, Y. Divya, Bommisetti Yamini Supriya, R. Sundar, Tabish Rao, and J. Balajee. "An Effective Twitter Spam Detection Model using Multiple Hidden Layers Extreme Learning Machine." *International Journal of Intelligent Systems and Applications in Engineering* 12, no. 1s (2024): 01-09.

[46] Thomas, Sijo, and Aruna Devi. "Design and implementation of unmanned ground vehicle (UGV) for surveillance and bomb detection using haptic arm technology." In *2017 International Conference on Innovations in Green Energy and Healthcare Technologies (IGEHT)*, pp. 1-5. IEEE, 2017.

[47] Bhola, Biswaranjan, and Raghvendra Kumar. "Improvement of the IoT Computing Platform for water meter network." In *2022 International Conference on Advancements in Smart, Secure and Intelligent Computing (ASSIC)*, pp. 1-5. IEEE, 2022.

[48] Kumar, R. Praveen, and S. Smys. "A novel report on architecture, protocols and applications in Internet of Things (IoT)." In *2018 2nd International Conference on Inventive Systems and control (ICISC)*, pp. 1156-1161. IEEE, 2018.

[49] Rathor, Ketan, Keyur Patil, Mandiga Sahasra Sai Tarun, Shashwat Nikam, Devanshi Patel, and Sasanapuri Ranjit. "A Novel and Efficient Method to Detect the Face Coverings to Ensurethe Safety

using Comparison Analysis." In *2022 International Conference on Edge Computing and Applications (ICECAA)*, pp. 1664-1667. IEEE, 2022.

[50] Wang, Mingxi, Shulin Liu, Shouyang Wang, and Kin Keung Lai. "A weighted product method for bidding strategies in multi-attribute auctions." *Journal of Systems Science and Complexity* 23, no. 1 (2010): 194-208.

[51] Murugaraj, Sadish Sendil, K. Suresh Kumar, K. Maithili, C. Ashokkumar, N. Alangudi Balaji, and Balambigai Subramanian. "Optimized Neural Network Based Location Prediction Along with Multiple Features in Communication Network." *Journal for ReAttach Therapy and Developmental Diversities* 6, no. 9s (2) (2023): 1192-1207.

[52] Parasa, Gayatri, M. Arulselvi, and Shaik Razia. "Identification of Diseases in Paddy Crops Using CNN." *International Journal of Intelligent Systems and Applications in Engineering* 11, no. 6s (2023): 548-557.

[53] Arul, U., V. Arun, T. Prabhakara Rao, R. Baskaran, S. Kirubakaran, and MI Thariq Hussan. "Effective Anomaly Identification in Surveillance Videos Based on Adaptive Recurrent Neural Network." *Journal of Electrical Engineering & Technology* (2024): 1-13.

[54] Gajala, Gowtham, and Nagavarapu Sateesh. "Adopting Domain based Reuse for Large-scale Company." *International Journal of Science and Research (IJSR), ISSN*: 2319-7064.

[55] Das, Bijoy, Suman Sankar Bhunia, Sarbani Roy, and Nandini Mukherjee. "Multi criteria routing in wireless sensor network using weighted product model and relative rating." In *2015 Applications and Innovations in Mobile Computing (AIMoC)*, pp. 132-136. IEEE, 2015.

[56] Prabha, B., P. Manivannan, and Puvvada Nagesh. "Human Abnormal Activity Detection in the ATM Surveillance Video." In *Evolution in Signal Processing and Telecommunication Networks: Proceedings of Sixth International Conference on Microelectronics, Electromagnetics and Telecommunications (ICMEET 2021), Volume 2*, pp. 39-48. Singapore: Springer Singapore, 2022.

[57] Rathor, Ketan. "MACHINE LEARNING BASED SMART E-AUDITOR TO PREVENT TAX EVASION."

[58] Mateo, José Ramón San Cristóbal. "Weighted sum method and weighted product method." In *Multi criteria analysis in the renewable energy industry*, pp. 19-22. Springer, London, 2012.

