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Original Article

Optimization of Process Parameters in CNC Turning of Aluminum 7075Alloy Using L27 Array-Based Taguchi Method

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***Abstract**: The manufacturing sector wants to create a lot of goods in a short amount of time as the fourth industrial revolution approaches. Response surface design and the Taguchi L27 orthogonal array methodological paradigm are used in this work. Through the use of a Computer Numerical Control (CNC) machine, the process parameters for turning aluminum alloy 7075 are optimized in this work. The force of cutting, the machined surface roughness, and the rate of metal removal were all affected by the ideal parameters. In this experimental study, the turning of Aluminum 7075 alloy in a CNC machine is optimized in terms of speed (800, 1200, and 1600 rpm), feed (0.15, 0.20, and 0.25 mm/rev), and cutting depth (1.0, 1.5, and 2.0 mm).*

***Key words:** Al7075; Turning Parameters; Taguchi Method; L27 Array; Signal to Noise Ratio.*

INTRODUCTION

Industrial sectors are concentrating on high production at low cost in the current market rivalry. Manufacturing sectors in particular are focusing on producing a wide range of goods in batches. These days, composites are used more widely as building materials in the majority of the top industrial industries. The only option available for producing components with tighter tolerances is machining. In many technical domains, the second generation of hybrid composites serves as a superior substitute for a variety of materials. In particular, lighter, higher-strength aluminum (Al) matrix composites must be used in place of ferrous materials in mechanical components used in the automobile, aerospace, and locomotive sectors. In order to turn the composites into technical components, the machining procedure becomes crucial and is always completed [1].

Because the reinforcing particles in Metal Matrix Composites (MMCs) are rough and abrasive, MMCs are difficult to manufacture. As a result, machinability investigations have grown in significance within the composites field [2]. The researchers have taken into account a wide range of factors, including the work piece's features, the geometry of the cutting tool, the metallurgical properties, and process variables including feed rate, depth of cut, and cutting speed. The three main output responses that were impacted were tool wear, surface roughness, and cutting zone temperature.

Using the Taguchi approach [3], the best output responses were found during the turning process, and the parameters and their levels were chosen. The methodological paradigm employed in the design and analysis of the trials was the Taguchi method. The authors presented a successful strategy for producing high-quality, reasonably priced product improvements [4]. Referencing many research studies is necessary in order to manage multiple performance parameters using the Taguchi method [5]. Numerous scholarly works provided comprehensive elucidations regarding the importance of implementing various constraints to turn through the Taguchi approach [6]. The fundamental information and characteristics of Al 7075, such as its chemical compositions, were clearly presented by an examination of laser micromachining on the material for optimization.

A study that looked at machining on Al7075-T7351 through experiments noted that there was a strong physical relationship between surface roughness and chip thickness [11]. Three hybrid composites made of Al7075 material were the subject of an experimental investigation that employed the turning process and concentrated on the specifics of the cutting force for the different factors of cutting depth (D), rate of feed (F), and speed of cutting (N) [12]. Researchers explained how they prepared for experimentation by using an orthogonal array (L27) to propose Taguchi's method for determining critical parameters that have a significant impact on cutting force and surface roughness [13]. Using the Taguchi gray relational approach, they examined the turning process at speeds between 125 and 185 m/min, feed rates between 0.12 and 0.20 mm/min, Depth of Cut (DOC) between 0.5 and 0.8 mm, and cutting fluid ratios between 4.0% and 12.0%.

Researchers were able to determine the DOC, cutting speed, cutting fluid combination ratios, and feed rate based on this investigation. The DOC was discovered to have the greatest influencing effect of all the components [14].

In the Taguchi approach, an orthogonal array (L9) was used in an experimental investigation of tool life, cutting force, surface roughness, and responses by taking into account parameters, such as feed (F) and speed of cutting (N) with DOC. Their study, which demonstrated the characteristics of the parameter correlations as well as the outcome outcomes, skillfully employed the optimization technique [15]. Tool life was inspected using a turning process with cutting speeds ranging from 135 to 285 m/min, feed rates ranging from 0.08 to 0.32 mm/min, and DOC ranging from 0.6 to 1.6 mm.

The Taguchi method's force of cutting with roughness on a machined surface was added for gray relational analysis. However, they projected the optimization values for the best production on the turning process and explained every step of their inquiry in detail. It is clear from their study [16] that the feed rate produces a higher contribution than the other factors taken into account. AISI (American Iron and Steel Institute)-1016 carbon steel material was converted using cubic boron nitride while taking a number of factors into account. The parameters included speed ranging from 360 to 1150 m/min, feed ranging from 0.05 to 0.13 mm/min, and DOC ranging from 0.5 to 1.0 mm from start to finish. To assess surface roughness, the Taguchi approach was used. They observed that the rate of feed, speed, and DOC accounted for 64% of the primary contributing order [17]. The turning of AISI 1045 steel under dry cutting conditions using the Taguchi technique was investigated. A range of machining parameters, including speed (160–620 m/min), feed (0.3–0.5 mm/min), and DOC (0.7–0.9 mm), were used. Using a method for the machined surface's roughness and the rate at which metal is manually removed, they had finished computing signal-to-noise ratios and produced a match through the experiment [18].

