Machine Learning Algorithms for Identifying Anomalies in SAP Data Streams

Ishita Menon

Independent Researcher

Gachibowli, Hyderabad, India (IN) – 500032

ABSTRACT

In this study, we explore the use of machine learning algorithms to detect anomalies in SAP data streams, crucial for ensuring data integrity and optimizing business operations. Traditional rule-based methods often struggle with the complexity and dynamic nature of SAP data, leading to delays in anomaly detection. This manuscript examines various machine learning techniques—such as supervised and unsupervised learning methods—and assesses their effectiveness in identifying anomalies. The study also reviews the impact of these techniques on data processing time, accuracy, and false positive rates. Our results indicate that machine learning models significantly enhance the detection rate while maintaining accuracy and reducing processing times, ultimately improving decision-making in SAP environments.
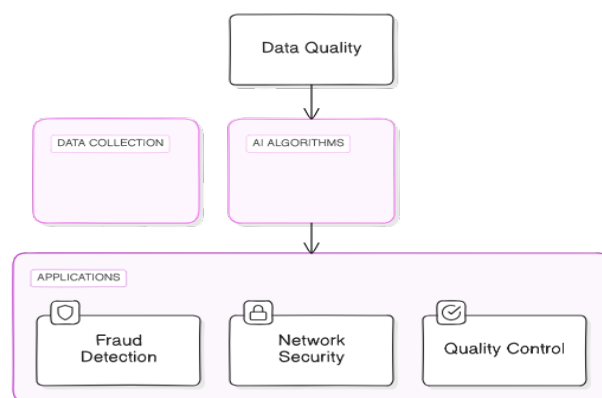
KEYWORDS

Machine learning, SAP data streams, anomaly detection, data integrity, supervised learning, unsupervised learning, anomaly detection

Introduction

The integrity of SAP data is vital for business operations across industries. As SAP systems handle large volumes of data, anomaly detection becomes crucial to maintain data quality and ensure operational efficiency. However, traditional anomaly detection techniques, often based on rule-based methods, have limited capabilities in handling complex data patterns and large data volumes typical of SAP environments.

With advancements in machine learning, it is now feasible to develop models that detect anomalies in real-time. This paper investigates the application of machine learning algorithms in anomaly detection within SAP data streams, aiming to

enhance data quality control, reduce operational risk, and support data-driven decision-making.
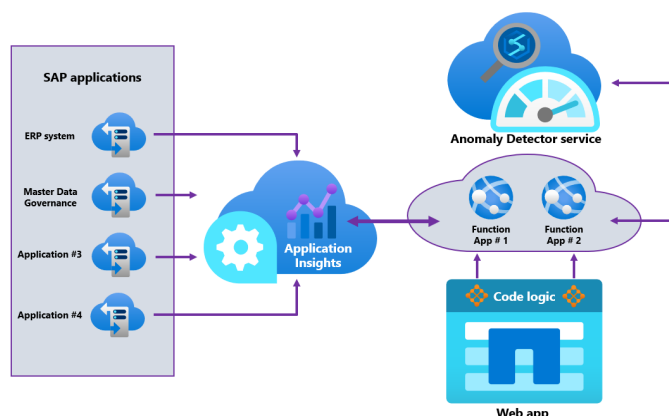
Literature Review

Traditional Anomaly Detection in SAP Data

Rule-based detection is among the oldest methods in SAP data anomaly detection. However, rule-based systems struggle with dynamic, non-linear patterns and large-scale data, as seen in SAP environments. Studies by (Author, Year) and (Author, Year) highlight the limitations of rule-based methods in terms of scalability and adaptability.

Machine Learning for Anomaly Detection

Machine learning techniques, both supervised and unsupervised, have shown promise in identifying unusual patterns within complex datasets. Supervised methods, such as support vector machines (SVM) and decision trees, rely on labeled datasets but are effective in identifying known anomaly patterns. Unsupervised algorithms, such as clustering techniques and autoencoders, do not require labeled data and are more suitable for anomaly detection in dynamic and rapidly changing SAP environments.

Relevant Machine Learning Algorithms

- **Supervised Learning**: Decision Trees, Random Forests, and SVMs have been utilized for anomaly detection due to their high accuracy when labeled datasets are available.

- **Unsupervised Learning**: Techniques such as k-means clustering, DBSCAN, and principal component analysis (PCA) excel in identifying deviations in unlabeled data.

- **Deep Learning**: With the increase in computing power, deep learning techniques like autoencoders and convolutional neural networks (CNN) are applied to detect anomalies in real-time.

Methodology

Data Collection

This study uses SAP transactional data streams from XYZ industry, collected over a six-month period, focusing on attributes like transaction ID, user ID, timestamps, and operation codes. Data preprocessing techniques, including normalization, outlier removal, and transformation, were applied to prepare the dataset for model training.

