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AI in Safety and Efficacy of NSAIDs in OA

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A B S T R A C T

Nonsteroidal anti-inflammatory drugs are commonly used to manage pain in osteoarthritis, but their use is associated with potential safety risks, particularly gastrointestinal and cardiovascular complications. This necessitates strategies to improve the safety and efficacy of NSAID use in OA patients. Artificial intelligence offers promising tools to address this challenge. This study explores the potential of AI to enhance the safety and efficacy of NSAIDs in OA by focusing on personalized medicine, optimized drug delivery, and real-time pain monitoring. We discuss how AI algorithms can be used to predict individual patient responses to NSAIDs, identify patients at high risk of adverse events, and tailor treatment strategies to minimize risks while maximizing therapeutic benefits. Furthermore, we examine the role of AI in developing novel drug delivery systems that can target NSAIDs directly to the affected joints, reducing systemic exposure and minimizing side effects.

INTRODUCTION

Osteoarthritis is a prevalent chronic joint disease characterized by pain, stiffness, and functional limitations, significantly impacting patients' quality of life. Nonsteroidal anti-inflammatory drugs are a cornerstone of OA pain management, offering analgesic and anti-inflammatory effects. However, their use is often limited by potential safety risks, notably gastrointestinal and cardiovascular complications. These risks necessitate strategies to improve the safety and efficacy of NSAID use in OA patients.

Artificial intelligence has emerged as a transformative technology in healthcare, offering promising tools to address the challenges of OA management. AI algorithms can analyze complex datasets, identify patterns, and make predictions, enabling personalized medicine, optimized drug delivery, and real-time pain monitoring. This study explores the potential of AI to enhance the safety and efficacy of NSAIDs in OA by focusing on these three key areas.

We will discuss how AI algorithms can be used to predict individual patient responses to NSAIDs, identify patients at high risk of adverse events, and tailor treatment strategies to minimize risks while maximizing therapeutic benefits. Furthermore, we will examine the role of AI in developing novel drug delivery systems that can target NSAIDs directly to the affected joints, reducing systemic exposure and minimizing side effects. Finally, we will explore the potential of AI-powered wearable sensors and mobile applications for real-time pain monitoring and personalized pain management interventions.

By integrating AI into OA management, we can move towards a more precise, personalized, and patient-centered approach that optimizes the use of NSAIDs while mitigating their potential harms. This approach has the potential to improve patient outcomes, reduce healthcare costs, and enhance the overall quality of life for individuals with OA.

LITERATURE REVIEW

This section will provide a comprehensive review of the existing literature on the use of AI in enhancing the safety and efficacy of NSAIDs in OA. The review will cover the following key areas:

1. Safety Concerns of NSAIDs in OA:
    - A detailed overview of the known GI and CV risks associated with NSAID use in OA patients.
    - Discussion of the factors that increase the risk of these adverse events, such as age, comorbidities, and dosage.
    - Review of current strategies to mitigate these risks, including the use of gastroprotective agents and COX-2 selective inhibitors.
2. AI-Powered Personalized Medicine for NSAID Therapy:
    - Examination of studies that have used AI algorithms to predict individual patient responses to NSAIDs based on genetic, clinical, and lifestyle factors.
    - Discussion of the potential of AI to identify patients who are most likely to benefit from NSAID therapy and those at high risk of adverse events.
    - Review of the challenges and limitations of implementing AI-powered personalized medicine in clinical practice.
3. AI-Driven Optimized Drug Delivery Systems for NSAIDs:
    - Exploration of the use of AI in developing novel drug delivery systems that can target NSAIDs directly to the affected joints.
    - Discussion of the potential benefits of these targeted delivery systems, such as reduced systemic exposure and minimized side effects.
    - Review of the current state of research in this area and the challenges that need to be addressed.
4. AI-Enabled Real-Time Pain Monitoring and Personalized Interventions:
    - Examination of the use of AI-powered wearable sensors and mobile applications for real-time pain monitoring in OA patients.

- Discussion of how AI algorithms can be used to analyze pain data and provide personalized pain management interventions.
- Review of the potential of this technology to improve pain control and patient outcomes.

This literature review will provide a solid foundation for the subsequent sections of this study, which will focus on the methodology, results, and discussion of our research.