[59] Kumar, Praveen. "Analysis of dynamic topology wireless sensor networks for the internet of things iot." (2017).

[60] Tasisa, Yirgalem Bekele, and Kogila Palanimuthu. "Psychosocial Impacts of Imprisonment among Youth Offenders in Correctional Administration Center, Kellem Wollega Zone, Ethiopia." *Medico-legal Update* 21, no. 2 (2021).

[61] Jhade, Srinivas, V. Senthil Kumar, T. Kuntavai, Purnendu Shekhar Pandey, Ajith Sundaram, and Gayatri Parasa. "An Energy Efficient and Cost Reduction based Hybridization Scheme for Mobile Ad-hoc Networks (MANET) over the Internet of Things (IoT)."

[62] Vijayalakshmi, N. S., Melanie Elizabeth Lourens, Sonali Vyas, Amitabh Bhargava, Anchal Pathak, Sujay Mugaloremutt Jayadeva, Kawerinder Singh Sidhu, Ankit Kumar Singh, Joel Alanya-Beltran, and Jeidy Panduro-Ramirez. "HR management in terms of improving employee retention within organizations."

[63] M. Malathi; P. Muthulakshmi; N. Patchiraja; M. Ramachandran; Chinnasami Sivaji, "Exploring Various Applications of Micro Controller", /Electrical and Automation Engineering, 1(1) 2022, 47-53.

[64] Fitriasari, Novi Sofia, Syifa Afifah Fitriani, and Rosa Ariani Sukamto. "Comparison of weighted product method and technique for order preference by similarity to ideal solution method: Complexity and accuracy." In *2017 3rd International Conference on Science in Information Technology (ICSITech)*, pp. 453-458. IEEE, 2017.

[65] Vadivelan, N., K. Bhargavi, Sarangam Kodati, and M. Nalini. "Detection of cyber attacks using machine learning." In *AIP Conference Proceedings*, vol. 2405, no. 1. AIP Publishing, 2022.

[66] Susanto, R., and A. D. Andriana. "Employee recruitment analysis using computer based weighted product model." In *IOP Conference Series: Materials Science and Engineering*, vol. 662, no. 2, p. 022049. IOP Publishing, 2019.

[67] Bhandekar, Prarthana, Chanchal Tomar, Divyani Kasewar, and Ansar Sheikh. "A Survey on Smart Trolley System Based on Android Application." *Engineering and Technology* 4, no. 4 (2018): 55-56.

[68] Khairina, Dyna Marisa, Muhammad Reski Asrian, and Heliza Rahmania Hatta. "Decision support system for new employee recruitment using weighted product method." In *2016 3rd International Conference on Information Technology, Computer, and Electrical Engineering (ICITACEE)*, pp. 297-301. IEEE, 2016.

[69] Supriyono, Heru, and Chintya Purnama Sari. "Developing decision support systems using the weighted product method for house selection." In *AIP Conference Proceedings*, vol. 1977, no. 1, p. 020049. AIP Publishing LLC, 2018.

[70] Nagavarapu, Sateesh, and Manthru Naik D. Narahari. "The A SURVEY ON SECURE AND EFFICIENT FEATURE BASED PRODUCT INFORMATION RETRIEVAL FROM CLOUD." *Turkish Journal of Computer and Mathematics Education (TURCOMAT)* 11, no. 1 (2020): 694-699.

[71] Li, Xiao, P. Manivannan, and M. Anand. "Task Modelling of Sports Event for Personalized Video Streaming Data in Augmentative and Alternative Communication." *Journal of Interconnection Networks* 22, no. Supp01 (2022): 2141027.

[72] Kuntavai, T., and A. Jeevanandham. "A Power Efficient Level Converter with Scalable Driving Capability Using Body Bias Techniques." *Journal of Computational and Theoretical Nanoscience* 15, no. 1 (2018): 237-244.