In a test investigation of CNC use on aluminum, the Taguchi method analysis revealed that the operating cutting speed ranged from 600 to 1000 m/min, the feed rate from 0.1 to 0.2 mm/min, and the DOC from 0.5 to 1.5 mm for MRR. The parameters of turning Al alloy using a CNC machine with cutting speeds between 600 and 700 m/min, feed rates between 25 and 50 mm/min, and DOC between 0.2 and 0.4 mm were discussed. Using a fishbone diagram, they also highlighted the constraints that affected surface roughness [20]. A strong correlation was found between the theoretical and experimental values when ANNs (Artificial Neural Networks) were used to calculate tool life during machining and determine parameter effects [21–23]. Despite a large body of study on the experimental examination and modeling of Al7075 alloy, no work was identified on the response surface methodology (RSM) modeling of CNC turning of Al7075 alloy. Thus, RSM has been utilized in the suggested study to model the CNC turning of Al7075 alloy

EXPERIMENTAL ARRANGEMENT AND METHODOLOGY

Aluminum alloy AA7075 with 24 mm diameter rods were procured; then, the pur- chased materials were visually tested regarding any cracks or damage on the surface of the materials. Each specimen was prepared with a length of 150 mm and diameter of 24 mm. There is no change in diameter for the raw materials, and only the length needed to be cut. So, the long raw material was cut as 150 mm length rods. There were more than 27 raw specimens, which were prepared from the purchased material for turning, as shown in Figure 1.

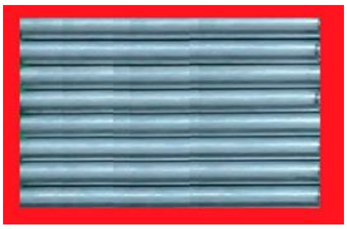

Figure 1: Raw Materials of Aluminum Alloy Al7075 Rods in Multiple Numbers

The turning operation was considered for this investigation. This turning can be done by various machines such as normal lathes, etc., but the greater accuracy can be obtained from CNC machine only [24]. So, in this investigation, turning operations are perfectly completed with the help of a FANUC Series 0i controlled CNC machine. Figure 2 shows the CNC machine chosen for the experiments and the corresponding most preferable specification of that CNC machine, including the model of the machine, the spindle power, and size of the chuck; the spindle bore dimensions are clearly mentioned in Table 1.

Figure 2: CNC Machine Used For the Experimental Investigation

Table 1: CNC machine specifications with parameter for turning process and responses for the experiment

		Model		**ATL 160**
CNC machine specifications (heavy-duty variant of std TL-160)		Chuck Size		165 m
		Tail Stock		Hydraulic
		Spindle Bore		25.5 mm
		Spindle Power		3.5/5.5 KW
			Control	FANUC Series 0i mate
Turning	Speed (N) in rpm	800	1200	1600
Process	Feed (F) in mm per rev	0.150	0.200	0.250
Parameters	Depth of cut (D) in mm	1.00	1.50	2.00
Responses	MRR – Metal removal rate in mm^3/min			

Table 1 also mentions the turning process parameters (N, F, and D) and three responses (MRR, SR, and CF) for investigational experiments. The raw material is turned by using a CNC machine as per the dimensions shown in Figure 3, i.e., 80 mm long, 16 mm diameter turned from the 24 mm diameter Al7075 rod. In the CNC turning process, the heat was generated in between the specimens and tool; that heat was carried away from both of them by applying coolant such as soluble oil.

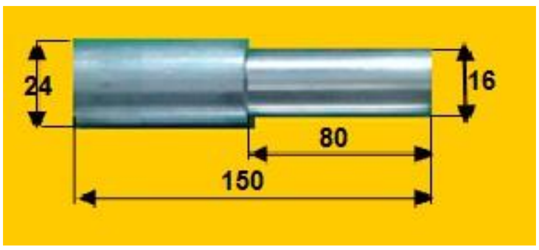

Figure 3: Turning Operation: Image After Turning of Al7075 Alloy with its Dimensions

Using an L27 orthogonal array, the twenty-seven numbers of specimens were ma- chined by applying 27 runs with correlations of parameters in CNC turning. The corre- sponding individual specimen responses such as cutting forces were measured with the help of a lathe tool dynamometer fixed on the machining setup in the CNC machine. The sensing elements have higher accuracy by using a strain gauge. The surface roughness was measured with the help of a surface roughness tester (Model: Mitutoyo SJ210) with a measuring range up to 160 microns. The evaluation parameters of this instrument such as Rx, Ry, Rz, and cut-off length were specified as 0.08, 0.25, 0.8, and 2.5 mm, and the sampling length of the instrument was specified as 0.08, 0.25, 0.8, and 2.5 mm. This instrument is used extremely often in industry with different sampling lengths (0.3 to 16.0 mm with 0.01 mm interval). All the responses compared chose optimum process parameters through the assistance of the Taguchi investigation method. Comparisons were completed as per the ideas shown in Table 2. In the turning process, MRR was preferred to be set as large (high), and a smaller amount of SR was favored for machining. Similarly, the minimum CF was set to be suitable for the operations [25].

Table 2: Summary of Responses and its Best Conditions

Comparison	Responses	Better/Best Conditions
1	Material Removal Rate (MRR)	Larger (High)
2	Surface Roughness (SR)	Smaller
3	Cutting Force (CF)	Smaller
4	Surface Roughness (SR) and Cutting Force (CF)	Smaller
5	Material Removal Rate (MRR), Roughness (SR) and Cutting Force Nominal is Best (CF)	

Assessment of Results Using Taguchi Analysis and RSM

There were 27 specimens that were turned as per the dimensions mentioned in Figure 3 with the conditions N, F, and D, as shown in Table 3. After completing the tuning process, the specimens were fully cleaned, and oil was applied on the surface. Then, the experiment- tally measured responses of an individual specimen's results based on an L27 orthogonal array of process parameters were measured with the help Minitab 17 statistical analysis on the CNC machine, as mentioned in Table 3. Figure 4 shows the sample specimen after turning with respect to process parameters. It is to be noted that excess raw specimens were kept as balance.