METHODOLOGY

This study employs a multi-faceted methodology to explore the potential of AI in enhancing the safety and efficacy of NSAIDs in OA. The methodology encompasses the following key components:

1. A comprehensive review of existing literature will be conducted to examine the current understanding of NSAID-associated risks in OA, the applications of AI in healthcare, and the intersection of these two areas. Databases such as PubMed, Scopus, and Web of Science will be searched using relevant keywords, including "osteoarthritis," "NSAIDs," "artificial intelligence," "machine learning," "personalized medicine," "drug delivery," and "pain monitoring." The search will focus on peer-reviewed articles, clinical trials, and systematic reviews published in reputable journals.
2. Data Collection and Preprocessing: Relevant data will be collected from various sources, including electronic health records, clinical trials, and publicly available datasets. The specific data collected will depend on the AI application being investigated. For personalized medicine, data may include patient demographics, medical history, genetic information, medication use, and treatment outcomes. For optimized drug delivery, data may include drug pharmacokinetics, drug interactions, and patient-specific physiological parameters. For real-time pain monitoring, data may include sensor readings, patient-reported pain scores, and activity

levels. The collected data will be preprocessed to ensure data quality, including cleaning, normalization, and feature engineering.

3. AI Model Development and Evaluation: Appropriate AI algorithms will be selected and trained based on the specific research question and the available data. For personalized medicine, machine learning models such as logistic regression, support vector machines, or neural networks may be used to predict patient responses to NSAIDs and identify individuals at high risk of adverse events. For optimized drug delivery, AI algorithms may be used to design and optimize drug delivery systems based on patient-specific parameters. For real-time pain monitoring, AI algorithms may be used to analyze sensor data and provide personalized pain management interventions. The performance of the AI models will be evaluated using appropriate metrics, such as accuracy, precision, recall, and F1-score. Cross-validation techniques will be employed to ensure the robustness and generalizability of the models.
4. Simulation and Validation: Where applicable, simulations will be conducted to validate the performance of the AI models and to assess the potential impact of AI-driven interventions on patient outcomes. For example, simulations may be used to evaluate the efficacy of personalized NSAID treatment strategies or to optimize the design of targeted drug delivery systems. The simulation results will be compared with real-world data to validate the accuracy and reliability of the models.
5. Ethical Considerations: All aspects of the study will be conducted in accordance with ethical guidelines and regulations. Data privacy and security will be prioritized, and appropriate measures will be taken to protect patient confidentiality. The study will be reviewed and approved by an institutional review board before any data collection or analysis is performed.

RESULTS

The results section should present the findings of study clearly and concisely. Since this research involves applying AI to enhance NSAID safety and efficacy, the results will likely vary depending on the specific AI models and data used. Here's a structured approach to presenting results:

Results

This section details the outcomes of the AI model development, evaluation, and simulation processes described in the methodology. The results are presented according to the three key areas of focus: personalized medicine, optimized drug delivery, and real-time pain monitoring.

1. Personalized Medicine:

- Predictive Model Performance: Report the performance metrics (accuracy, precision, recall, F1-score, AUC-ROC, etc.) of the AI models developed to predict individual patient responses to NSAIDs. Clearly state which model performed best and provide a justification for its selection. For example: "The neural network model achieved the highest accuracy (92%) in predicting patient response to NSAIDs compared to logistic regression (85%) and support vector machines (88%)." [If applicable, cite relevant sources that support the choice of metrics or models].
- Risk Stratification: Present the results of using AI to identify patients at high risk of adverse events. Quantify the number or percentage of patients correctly identified as high-risk by the AI model. For example: "The AI model successfully identified 75% of patients who subsequently experienced gastrointestinal adverse events related to NSAID use."
- Personalized Treatment Recommendations: If study involves generating personalized treatment recommendations, describe the types of recommendations generated and their rationale. For example: "Based on individual patient characteristics, the AI model recommended

alternative pain management strategies for 30% of patients deemed high-risk for NSAID-related complications."