[73] Nagavarapu, Sateesh, and Vamsi KrishnaK Bhavani. "The REDUCTION OF TRAFFIC LOAD IN CLOUD COMPUTING USING ENERGY EFFICIENT CLUSTERING TECHNIQUE." *Turkish Journal of Computer and Mathematics Education (TURCOMAT)* 11, no. 3 (2020): 1118-1124.

[74] Rao, T. Prabhakara, M. Nagabhushana Rao, U. Arul, and J. Balajee. "Detection of MRI Medical MRI Images of Brain Tumors Using Deep Learning & Secure the Transfer of Medical Images Using Blockchain." *Journal of Algebraic Statistics* 13, no. 3 (2022): 374-377.

[75] Taufik, I., A. Saleh, C. Slamet, D. S. Maylawati, M. A. Ramdhani, and B. A. Muhammad. "Decision support system design for determining brown sugar quality with weighted product method." In *Journal of Physics: Conference Series*, vol. 1280, no. 2, p. 022019. IOP Publishing, 2019.

[76] Raghu, D., T. Srikanth, and Ch Raja Jacub. "Probability based heart disease prediction using data mining techniques." *IJCST* 2, no. 4 (2011): 66-68.

[77] Babu, Awari Mahesh, T. Sunil Kumar, and Sarangam Kodati. "Construction Method of Urban Planning Development Using Artificial Intelligence Technology." *Design Engineering* (2021): 782-792.

[78] Shailendra, Roopashree, Anitha Jayapalan, Sathiyamoorthi Velayutham, Arunadevi Baladhandapani, Ashutosh Srivastava, Sachin Kumar Gupta, and Manoj Kumar. "An IoT and machine learning based intelligent system for the classification of therapeutic plants." *Neural Processing Letters* 54, no. 5 (2022): 4465-4493.

[79] Zhang, Li, Sudhakar Sengan, and P. Manivannan. "The capture and evaluation system of student actions in physical education classroom based on deep learning." *Journal of Interconnection Networks* 22, no. Supp02 (2022): 2143025.

[80] Nirmala, A. P., Ansar Isak Sheikh, and R. Kesavamoorthy. "An Approach for Detecting Complications in Agriculture Using Deep Learning and Anomaly-Based Diagnosis." *Mathematical Statistician and Engineering Applications* 70, no. 2 (2021): 880-889.

[81] Vikrant Sharma, M. Ramachandran, Kurinjimalar Ramu, Chinnasami Sivaji, "A Review on Material Selection for Small Wind Turbine Blades Using the WASPAS Method", Journal on Advances in Mechanical Engineering, 9(3) September 2023, 01-10.

[82] Rajagopalan, Sundararaman, Sivaraman Rethinam, V. Lakshmi, J. Mahalakshmi, R. Ramya, and Amirtharajan Rengarajan. "Secure medical image sharing: a hardware authentication approach." In *2017 international conference on microelectronic devices, circuits and systems (ICMDCS)*, pp. 1-4. IEEE, 2017.

[83] Praveen Kumar, R., Jennifer S. Raj, and S. Smys. "Performance analysis of hybrid optimization algorithm for virtual head selection in wireless sensor networks." *Wireless Personal Communications* (2021): 1-16.

[84] Kothavari, K., B. Arunadevi, and S. N. Deepa. "A hybrid DE-RGSO-ELM for brain tumor tissue categorization in 3D magnetic resonance images." *Mathematical Problems in Engineering* 2014 (2014).

[85] Goswami, Chandrashekhar, T. Vaishnavi, Parismita Sarma, P. Muthu Krishnammal, KV Daya Sagar, and S. Hari Kumar. "An incentive-based approach for information sharing control between human and computer interface." *Optical and Quantum Electronics* 56, no. 3 (2024): 312.

[86] Parasa, Gayatri, M. Arulselvi, and Shaik Razia. "Comparative Analysis of VGG and ResNet for the Prediction of Rice Leaf Disease." In *2023 5th International Conference on Inventive Research in Computing Applications (ICIRCA)*, pp. 191-199. IEEE, 2023.