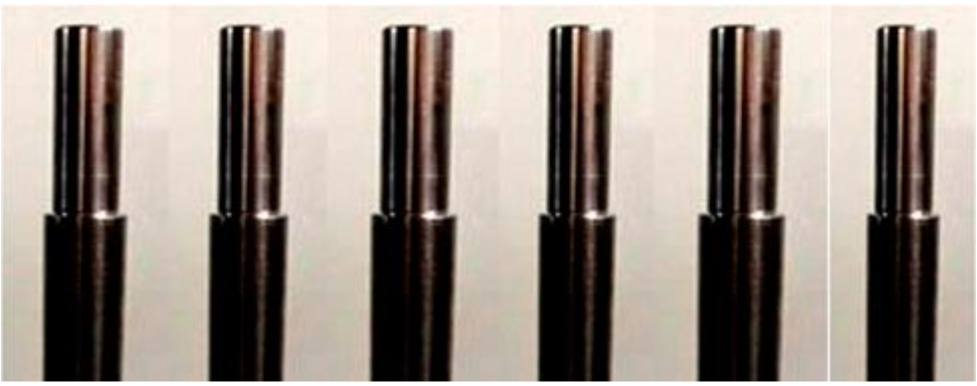

Table 3: L27 Orthogonal Array with Experimental Results of Responses

Number	N in Revolutions per Minute	F in mm per Revolution	D in mm	MRR in mm^3 per Minute	SR in µm	CF in Newton
1	800	0.15	1	11,194.8	0.74	710.12
2	800	0.2	1	12,594.15	1.79	723.22
3	800	0.25	1	14,393.32	2.43	786.23
4	800	0.15	1.5	13,993.5	0.64	799.56
5	800	0.2	1.5	16,516.92	1.74	746.56
6	800	0.25	1.5	19,375.62	2.85	789.31

7	800	0.15	2	17,563.52	0.82	780.45
8	800	0.2	2	20,307.82	1.66	912.32
9	800	0.25	2	23,630.92	2.76	946.31
10	1200	0.15	1	14,816.65	1.52	776.32
11	1200	0.2	1	19,010.04	1.83	786.98
12	1200	0.25	1	20,561.88	2.89	756.84
13	1200	0.15	1.5	19,375.62	0.63	789.56
14	1200	0.2	1.5	23,988.86	2.49	800.12
15	1200	0.25	1.5	25,834.16	2.77	835.35
16	1200	0.15	2	25,484.32	0.93	865.66
17	1200	0.2	2	29,538.65	2.75	883.25
18	1200	0.25	2	35,127.04	2.44	896.21
19	1600	0.15	1	18,318.77	1.35	798.91
20	1600	0.2	1	22,898.46	1.47	765.54
21	1600	0.25	1	25,188.31	2.75	796.46
22	1600	0.15	1.5	25,188.31	0.71	888.65
23	1600	0.2	1.5	29,633.3	1.48	864.26
24	1600	0.25	1.5	34,742.49	2.82	798.65
25	1600	0.15	2	36,102.79	0.76	812.12
26	1600	0.2	2	38,226.48	1.83	841.73
27	1600	0.25	2	41,925.82	2.82	897.87

For the initial analysis, only one response—that is, MRR–was taken for the consid- eration. Table 4 clearly mentions the Taguchi analysis details of MRR versus speed (N), feed (F), and depth of cut (D). In addition, it also mentions the designated rank: i.e., rank one for feed, second rank for depth of cut, and third rank for speed. The corresponding main effects diagram regarding the ratio of signal to noise for the material removal rate is highlighted in Figure 5 under the larger is better condition [26]. The highest MRR is obtained at the conditions of 1600 rpm cutting speed, 0.25 mm per min of feed, and 2.0 mm of cutting depth as shown in Figure 5 with respect to the signal-to-noise (SN) ratio. The interaction diagram regarding the SN ratios of MRR is shown in Figure 6. It also provides the details of the individual factors such as N, F, and D as the separate diagrams of the combination with the response such as MRR.

CONCLUSION

The proposed work takes into consideration the optimization of speed of cutting, feed, and cutting depth on the turning of Aluminum 7075 alloy through a CNC machine. When examining their effects on the metal removal rate, roughness of the machined surface, and force of cutting with the assist of L27 array, the Taguchi method produced substantial conclusions by taking into account the SN ratio, various surface diagrams, contour diagrams, and ranking positions.

The maximum material removal rate was obtained at a speed of 1600 rpm, and a 0.25 mm/min feed with 2 mm cutting depth was preferred for the specimen number 27. Moreover, the least amount of surface roughness was reached through a speed of 1200 rpm and a 0.25 mm/min feed with 1 mm cutting depth for specimen 12. The lowest possible cutting force was accomplished at a speed of 1600 rpm and 0.25 mm/min feed with 2 mm cutting depth for specimen 27. Both parameters, i.e., CF and SR, achieved the smallest amount at 1600 rpm speed, 0.25 mm/min feed, and 2.0 mm depth of cut for specimen 27. By taking the nominal is best condition with respect to three responses, we attained 800 rpm speed, 0.15 mm/min feed and 2.0 mm depth of cut in specimen 7. Nonetheless, specimen 27 demonstrated a speed of 1600 rpm, and a 0.25 mm/min feed with 2 mm cutting depth were chosen as the optimum limitations for the greatest MRR and least amount of SR and CF.

Author Contributions:

Conceptualization, M.N.A., T.S., A.A.; Formal analysis, M.N.A., E.A.B., V.M., K.A.; Methodology, M.N.A., T.S., K.A., M.R. and A.A.; Project administration, S.S.N.A., E.A.B., I.A.R.
and T.S.; Supervision, S.S.N.A., E.A.B., I.A.R. and B.S.; Writing—original draft, M.N.A., T.S. and K.A.; Writing—review and editing, M.N.A., V.M., M.R. and B.S. All authors have read and agreed to the published version of the manuscript.