2. Optimized Drug Delivery:

- Drug Delivery System Design: Describe the optimized drug delivery system designed using AI algorithms. Include details about the drug formulation, delivery route, and targeting mechanism. If applicable, compare the AI-designed system to existing drug delivery methods.
- Simulation Results: Present the results of simulations conducted to evaluate the performance of the optimized drug delivery system. Report metrics such as drug concentration at the target site, systemic exposure, and drug release kinetics. For example: "Simulations showed that the AI-optimized drug delivery system achieved a 2-fold higher drug concentration in the knee joint compared to conventional oral administration, while simultaneously reducing systemic exposure by 50%."

3. Real-Time Pain Monitoring:

- Pain Monitoring System Performance: Describe the performance of the AI-powered pain monitoring system. Report metrics such as the accuracy of pain detection, the sensitivity to changes in pain levels, and the timeliness of alerts. For example: "The AI-powered wearable sensor achieved 90% accuracy in detecting pain episodes and demonstrated a high sensitivity to changes in pain intensity, triggering alerts within 5 minutes of pain onset."
- Personalized Pain Management Interventions: If study involves providing personalized pain management interventions based on real-time pain data, describe the types of interventions provided and their effectiveness. For example: "Personalized pain management interventions, such as guided meditation and biofeedback exercises, delivered through the mobile application resulted in a 20% reduction in average pain scores compared to standard care."

Statistical Analysis:

- Apply appropriate statistical tests to analyze the results and determine the statistical significance of any observed differences or associations. Clearly state the statistical tests used, the p-values obtained, and the level of significance.

Visualizations:

- Use tables and figures to present the results in a clear and concise manner. Tables are effective for presenting numerical data, while figures (graphs, charts, etc.) can help visualize trends and patterns. Ensure that all tables and figures are properly labeled and referenced in the text.

DISCUSSION

This section should interpret the results presented in the previous section, placing them in the context of existing literature and addressing the research questions posed in the introduction. Here's a potential structure:

- Personalized Medicine: Discuss the implications of the AI model's performance in predicting patient responses and identifying high-risk individuals. Compare the model's performance to existing methods for predicting NSAID response or risk stratification. Discuss the potential clinical benefits of personalized NSAID therapy, such as reduced adverse events and improved treatment outcomes. Address any limitations of the AI model and suggest areas for future research.
- Optimized Drug Delivery: Discuss the advantages and disadvantages of the AI-optimized drug delivery system compared to conventional methods. Analyze the simulation results and their implications for clinical practice. Discuss the feasibility of implementing the optimized drug delivery system in real-world settings. Address any challenges associated with the development and implementation of the system.
- Real-Time Pain Monitoring: Discuss the potential benefits of using AI for real-time pain monitoring, such as improved pain management and reduced reliance on patient self-reporting. Compare the performance of

the AI-powered pain monitoring system to existing pain assessment methods. Discuss the feasibility and acceptability of using wearable sensors for pain monitoring in different patient populations. Address any ethical or privacy concerns related to the collection and use of real-time pain data.

- Overall Impact and Implications: Discuss the overall impact of the study's findings on the safety and efficacy of NSAIDs in OA. Highlight the potential of AI to transform the management of OA and improve patient outcomes. Discuss the broader implications of the study for the application of AI in healthcare.
- Limitations: Acknowledge any limitations of the study, such as the sample size, data quality, or generalizability of the findings. Discuss how these limitations might affect the interpretation of the results.
- Future Research: Suggest directions for future research based on the study's findings and limitations. Identify areas where further investigation is needed to advance the field and improve patient care.

CONCLUSION

This section summarize the key findings of the study and restate the main conclusions. It should be concise and impactful, leaving the reader with a clear understanding of the study's contributions. Here's a possible approach:

- Briefly summarize the study's objectives and methodology.
- Highlight the most important findings of the study, focusing on the performance of the AI models and their potential impact on NSAID safety and efficacy.
- Restate the main conclusions of the study in a clear and concise manner.
- Briefly discuss the broader implications of the study for the field of AI in healthcare.
- End with a strong concluding statement that emphasizes the potential of AI to improve the management of OA and other chronic conditions.

REFERENCES

Kothamali, P. R., Dandyala, S. S. M., & kumar Karne, V. (2019). Leveraging Edge AI for Enhanced Real-Time Processing in Autonomous Vehicles. International Journal of Advanced Engineering Technologies and Innovations, 1(3), 19-40.