[87] Aswini, S., S. Tharaniya, R. J. Joey Persul, B. Avinash Lingam, and P. Kogila. "Assessment of Knowledge, Attitude and Practice on Immunization among Primi Mothers of Children." *Indian Journal of Public Health Research & Development* 11, no. 3 (2020).

[88] Rathor, Ketan. "Impact of using Artificial Intelligence-Based Chatgpt Technology for Achieving Sustainable Supply Chain Management Practices in Selected Industries." *International Journal of Computer Trends and Technology* 71, no. 3 (2023): 34-40.

[89] Makde, Shivani, Sonali Deshmukh, Bhuvaneshwari Gaddamwar, Khushbu Akare Poonam Thakur, Nikita Dongre, Shraddha Malwe, and Ansar Sheikh. "A Review on Detection of Covid

Symptoms." *International Journal of Computational and Electronics Aspects in Engineering* 2, no. 3 (2021).

[90] Mohan, K. Venkata Murali, Sarangam Kodati, and V. Krishna. "Securing SDN enabled IoT scenario infrastructure of fog networks from attacks." In *2022 Second International Conference on Artificial Intelligence and Smart Energy (ICAIS)*, pp. 1239-1243. IEEE, 2022.

[91] Seetha, J., D. Nagaraju, T. Kuntavai, and K. Gurnadha Gupta. "The Smart Detection and Analysis on Skin Tumor Disease Using Bio Imaging Deep Learning Algorithm." *ICTACT Journal on Image & Video Processing* 13, no. 4 (2023).

[92] Sendil, Dr M. Sadish, and Dr M. Sadish Sendil. "Heart disease prediction using SVM based neuro-fuzzy technique in the cloud computing." *International Journal of Engineering & Technology* 7, no. 2.20 (2018): 153-158.

[93] Yamuna Devi, M. M., J. Jeyabharathi, S. Kirubakaran, Sreekumar Narayanan, T. Srikanth, and Prasun Chakrabarti. "Efficient segmentation and classification of the lung carcinoma via deep learning." *Multimedia Tools and Applications* (2023): 1-15.

[94] Muthumayil, K., R. Karuppathal, T. Jayasankar, B. Aruna Devi, N. B. Prakash, and S. Sudhakar. "A big data analytical approach for prediction of cancer using modified k-nearest neighbour algorithm." *Journal of Medical Imaging and Health Informatics* 11, no. 8 (2021): 2184-2189.

[95] Anand, L., S. Padmalal, J. Seetha, R. Juliana, PS Naveen Kumar, and Gayatri Parasa. "Evaluation of Wireless Sensor Networks Module using IoT Approach." In *2023 Third International Conference on Artificial Intelligence and Smart Energy (ICAIS)*, pp. 1543-1546. IEEE, 2023.

[96] Rene Robin, C. R., D. Moses, D. V. Babu, B. Subramanian, and S. Siva Shankar. "A Novel Hybrid Based Method in Covid 19 Health System for Data Extraction with Blockchain Technology." *International Journal on Recent and Innovation Trends in Computing and Communication* (2023): 81-94.

[97] Selvan Chenni Chetty, Thirumalai, Vadim Bolshev, Siva Shankar Subramanian, Tulika Chakrabarti, Prasun Chakrabarti, Vladimir Panchenko, Igor Yudaev, and Yuliia Daus. "Optimized Hierarchical Tree Deep Convolutional Neural Network of a Tree-Based Workload Prediction Scheme for Enhancing Power Efficiency in Cloud Computing." *Energies* 16, no. 6 (2023): 2900.

[98] Goswami, Chandrashekhar, Priti Sharma, Rakesh Bharati, K. C. Rajheshwari, Lakshmana Phaneendra Maguluri, and Muniyandy Elangovan. "Algorithms for high mobility environment in 5G radio access networks with millimeter wave communications." *Optical and Quantum Electronics* 56, no. 2 (2024): 276.