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The dataset can be requested from the corresponding authors upon a formal request.

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Conflicts of Interest:

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

REFERENCES

[1] Rajmohan, T.; Palanikumar, K.; Prakash, S. Grey-fuzzy algorithm to optimise machining parameters in drilling of hybrid metal matrix composites. *Compos. Part B Eng.* **2013**, *50*, 297–308. [CrossRef]

[2] Kılıçkap, E.; Çakır, O.; Aksoy, M.; Inan, A. Study of tool wear and surface roughness in machining of homogenised SiC-p reinforced aluminium metal matrix composite. *J. Mater. Process. Technol.* **2005**, *164-165*, 862–867. [CrossRef]

[3] Grzesik, W. Influence of tool wear on surface roughness in hard turning using differently shaped ceramic tools. *Wear* **2008**, *265*, 327–335. [CrossRef]

[4] Aouici, H.; Yallese, M.A.; Chaoui, K.; Mabrouki, T.; Rigal, J.-F. Analysis of surface roughness and cutting force components in hard turning with CBN tool: Prediction model and cutting conditions optimization. *Measurement* **2012**, *45*, 344–353. [CrossRef]

[5] Kulandaivel, A.; Kumar, S. Effect of magneto rheological minimum quantity lubrication on machinability, wettability and tribological behavior in turning of Monel K500 alloy. *Mach. Sci. Technol.* **2020**, *24*, 810–836. [CrossRef]

[6] Sathish, T.; Sevvel, P.; Sudharsan, P.; Vijayan, V. Investigation and optimization of laser welding process parameters for AA7068 aluminium alloy butt joint. *Mater. Today Proc.* **2021**, *37*, 1672–1677. [CrossRef]

[7] Ross, P.J. *Taguchi Techniques for Quality Engineering*, 2nd ed.; McGraw-Hill Professional: New York, NY, USA, 1988.

[8] Elsayed, E.; Chen, A. Optimal levels of process parameters for products with multiple characteristics. *Int. J. Prod. Res.* **1993**, *31*, 1117–1132. [CrossRef]

[9] Sathish, T.; Karthick, S. Wear behaviour analysis on Aluminium Alloy 7050 with Reinforced SiC through Taguchi approach. *J. Mater. Res. Technol.* **2020**, *9*, 3481–3487. [CrossRef]

[10] Ranganath, M.S.; Vipin, H. Optimization of Process Parameters in Turning Operation Using Taguchi Method and Anova: A Review. *Int. J. Emerg. Technol. Adv. Eng.* **2013**, *1*, 31–45.

[11] Mandal, K.; Kuar, A.S.; Mitra, S. Experimental investigation on laser micro-machining of Al 7075 Alloy. *Opt. Laser Technol.* **2018**,

[12] *107*, 260–267. [CrossRef]

[13] Karabulut, S. Optimization of surface roughness and cutting force during AA7039/Al2O3 metal matrix composites milling using neural networks and Taguchi method. *Measurement* **2015**, *66*, 139–149. [CrossRef]

[14] Muñoz-Escalona, P.; Maropoulos, P.G. Artificial neural networks for surface roughness prediction when face milling Al 7075– T7351. *J. Mater. Eng. Perform.* **2010**, *19*, 185–193. [CrossRef]

[15] Ajithkumar, J.P.; Xavior, M.A. Cutting Force and Surface Roughness Analysis During Turning of Al 7075 Based Hybrid Composites.

[16] Divit Gupta, Anushree Srivastava "Investigating the Use of Artificial Intelligence in Talent Acquisition Procesdures" IJARCCE International Journal of Advanced Research in Computer and Communication Engineering, vol. 12, no.11, pp. 77-87, 2023/ Crossref https://doi.org/10.17148/IJARCCE.2023.121111

[17] Ganesh, A. ., & Crnkovich, M., (2023). Artificial Intelligence in Healthcare: A Way towards Innovating Healthcare Devices. *Journal of Coastal Life Medicine*, 11(1), 1008–1023. Retrieved from https://jclmm.com/index.php/journal/article/view/467 | Google Scholar

[18] Kushal Walia, 2024. "*Scalable AI Models through Cloud Infrastructure*" *ESP International Journal of Advancements in Computational Technology (ESP-IJACT)* Volume 2, Issue 2: 1-7. | Link

[19] "Digital Signal Processing for Noise Suppression in Voice Signals", IJCSPUB - INTERNATIONAL JOURNAL OF CURRENT SCIENCE (www.IJCSPUB.org), ISSN:2250-1770, Vol.14, Issue 2, page no.72-80, April-2024, Available :https://rjpn.org/IJCSPUB/papers/IJCSP24B1010.pdf

[20] Sridhar Selvaraj, 2024. "*SAP Supply Chain with Industry 4.0*" *ESP International Journal of Advancements in Computational Technology (ESP-IJACT)* Volume 2, Issue 1: 44-48. | Google Scholar

[21] Bhattacharya, S. (2024). Decentralized Identity Verification via Smart Contract Validation: Enhancing PKI Systems for Future Digital Trust. *International Journal of Global Innovations and Solutions (IJGIS)*. https://doi.org/10.21428/e90189c8.93f690d2

[22] Venkata Sathya Kumar Koppisetti, "Automation of Triangulation, Inter-Company, or Intra-Company Procurement in SAP SCM," *International Journal of Computer Trends and Technology*, vol. 71, no. 9, pp. 7-14, 2023. Crossref, https://doi.org/10.14445/22312803/IJCTT-V71I9P102

[23] Sumanth Tatineni, Anirudh Mustyala, 2024. "*Leveraging AI for Predictive Upkeep: Optimizing Operational Efficiency*" *ESP International Journal of Advancements in Computational Technology (ESP-IJACT)* Volume 2, Issue 1: 66-79.