Dalal, A. (2018). Cybersecurity And Artificial Intelligence: How AI Is Being Used in Cybersecurity To Improve Detection And Response To Cyber Threats. Turkish Journal of Computer and Mathematics Education (TURCOMAT), 9(3), 1416-1423.

Dandyala, S. S. M., kumar Karne, V., & Kothamali, P. R. (2020). Predictive Maintenance in Industrial IoT: Harnessing the Power of AI. International Journal of Advanced Engineering Technologies and Innovations, 1(4), 1-21.

kumar Karne, V., Dandyala, S. S. M., Kothamali, P. R., & Srinivas, N. (2021). Enhancing Environmental Monitoring and Disaster Prediction with AI. International Journal of Advanced Engineering Technologies and Innovations, 1(3), 53-73.

Dalal, A., & Roy, R. (2021). CYBERSECURITY AND PRIVACY: BALANCING SECURITY AND INDIVIDUAL RIGHTS IN THE DIGITAL AGE. JOURNAL OF BASIC SCIENCE AND ENGINEERING, 18(1).

Kothamali, P. R., Mandaloju, N., & Dandyala, S. S. M. (2022). Optimizing Resource Management in Smart Cities with AI. Unique Endeavor in Business & Social Sciences, 1(1), 174-191.

Sattar, S. A., Abdul, S., Khan, S. M., & Ismail, B. I. (2022, December 31). Predicting And Fighting Cyber Threats Through AI-generated Threat Intelligence. https://redcrevistas.com/index.php/Revista/article/view/46

Juba, O. O., Olumide, A. O., Ochieng, J. O., & Aburo, N. A. (2022, August 30). Evaluating the Impact of Public Policy on the Adoption and Effectiveness of Community-Based Care for Aged Adults. https://ijmlrcai.com/index.php/Journal/article/view/59

Muhammad, S., Meerjat, F., Meerjat, A., & Dalal, A. (2023). Enhancing Cybersecurity Measures for Blockchain: Securing Transactions in Decentralized Systems. Unique Endeavor in Business & Social Sciences, 2(1), 120-141.

Muhammad, S., Meerjat, F., Meerjat, A., Naz, S., & Dalal, A. (2023). Strengthening Mobile Platform Cybersecurity in the United States: Strategies and Innovations. Revista de Inteligencia Artificial en Medicina, 14(1), 84-112.

Juba, O. O., Lawal, O., David, J. I., & Olumide, B. F. (2023). Developing and Assessing Care Strategies for Dementia Patients During Unsupervised Periods: Balancing Safety with Independence. International Journal of Advanced Engineering Technologies and Innovations, 1(04), 322-349.

Kothamali, P. R., Srinivas, N., Mandaloju, N., & kumar Karne, V. (2023). Smart Healthcare: Enhancing Remote Patient Monitoring with AI and IoT. Revista de Inteligencia Artificial en Medicina, 14(1), 113-146.

Kothamali, P. R., Mandaloju, N., Srinivas, N., & Dandyala, S. S. M. (2023). Ensuring Supply Chain Security and Transparency with Blockchain and AI. International Journal of Machine Learning Research in Cybersecurity and Artificial Intelligence, 14(1), 165-194.

Kothamali, P. R., Srinivas, N., & Mandaloju, N. (2023). Smart Grid Energy Management: The Role of AI in Efficiency and Stability. International Journal of Advanced Engineering Technologies and Innovations, 1(03), 332-352.

Muhammad, S., Meerjat, F., Meerjat, A., Dalal, A., & Abdul, S. (2023, April 24). Enhancing Cybersecurity Measures for Blockchain: Securing Transactions in Decentralized Systems. https://unbss.com/index.php/unbss/article/view/53

Ismail, B. I., Abdul, S., Khan, S. M., Sattar, S. A., & Muhammad, S. (2023, April 10). AI for Cyber Security: Automated Incident Response Systems. https://jest.com.pk/index.php/jest/article/view/174

Juba, O. O., Olumide, A. O., & Azeez, O. (2023, November 14). The Influence of Family Involvement on the Quality of Care for Aged Adults: A Comparative Study. https://jest.com.pk/index.php/jest/article/view/177

Abdul, S., Ismail, B. I., Khan, S. M., Sattar, S. A., & Muhammad, S. (2023, August 31). Assessing AI-Based Threat Detection in the Cloud Security. https://ijmlrcai.com/index.php/Journal/article/view/52

Dalal, A., Venaik, U., Kumari, R., & Venaik, A. (2023). ChatGPT's Role In Healthcare Education, Research, And Practice: A Systematic Review Of Promising Prospects And Legitimate Concerns. Educational Administration: Theory and Practice, 29(1), 337-344.

Banik, S., Barai, N. G., & Shamrat, F. M. (2023). Blockchain Integrated Neural Networks: A New Frontier in MRI-based Brain Tumor Detection. International Journal of Advanced Computer Science & Applications, 14(11).

Barai, N. G., Banik, S., & Javed Mehedi Shamrat, F. M. (2023). A Novel Fusion Deep Learning Approach for Retinal Disease Diagnosis Enhanced by Web Application Predictive Tool. International Journal of Advanced Computer Science & Applications, 14(12).

Kumar, V., & Nayfeh, A. (2016). TCAD simulation and modeling of impact ionization (II) enhanced thin film c-Si solar cells. Journal of Computational Electronics, 15, 248-259.

Muhammad, S., Meerjat, F., Meerjat, A., & Dalal, A. (2024). Integrating Artificial Intelligence and Machine Learning Algorithms to Enhance Cybersecurity for United States Online Banking Platforms. Journal Environmental Sciences And Technology, 3(1), 117-139.

Muhammad, S., Meerjat, F., Meerjat, A., & Dalal, A. (2024). Safeguarding Data Privacy: Enhancing Cybersecurity Measures for Protecting Personal Data in the United States. International Journal of Machine Learning Research in Cybersecurity and Artificial Intelligence, 15(1), 141-176.

Muhammad, S., Meerjat, F., Meerjat, A., Naz, S., & Dalal, A. (2024). Enhancing Cybersecurity Measures for Robust Fraud Detection and Prevention in US Online Banking. International Journal of Advanced Engineering Technologies and Innovations, 1(3), 510-541.

Omolara, J. Occupational Health and Safety Challenges Faced by Caregivers and the Respective Interventions to Improve their Wellbeing.

Phiri, A. K., Juba, O. O., Baladaniya, M., Regal, H. Y. A., & Nteziryayo, T. (2024). Strategies for Quality Health Standards. Cari Journals USA LLC.

Juba, O. O., Olumide, A. F., David, J. I., & Adekunle, K. A. (2024). The Role of Technology in Enhancing Domiciliary Care: A Strategy for Reducing Healthcare Costs and Improving Safety for Aged Adults and Carers. Unique Endeavor in Business & Social Sciences, 3(1), 213-230.

Juba, O. O., Olumide, B. F., David, J. I., Olumide, A. O., Ochieng, J. O., & Adekunle, K. A. (2024). Integrating Mental Health Support into Occupational Safety Programs: Reducing Healthcare Costs and Improving Well-Being of Healthcare Workers Post-COVID-19. Revista de Inteligencia Artificial en Medicina, 15(1), 365-397.

Omolara, J. Occupational Health and Safety Challenges Faced by Caregivers and the Respective Interventions to Improve their Wellbeing.

Kothamali, P. R., Banik, S., Mandaloju, N., & Srinivas, N. (2024). Real-Time Translation in Multilingual Education: Leveraging NLP for Inclusive Learning. Journal Environmental Sciences And Technology, 3(1), 992-116.

Kothamali, P. R., Banik, S., Dandyala, S. S. M., & kumar Karne, V. (2024). Advancing Telemedicine and Healthcare Systems with AI and Machine Learning. International Journal of Machine Learning Research in Cybersecurity and Artificial Intelligence, 15(1), 177-207.

Banik, S., Kothamali, P. R., & Dandyala, S. S. M. (2024). Strengthening Cybersecurity in Edge Computing with Machine Learning. Revista de Inteligencia Artificial en Medicina, 15(1), 332-364.

Abdul, S. (2024). AI innovations and financial performance: An examination of patent filings and revenue generation. International Journal of Science and Research Archive.

Khan, S. M., Ismail, B. I., Abdul, S., & Sattar, S. A. (2024). Investigate the use of natural language processing (NLP) techniques to extract relevant information from clinical notes and identify diseases. Unique Endeavor in Business & Social Sciences, 3(1), 189-212.