[24] Arnab Dey, "Innovative Approach to Mitigate Man-in-the-Middle Attacks i Secure Communication Channels", International Journal of Science and Research (IJSR), Volume 11 Issue 8, August 2022, pp. 1497-1500. https://www.ijsr.net/getabstract.php?paperid=SR24320191712

[25] Dhamotharan Seenivasan, "ETL (Extract, Transform, Load) Best Practices," International Journal of Computer Trends and Technology, vol. 71, no. 1, pp. 40-44, 2023. Crossref, https://doi.org/10.14445/22312803/IJCTT-V71I1P106

[26] Shreyaskumar Patel "Enhancing Image Quality in Wireless Transmission through Compression and De-noising Filters" Published in International Journal of Trend in Scientific Research and Development (ijtsrd), ISSN: 2456-6470, Volume-5 | Issue-3, April 2021, pp.1318-1323, URL: https://www.ijtsrd.com/papers/ijtsrd41130.pdf

[27] A. Kumar, S. M. Ahmed and V. K. Duleb, "English text compression for small messages," ICIMU 2011 : Proceedings of the 5th international Conference on Information Technology & Multimedia, Kuala Lumpur, Malaysia, 2011, pp. 1-5, doi: 10.1109/ICIMU.2011.6122737.

[28] Next-Generation Decision Support: Harnessing AI and ML within BRMS Frameworks (N. R. Palakurti , Trans.). (2023). International Journal of Creative Research in Computer Technology and Design, 5(5), 1-10. https://jrctd.in/index.php/IJRCTD/article/view/42

[29] Pratiksha Agarwal, Arun Gupta, "Harnessing the Power of Enterprise Resource Planning (ERP) and Customer Relationship Management (CRM) Systems for Sustainable Business Practices," International Journal of Computer Trends and Technology, vol. 72, no. 4, pp. 102-110, 2024. Crossref, https://doi.org/10.14445/22312803/IJCTT-V72I4P113

[30] Kalla, Dinesh and Smith, Nathan and Samaah, Fnu and Polimetla, Kiran, Facial Emotion and Sentiment Detection Using Convolutional Neural Network (January 2021). Indian Journal of Artificial Intelligence Research (INDJAIR), Volume 1, Issue 1, January-December 2021, pp. 1–13, Article ID: INDJAIR_01_01_001, Available at SSRN: https://ssrn.com/abstract=4690960

[31] Dixit, A., Wazarkar, K. and Sabnis, A.S., 2021. Antimicrobial uv curable wood coatings based on citric acid. *Pigment & Resin Technology*, *50*(6), pp.533-544.

[32] Amit Mangal, 2023. *Revolutionizing Project Management with Generative AI, ESP Journal of Engineering & Technology Advancements* 3(4): 53-60. [Link]

[33] Chanthati, S. R. (2024). Website Visitor Analysis & Branding Quality Measurement Using Artificial Intelligence. Sasibhushan Rao Chanthati. https://journals.e-palli.com/home/index.php/ajet. https://doi.org/10.54536/ajet.v3i3.3212

[34] Panwar, V. (2024). Optimizing Big Data Processing in SQL Server through Advanced Utilization of Stored Procedures. Journal Homepage: http://www. ijmra. us, 14(02).

[35] A. Kumar, S. M. Ahmed and V. K. Duleb, "English text compression for small messages," ICIMU 2011 : Proceedings of the 5th international Conference on Information Technology & Multimedia, Kuala Lumpur, Malaysia, 2011, pp. 1-5, doi: 10.1109/ICIMU.2011.6122737.

[36] Palakurti, N. R. (2023). Governance Strategies for Ensuring Consistency and Compliance in Business Rules Management. Transactions on Latest Trends in Artificial Intelligence, 4(4).

[37] Dileep Kumar Pandiya, Nilesh Charankar. AI-Driven Intrusion Detection Systems for Microservices in B2B Sales Platforms. International Journal of Computer Engineering and Technology (IJCET), 14(1), 2023, 53-60.

[38] P. S. Venkateswaran, F. T. M. Ayasrah, V. K. Nomula, P. Paramasivan, P. Anand, and K. Bogeshwaran, "Applications of Artificial Intelligence Tools in Higher Education," www.igi-global.com, 2024. https://www.igi-global.com/chapter/applications-of-artificial-intelligence-tools-in-higher-education/335567