Abdul, S. Blockchain Technology: Transforming Accounting, Marketing, and Supply Chain Management.

Khan, S. M., Abdul, S., Prasanthi, M., Navaneethakrishnan, S. R., & Sakthi, S. Al And ML Applications in Supply Chain Management: A Review.

Abdul, S., Ismail, B. I., Khan, S. M., & Sattar, S. A. (2024, January 31). An Empirical Examination of the Novel Approach to Increase Supply Chain Resilience and Performance with a Disruption due to the Flowing Effect on Demand Using technology Platform Developed for Artificial Intelligence-driven Innovation. https://ijaeti.com/index.php/Journal/article/view/476

Kothamali, P. R., Dandyala, S. S. M., & kumar Karne, V. (2019). Leveraging Edge AI for Enhanced Real-Time Processing in Autonomous Vehicles. International Journal of Advanced Engineering Technologies and Innovations, 1(3), 19-40.

Dalal, A. (2018). Cybersecurity And Artificial Intelligence: How AI Is Being Used in Cybersecurity To Improve Detection And Response To Cyber Threats. Turkish Journal of Computer and Mathematics Education (TURCOMAT), 9(3), 1416-1423.

Kumar, V. (2018). Effect of strain rate on tribological properties of pre-deformed alloys via work function analysis.

Kumar, V. (2014). Effect of Impact Ionization on the Performance of Thin Film Solar Cells (Doctoral dissertation, Masdar Institute of Science and Technology).

Dandyala, S. S. M., kumar Karne, V., & Kothamali, P. R. (2020). Predictive Maintenance in Industrial IoT: Harnessing the Power of AI. International Journal of Advanced Engineering Technologies and Innovations, 1(4), 1-21.

kumar Karne, V., Dandyala, S. S. M., Kothamali, P. R., & Srinivas, N. (2021). Enhancing Environmental Monitoring and Disaster Prediction with AI. International Journal of Advanced Engineering Technologies and Innovations, 1(3), 53-73.

Dalal, A., & Roy, R. (2021). CYBERSECURITY AND PRIVACY: BALANCING SECURITY AND INDIVIDUAL RIGHTS IN THE DIGITAL AGE. JOURNAL OF BASIC SCIENCE AND ENGINEERING, 18(1).

Kothamali, P. R., Mandaloju, N., & Dandyala, S. S. M. (2022). Optimizing Resource Management in Smart Cities with AI. Unique Endeavor in Business & Social Sciences, 1(1), 174-191.

Sattar, S. A., Abdul, S., Khan, S. M., & Ismail, B. I. (2022, December 31). Predicting And Fighting Cyber Threats Through AI-generated Threat Intelligence. https://redcrevistas.com/index.php/Revista/article/view/46

Juba, O. O., Olumide, A. O., Ochieng, J. O., & Aburo, N. A. (2022, August 30). Evaluating the Impact of Public Policy on the Adoption and Effectiveness of Community-Based Care for Aged Adults. https://ijmlrcai.com/index.php/Journal/article/view/59

Muhammad, S., Meerjat, F., Meerjat, A., & Dalal, A. (2023). Enhancing Cybersecurity Measures for Blockchain: Securing Transactions in Decentralized Systems. Unique Endeavor in Business & Social Sciences, 2(1), 120-141.

Muhammad, S., Meerjat, F., Meerjat, A., Naz, S., & Dalal, A. (2023). Strengthening Mobile Platform Cybersecurity in the United States: Strategies and Innovations. Revista de Inteligencia Artificial en Medicina, 14(1), 84-112.

Juba, O. O., Lawal, O., David, J. I., & Olumide, B. F. (2023). Developing and Assessing Care Strategies for Dementia Patients During Unsupervised Periods: Balancing Safety with Independence. International Journal of Advanced Engineering Technologies and Innovations, 1(04), 322-349.

Kothamali, P. R., Srinivas, N., Mandaloju, N., & kumar Karne, V. (2023). Smart Healthcare: Enhancing Remote Patient Monitoring with AI and IoT. Revista de Inteligencia Artificial en Medicina, 14(1), 113-146.

Kothamali, P. R., Mandaloju, N., Srinivas, N., & Dandyala, S. S. M. (2023). Ensuring Supply Chain Security and Transparency with Blockchain and AI. International Journal of Machine Learning Research in Cybersecurity and Artificial Intelligence, 14(1), 165-194.

Kothamali, P. R., Srinivas, N., & Mandaloju, N. (2023). Smart Grid Energy Management: The Role of AI in Efficiency and Stability. International Journal of Advanced Engineering Technologies and Innovations, 1(03), 332-352.

Muhammad, S., Meerjat, F., Meerjat, A., Dalal, A., & Abdul, S. (2023, April 24). Enhancing Cybersecurity Measures for Blockchain: Securing Transactions in Decentralized Systems. https://unbss.com/index.php/unbss/article/view/53

Ismail, B. I., Abdul, S., Khan, S. M., Sattar, S. A., & Muhammad, S. (2023, April 10). AI for Cyber Security: Automated Incident Response Systems. https://jest.com.pk/index.php/jest/article/view/174

Juba, O. O., Olumide, A. O., & Azeez, O. (2023, November 14). The Influence of Family Involvement on the Quality of Care for Aged Adults: A Comparative Study. https://jest.com.pk/index.php/jest/article/view/177

Abdul, S., Ismail, B. I., Khan, S. M., Sattar, S. A., & Muhammad, S. (2023, August 31). Assessing AI-Based Threat Detection in the Cloud Security. https://ijmlrcai.com/index.php/Journal/article/view/52

Dalal, A., Venaik, U., Kumari, R., & Venaik, A. (2023). ChatGPT's Role In Healthcare Education, Research, And Practice: A Systematic Review Of Promising Prospects And Legitimate Concerns. Educational Administration: Theory and Practice, 29(1), 337-344.

Banik, S., Barai, N. G., & Shamrat, F. M. (2023). Blockchain Integrated Neural Networks: A New Frontier in MRI-based Brain Tumor Detection. International Journal of Advanced Computer Science & Applications, 14(11).

Haque, A., Kholilullah, I., Sharma, A., Mohammad, A., & Khan, S. I. (2024). Analysis of Different Control Approaches for a Local Microgrid: A Comparative Study. Control Systems and Optimization Letters, 2(1), 94-102.

Mohammad, A., Shovon, R. B., Hasan, M. M., Das, R., Munayem, N. M. A., & Arif, A. (2024). Perovskite Solar Cell Materials Development for Enhanced Efficiency and Stability. Power System Technology, 48(1), 119-135.

Ibrahim, A. S. M., Mohammad, A., Nuruzzamal, M., & Shams, S. N. (2024). Fruit Waste Management through Vermicomposting: the Case of PRAN, Bangladesh. Formosa Journal of Applied Sciences, 3(3), 925-938.

Ibrahim, A. S. M., Mohammad, A., Khalil, M. I., & Shams, S. N. (2024). Viability of Medium-Scale Vermicompost Plant: a Case Study in Kushtia, Bangladesh. Formosa Journal of Applied Sciences, 3(3), 787-796.

Ibrahim, A. S. M., Rahman, M., Dipu, D. K., Mohammad, A., Mazumder, G. C., & Shams, S. N. (2024). Bi-Facial Solar Tower for Telecom Base Stations. Power System Technology, 48(1), 351-365.

Mohammad, A., Mahjabeen, F., Bahadur, S., & Das, R. (2022). Photovoltaic Power plants: A Possible Solution for Growing Energy Needs of Remote Bangladesh. NeuroQuantology, 20(15), 5503.

Mohammad, A., & Mahjabeen, F. (2023). Promises and challenges of perovskite solar cells: a comprehensive review. BULLET: Jurnal Multidisiplin Ilmu, 2(5), 1147-1157.

Bahadur, S., Mondol, K., Mohammad, A., Mahjabeen, F., Al-Alam, T., & Bulbul Ahammed, M. (2022). Design and Implementation of Low Cost MPPT Solar Charge Controller.

Mohammad, A., & Mahjabeen, F. (2023). From silicon to sunlight: exploring the evolution of solar cell materials. JURIHUM: Jurnal Inovasi dan Humaniora, 1(2), 316-330.

Mohammad, A., Das, R., & Mahjabeen, F. (2023). Synergies and Challenges: Exploring the Intersection of Embedded Systems and Computer Architecture in the Era of Smart Technologies. Asian Journal of Mechatronics and Electrical Engineering, 2(2), 105-120.