[39] Next-Generation Decision Support: Harnessing AI and ML within BRMS Frameworks (N. R. Palakurti, Trans.). (2023). International Journal of Creative Research in Computer Technology and Design, 5(5), 1-10. https://jrctd.in/index.php/IJRCTD/article/view/42
[40] Pratiksha Agarwal, Arun Gupta, "Harnessing the Power of Enterprise Resource Planning (ERP) and Customer Relationship Management (CRM) Systems for Sustainable Business Practices," International Journal of Computer Trends and Technology, vol. 72, no. 4, pp. 102-110, 2024. Crossref, https://doi.org/10.14445/22312803/IJCTT-V72I4P113
[41] Chanthati, Sasibhushan Rao. (2021). How the Power of Machine – Machine Learning, Data Science and NLP Can Be Used to Prevent Spoofing and Reduce Financial Risks. 10.13140/RG.2.2.18761.76640.
[42] "Optimizing Wiring Harness Minimization through Integration of Internet of Vehicles (IOV) and Internet of Things (IoT) with ESP-32 Module: A Schematic Circuit Approach", International Journal of Science & Engineering Development Research (www.ijrti.org), ISSN:2455-2631, Vol.8, Issue 9, page no.95 - 103, September-2023, Available : http://www.ijrti.org/papers/IJRTI2309015.pdf
[43] Borra, Praveen; Exploring Microsoft Azure's Cloud Computing: A Comprehensive Assessment International Journal of Advanced Research in Science, Communication and Technology 2 8, 897-906, 2022 IJARSCT.
[44] Kalla, Dinesh and Smith, Nathan and Samaah, Fnu and Polimetla, Kiran, Facial Emotion and Sentiment Detection Using Convolutional Neural Network (January 2021). Indian Journal of Artificial Intelligence Research (INDJAIR), Volume 1, Issue 1, January-December 2021, pp. 1–13, Article ID: INDJAIR_01_01_001, Available at SSRN: https://ssrn.com/abstract=4690960
[45] S. E. Vadakkethil Somanathan Pillai and K. Polimetla, "Analyzing the Impact of Quantum Cryptography on Network Security," 2024 International Conference on Integrated Circuits and Communication Systems (ICICACS), Raichur, India, 2024, pp. 1-6, doi: 10.1109/ICICACS60521.2024.10498417.
[46] D. A. Hassan, "Software Security - Threats, Vulnerabilities, and Countermeasures: Investigating common security threats, vulnerabilities, and countermeasures in software systems to enhance security posture", Australian Journal of Machine Learning Research & Applications, vol. 4, no. 1, pp. 35–45, May 2024, Accessed: Jul. 18, 2024. [Online]. Available: https://sydneyacademics.com/index.php/ajmlra/article/view/12
[47] Palakurti, N. R. (2023). Governance Strategies for Ensuring Consistency and Compliance in Business Rules Management. Transactions on Latest Trends in Artificial Intelligence, 4(4).
[48] M., Arshey and Daniel, Ravuri and Rao, Deepak Dasaratha and Emerson Raja, Joseph and Rao, D. Chandrasekhar and Deshpande, Aniket (2023) Optimizing Routing in Nature-Inspired Algorithms to Improve Performance of Mobile Ad-Hoc Network. International Journal of Intelligent Systems and Applications in Engineering, 11 (8S). pp. 508-516. ISSN 2147-6799
[49] Sachan, V., Malik, S., Gautam, R., & Kumar, P. (Eds.). (2024). Advances in AI for Biomedical Instrumentation, Electronics and Computing: Proceedings of the 5th International Conference on Advances in AI for Biomedical Instrumentation, Electronics and Computing (ICABEC - 2023), 22–23 December 2023, India (1st ed.). CRC Press. https://doi.org/10.1201/9781032644752
[50] S. E. Vadakkethil Somanathan Pillai and K. Polimetla, "Analyzing the Impact of Quantum Cryptography on Network Security," 2024 International Conference on Integrated Circuits and Communication Systems (ICICACS), Raichur, India, 2024, pp. 1-6, doi: 10.1109/ICICACS60521.2024.10498417.
[51] A. B. Yadav, "PLC Function Block 'Filter_PT1: Providing PT1 Transfer Function'," 2013 International Conference on Advances in Technology and Engineering (ICATE), Mumbai, India, 2013, pp. 1-3, doi: 10.1109/ICAdTE.2013.6524713.
[52] Vamsi Katragadda "Ethical AI in Customer Interactions: Implementing Safeguards and Governance Frameworks" Iconic Research And Engineering Journals Volume 7 Issue 12 2024 Page 394-397.
[53] Naga Ramesh Palakurti, 2023. "*Evolving Drug Discovery: Artificial Intelligence and Machine Learning's Impact in Pharmaceutical Research*" *ESP Journal of Engineering & Technology Advancements* 3(3): 136-147. [Link]
[54] Naga Ramesh Palakurti, 2022. "*AI Applications in Food Safety and Quality Control*" ESP Journal of Engineering & Technology Advancements 2(3): 48-61. [Link]
[55] Chanthati, S. R. (2024). An automated process in building organic branding opportunity, budget Intensity, recommendation in seasons with Google trends data. Sasibhushan Rao Chanthati. https://doi.org/10.30574/wjaets.2024.12.2.0326
[56] Chanthati, S. R. (2024). Product Colour Variation Management with Artificial Intelligence. Sasibhushan Rao Chanthati. American Journal of Education and Technology, 3(3), 46–52. https://doi.org/10.54536/ajet.v3i3.3213
[57] Kumar Shukla, Shashikant Tank, 2024. "CYBERSECURITY MEASURES FOR SAFEGUARDING INFRASTRUCTURE FROM RANSOMWARE AND EMERGING THREATS", International Journal of Emerging Technologies and Innovative Research (www.jetir.org), ISSN: 2349-5162, Vol.11, Issue 5, page no.i229-i235, May-2024, Available: http://www.jetir.org/papers/JETIR2405830.pdf
[58] Sukhdev S. Kapur, Ashok Ganesan, Jacopo Pianigiani, Michal Styszynski, Atul S Moghe, Joseph Williams, Sahana Sekhar Palagrahara Chandrashekar, Tong Jiang, Rishabh Ramakant Tulsian, Manish Krishnan, Soumil Ramesh Kulkarni, Vinod NairJeba Paulaiyan, 2021. *Automation of Maintenance Mode Operations for Network Devices*, US10938660B1. [Link]
[59] Kumar Shukla, Nimeshkumar Patel, Hirenkumar Mistry, 2024. "Transforming Incident Responses, Automating Security Measures, and Revolutionizing Defence Strategies through AI-Powered Cyber security", International Journal

of Emerging Technologies and Innovative Research (www.jetir.org), ISSN: 2349-5162, Vol.11, Issue 3, page no.h38-h45, March-2024, Available: http://www.jetir.org/papers/JETIR2403708.pdf