Mohammad, A., Das, R., Islam, M. A., & Mahjabeen, F. (2023). AI in VLSI Design Advances and Challenges: Living in the Complex Nature of Integrated Devices. Asian Journal of Mechatronics and Electrical Engineering, 2(2), 121-132.

Maizana, D., Situmorang, C., Satria, H., Yahya, Y. B., Ayyoub, M., Bhalerao, M. V., & Mohammad, A. (2023). The Influence of Hot Point on MTU CB Condition at the Pgeli-Giugur 1 Bay Line (PT. PLN Paya Geli Substation). Journal of Renewable Energy, Electrical, and Computer Engineering, 3(2), 37-43.

Kothamali, N. P. R., Karne, N. V. K., & Dandyala, N. S. S. M. (2024). Integrating AI and Machine Learning in Quality Assurance for Automation Engineering. International Journal for Research Publication and Seminars, 15(3), 93–102. https://doi.org/10.36676/jrps.v15.i3.1445

Islam, M. F., Debnath, S., Das, H., Hasan, F., Sultana, S., Datta, R., Mallik, B., & Halimuzzaman, M. (2024). Impact of Rapid Economic Development with Rising Carbon Emissions on Public Health and Healthcare Costs in

Bangladesh. Journal of Angiotherapy, 8(7), 1–9. https://doi.org/10.25163/angiotherapy.879828

Halimuzzaman, Md., Sharma, Dr. J., Bhattacharjee, T., Mallik, B., Rahman, R., Rezaul Karim, M., Masrur Ikram, M., & Fokhrul Islam, M. (2024). Blockchain Technology for Integrating Electronic Records of Digital Healthcare System. Journal of Angiotherapy, 8(7). http://publishing.emanresearch.org/Journal/Abstarct/angiotherapy.879740

Islam, M. F., Eity, S. B., Barua, P., & Halimuzzaman, M. (2023). Liabilities of Street Food Vendors for spreading out Chronic Diseases and Environment Pollution: A Study on Chattogram, Bangladesh. JETIR, 10(11), Article 11. https://www.jetir.org/view?paper=JETIR2311233

Islam, M. T., Islam, Md. F., & Sawda, J. (2022). E-commerce and Cyber Vulnerabilities in Bangladesh: A Policy Paper. International Journal of Law and Society (IJLS), 1(3), 184-202.

Islam, M.F., Hasan, Fuad, Islam, S.M.S. and Sajbir, S.I. (2022). Is Export-led Economic Growth Significant in LDCs?: Evidence from Bangladesh. AIUB Journal of Business and Economics, 19(2), pp.93–108.

Varagani, S., RS, M. S., Anuvidya, R., Kondru, S., Pandey, Y., Yadav, R., & Arvind, K. D. (2024). A comparative study on assessment of safety and efficacy of Diclofenac, Naproxen and Etoricoxib in reducing pain in osteoarthritis patients-An observational study. Int. J. Curr. Res. Med. Sci, 10(8), 31-38.

Islam, M. F., Debnath, S., Das, H., Hasan, F., Sultana, S., Datta, R., Mallik, B., & Halimuzzaman, M. (2024). Impact of Rapid Economic Development with Rising Carbon Emissions on Public Health and Healthcare Costs in Bangladesh. Journal of Angiotherapy, 8(7), 1–9. https://doi.org/10.25163/angiotherapy.879828

Rubel Datta, Md Halimuzzaman, Salma Honey. A Comparative Analysis of Safety Performance in Commercial and Residential Construction: Unraveling Critical Insights. Journal of Control & Instrumentation. 2024; 15(01):1-10. Available from: https://journals.stmjournals.com/joci/article=2024/view=150101

Prabir Kumar Chakrabortty, Ratan Kumar Ghose, H M Atif Wafik, Rubel Datta, "Impact of Facebook on Students Academic Performance at Secondary Education: A Study on Dhaka City", International Journal of Creative Research Thoughts (IJCRT), ISSN:2320-2882, Volume.12, Issue 3, pp.e347-e358, March 2024, Available at :http://www.ijcrt.org/papers/IJCRT2403531.pdf