[60] Lekkala, Chandrakanth, AI-Driven Dynamic Resource Allocation in Cloud Computing: Predictive Models and Real-Time Optimization (February 06, 2024). J Artif Intell Mach Learn & Data Sci | Vol: 2 & Iss: 2, Available at SSRN: https://ssrn.com/abstract=4908420 or http://dx.doi.org/10.2139/ssrn.4908420

[61] Patel, N. (2024, March). SECURE ACCESS SERVICE EDGE(SASE): "EVALUATING THE IMPACT OF CONVEREGED NETWORK SECURITYARCHITECTURES IN CLOUD COMPUTING." Journal of Emerging Technologies and Innovative Research. https://www.jetir.org/papers/JETIR2403481.pdf

[62] Ayyalasomayajula, Madan Mohan Tito, Sathishkumar Chintala, and Sandeep Reddy Narani. "Optimizing Textile Manufacturing With Neural Network Decision Support: An Ornstein-Uhlenbeck Reinforcement Learning Approach." Journal of Namibian Studies: History Politics Culture 35 (2023): 335-358.

[63] Vishwanath Gojanur , Aparna Bhat, "Wireless Personal Health Monitoring System", IJETCAS:International Journal of Emerging Technologies in Computational and Applied Sciences,eISSN: 2279-0055,pISSN: 2279-0047, 2014. [Link]

[64] Ayyalasomayajula, Madan Mohan Tito, et al. "Proactive Scaling Strategies for Cost-Efficient Hyperparameter Optimization in Cloud-Based Machine Learning Models: A Comprehensive Review." ESP Journal of Engineering & Technology Advancements (ESP JETA) 1.2 (2021): 42-56.

[65] Mistry, H., Shukla, K., & Patel, N. (2024). Transforming Incident Responses, Automating Security Measures, and Revolutionizing Defence Strategies throughAI-Powered Cybersecurity. Journal of Emerging Technologies and Innovative Research, 11(3), 25. https://www.jetir.org/

[66] Ayyalasomayajula, M., & Chintala, S. (2020). Fast Parallelizable Cassava Plant Disease Detection using Ensemble Learning with Fine Tuned AmoebaNet and ResNeXt-101. Turkish Journal of Computer and Mathematics Education (TURCOMAT), 11(3), 3013–3023.

[67] Aparna Bhat, "Comparison of Clustering Algorithms and Clustering Protocols in Heterogeneous Wireless Sensor Networks: A Survey," 2014 INTERNATIONAL JOURNAL OF SCIENTIFIC PROGRESS AND RESEARCH (IJSPR)-ISSN : 2349-4689 Volume 04- NO.1, 2014. [Link]

[68] Ayyalasomayajula, Madan Mohan Tito, et al. "Implementing Convolutional Neural Networks for Automated Disease Diagnosis in Telemedicine." 2024 Third International Conference on Distributed Computing and Electrical Circuits and Electronics (ICDCECE). IEEE, 2024.

[69] Shashikant Tank Kumar Mahendrabhai Shukla, Nimeshkumar Patel, Veeral Patel, 2024." AI BASED CYBER SECURITY DATA ANALYTIC DEVICE", 414425-001, [Link]

[70] Ayyalasomayajula, Madan Mohan Tito, Akshay Agarwal, and Shahnawaz Khan. "Reddit social media text analysis for depression prediction: using logistic regression with enhanced term frequency-inverse document frequency features." International Journal of Electrical and Computer Engineering (IJECE) 14.5 (2024): 5998-6005.

[71] Aparna Bhat, Rajeshwari Hegde, "Comprehensive Study of Renewable Energy Resources and Present Scenario in India," 2015 IEEE International Conference on Engineering and Technology (ICETECH), Coimbatore, TN, India, 2015. [Link]

[72] Ayyalasomayajula, Madan Mohan Tito. "Innovative Water Quality Prediction For Efficient Management Using Ensemble Learning." Educational Administration: Theory and Practice 29.4 (2023): 2374-2381.

[73] Sarangkumar Radadia Kumar Mahendrabhai Shukla ,Nimeshkumar Patel ,Hirenkumar Mistry,Keyur Dodiya 2024." CYBER SECURITY DETECTING AND ALERTING DEVICE", 412409-001, [Link]

[74] Ayyalasomayajula, Madan Mohan Tito, Srikrishna Ayyalasomayajula, and Sailaja Ayyalasomayajula. "Efficient Dental X-Ray Bone Loss Classification: Ensemble Learning With Fine-Tuned VIT-G/14 And Coatnet-7 For Detecting Localized Vs. Generalized Depleted Alveolar Bone." Educational Administration: Theory and Practice 28.02 (2022).

[75] Aparna K Bhat, Rajeshwari Hegde, 2014. "Comprehensive Analysis Of Acoustic Echo Cancellation Algorithms On DSP Processor", International Journal of Advance Computational Engineering and Networking (IJACEN), volume 2, Issue 9, pp.6-11. [Link]

[76] Ayyalasomayajula, M. M. T., Chintala, S., & Sailaja, A. (2019). A Cost-Effective Analysis of Machine Learning Workloads in Public Clouds: Is AutoML Always Worth Using? International Journal of Computer Science Trends and Technology (IJCST), 7(5), 107–115.

[77] Nimeshkumar Patel, 2022." QUANTUM CRYPTOGRAPHY IN HEALTHCARE INFORMATION SYSTEMS: ENHANCING SECURITY IN MEDICAL DATA STORAGE AND COMMUNICATION", Journal of Emerging Technologies and Innovative Research, volume 9, issue 8, pp.g193-g202. [Link]

[78] Bhat, A., & Gojanur, V. (2015). Evolution Of 4g: A Study. International Journal of Innovative Research in ComputerScience & Engineering (IJIRCSE). Booth, K. (2020, December 4). How 5G is breaking new ground in the construction industry. BDC Magazine.https://bdcmagazine.com/2020/12/how-5g-is-breaking-new-ground-in-the-constructionindustry/. [Link]

[79] Nimeshkumar Patel, 2021." SUSTAINABLE SMART CITIES: LEVERAGING IOT AND DATA ANALYTICS FOR ENERGY EFFICIENCY AND URBAN DEVELOPMENT", Journal of Emerging Technologies and Innovative Research, volume 8, Issue 3, pp.313-319. [Link]

[80] Bhat, A., Gojanur, V., & Hegde, R. (2014). 5G evolution and need: A study. In International conference on electrical, electronics, signals, communication and optimization (EESCO)—2015.[Link]

[81] Chintala, S. ., & Ayyalasomayajula, M. M. T. . (2019). OPTIMIZING PREDICTIVE ACCURACY WITH GRADIENT BOOSTED TREES IN FINANCIAL FORECASTING. Turkish Journal of Computer and Mathematics Education (TURCOMAT), 10(3), 1710–1721. https://doi.org/10.61841/turcomat.v10i3.14707

[82] A. Bhat, V. Gojanur, and R. Hegde. 2015. 4G protocol and architecture for BYOD over Cloud Computing. In Communications and Signal Processing (ICCSP), 2015 International Conference on. 0308-0313. Google Scholar. [Link]

[83] Akbar Doctor,2023." Biomedical Signal and Image Processing with Artificial Intelligence Chapter Manufacturing of Medical Devices Using Artificial Intelligence-Based Troubleshooters", Springer Nature Switzerland AG, Volume 1, PP-195-206.[LINK]

[84] DOCTOR A., VONDENBUSCH B., KOZAK J., Bone segmentation applying rigid bone position and triple shadow check method based on RF data, Acta of Bioengineering and Biomechanics, 2011, Vol. 13, 3–11.[LINK]

[85] Rajarao Tadimety Akbar Doctor, 2016." A METHOD AND SYSTEM FOR FLICKER TESTING OF LOADS CONTROLLED BY BUILDING MANAGEMENT DEVICES", patent Office IN, Patent number-201641009974, Application number, 201641009974, [LINK]

[86] Rajarao Tadimety Akbar Doctor, Sambiah Gunkala, 2016." A Method and System For Automated Light Intensity Testing Of Building Management, patent Office IN, Patent number 201641001890, Application number 201641001890, [LINK].

[87] Rajarao Tadimety Akbar Doctor, 2015." A Method And System For Analysing Electronic Circuit Schematic" Patent officeIN, Patent number 6529/CHE/2014, Application number 201641001890, [LINK].

[88] Shrikaa Jadiga, "Big Data Engineering Using Hadoop and Cloud (GCP/AZURE) Technologies," International Journal of Computer Trends and Technology, vol. 72, no. 8, pp.60-69, 2024., [Link]

[89] Shrikaa Jadiga, A. S. (2024). AI Applications for Improving Transportation and Logistics Operations. International Journal of Intelligent Systems and Applications in Engineering, 12(3), 2607–2617 [Link]

[90] Amrish Solanki, Kshitiz Jain, Shrikaa Jadiga, "Building a Data-Driven Culture: Empowering Organizations with Business Intelligence," International Journal of Computer Trends and Technology, 2024; 72, 2: 46-55. [Link]

[91] Darji P., Patel J., Patel B., Chudasama A., Fnu P.I.J., Nalla S. A comprehensive review on anticancer natural drugs. World J. Pharm. Pharm. Sci. 2024; 13:717–734. [Link]

[92] Ankitkumar Tejani, 2021. "Assessing the Efficiency of Heat Pumps in Cold Climates: A Study Focused on Performance Metrics", ESP Journal of Engineering & Technology Advancements 1(1): 47-56. [Link]

[93] Ankitkumar Tejani, 2021. "Integrating Energy-Efficient HVAC Systems into Historical Buildings: Challenges and Solutions for Balancing Preservation and Modernization", ESP Journal of Engineering & Technology Advancements 1(1): 83-97. [Link]

[94] Vedamurthy Gejjegondanahalli Yogeshappa, 2024. "*AI - Driven Innovations in Patient Safety: A Comprehensive Review of Quality Care*", International Journal of Science and Research (IJSR), Volume 13 Issue 9, September 2024, pp. 815-826, [Link]

[95] Vikramrajkumar Thiyagarajan, 2024. "*Predictive Modeling for Revenue Forecasting in Oracle EPBCS: A Machine Learning Perspective*", International Journal of Innovative Research of science, Engineering and technology (IJIRSET), Volume 13, Issue 4, [Link]

[96] Suvvari, S. K. (2024). Ensuring security and compliance in agile cloud infrastructure projects. *International Journal of Computing and Engineering, 6*(4), 54–73. https://doi.org/10.47941/ijce.2222

[97] Sunil Kumar Suvvari (2024). Building an architectural runway: Emergent practices in agile methodologies. *International Journal of Science and Research (IJSR), 13*(9), 140-144. https://www.ijsr.net/getabstract.php?paperid=SR24828021739

[98] Sunil Kumar Suvvari & DR. VIMAL DEEP SAXENA. (2024). Innovative Approaches to Project Scheduling: Techniques and Tools. *Innovative Research Thoughts*, *10*(2), 133–143. https://doi.org/10.36676/irt.v10.i2.1481