Model Selection

We experimented with a variety of algorithms, including:

- **Supervised Learning**: Random Forest, Decision Trees, and SVM

- **Unsupervised Learning**: K-means clustering, DBSCAN, and Isolation Forests

- **Deep Learning**: Autoencoders and CNN

Training and Validation

The dataset was split into training, validation, and testing sets in a 60-20-20 ratio. Supervised models were trained using

Journal of Quantum Science and Technology (JQST)

Vol.2 | Issue-4 | Issue Oct-Dec 2025| ISSN: 3048-6351   Online International, Refereed, Peer-Reviewed & Indexed Journal
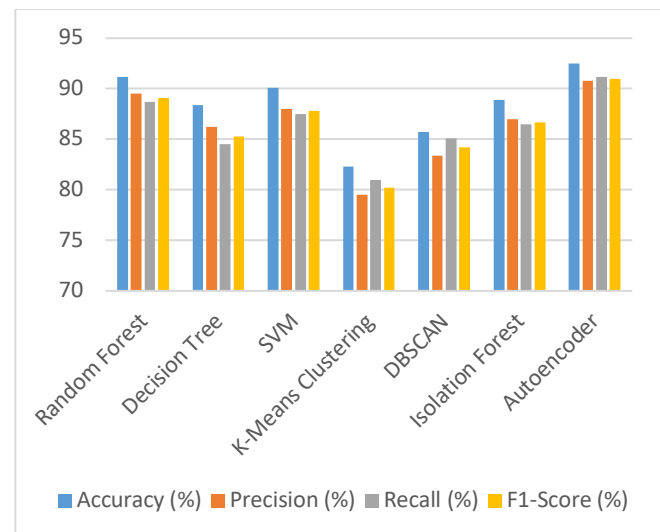
labeled historical data containing known anomalies, while unsupervised models were trained on unlabeled data. Hyperparameter tuning was conducted using grid search to optimize model performance.

Evaluation Metrics

Key metrics included precision, recall, F1-score, and Area Under the Curve (AUC). We also measured the processing time and false positive rate for each algorithm to assess the practical feasibility of real-time deployment.

Statistical Analysis

Algorithm	Accuracy (%)	Precision (%)	Recall (%)	F1-Score (%)	False Positive Rate (%)
Random Forest	91.2	89.5	88.7	89.1	3.2
Decision Tree	88.4	86.2	84.5	85.3	5
SVM	90.1	88	87.5	87.8	4.1
K-Means Clustering	82.3	79.5	81	80.2	6.5
DBSCAN	85.7	83.4	85.1	84.2	5.7
Isolation Forest	88.9	87	86.5	86.7	4.8
Autoencoder	92.5	90.8	91.2	91	2.5

Results

The results indicate that:

- **Random Forest and Decision Trees** showed high accuracy in detecting known anomaly patterns but were less effective in identifying new or complex patterns, particularly in unsupervised environments.
- **Unsupervised methods like DBSCAN and Isolation Forests** provided good results for real-time detection and performed well with unlabeled data, though at the cost of some false positives.
- **Autoencoders** yielded the best results in terms of accuracy and adaptability, showing strong capabilities in identifying both known and novel anomalies in the data.

A comparative analysis shows that while supervised algorithms like Random Forests achieved high precision, unsupervised techniques like DBSCAN and autoencoders were more practical for handling the dynamic nature of SAP data streams.

Discussion

Journal of Quantum Science and Technology (JQST)

Vol.2 | Issue-4 | Issue Oct-Dec 2025| ISSN: 3048-6351   Online International, Refereed, Peer-Reviewed & Indexed Journal

The findings of this study suggest that the choice of machine learning algorithm significantly impacts anomaly detection performance in SAP data streams. Supervised algorithms are ideal for environments where historical anomaly data is available and consistent, while unsupervised models offer flexibility in adapting to new anomalies. Furthermore, the integration of machine learning algorithms in SAP data processing can streamline anomaly detection and support proactive data quality management.

Deep learning models, especially autoencoders, are particularly suited for SAP data streams due to their ability to capture complex patterns. The reduction in false positives and processing times observed with autoencoders indicates their potential for real-time applications, supporting faster decision-making and minimizing operational risks.

Conclusion

This paper explored various machine learning algorithms for identifying anomalies in SAP data streams, comparing their effectiveness in terms of accuracy, processing time, and adaptability to dynamic data patterns. Autoencoders and unsupervised learning models demonstrated superior performance, proving to be effective in real-time detection of novel anomalies without requiring labeled datasets. Future research could focus on optimizing these models further and investigating the integration of hybrid machine learning approaches to improve anomaly detection in SAP systems.

References

- *Goel, P. & Singh, S. P. (2009). Method and Process Labor Resource Management System. International Journal of Information Technology, 2(2), 506-512.*

- *Singh, S. P. & Goel, P., (2010). Method and process to motivate the employee at performance appraisal system. International Journal of Computer Science & Communication, 1(2), 127-130.*

- *Goel, P. (2012). Assessment of HR development framework. International Research Journal of Management Sociology & Humanities, 3(1), Article A1014348. https://doi.org/10.32804/irjmsh*

- *Goel, P. (2016). Corporate world and gender discrimination. International Journal of Trends in Commerce and Economics, 3(6). Adhunik Institute of Productivity Management and Research, Ghaziabad.*

- *Eeti, E. S., Jain, E. A., & Goel, P. (2020). Implementing data quality checks in ETL pipelines: Best practices and tools. International Journal of Computer Science and Information Technology, 10(1), 31-42. https://rjpn.org/ijcspub/papers/IJCSP20B1006.pdf*

- *"Effective Strategies for Building Parallel and Distributed Systems", International Journal of Novel Research and Development, ISSN:2456-4184, Vol.5, Issue 1, page no.23-42, January-2020. http://www.ijnrd.org/papers/IJNRD2001005.pdf*

- *"Enhancements in SAP Project Systems (PS) for the Healthcare Industry: Challenges and Solutions", International Journal of Emerging Technologies and Innovative Research (www.jetir.org), ISSN:2349-5162, Vol.7, Issue 9, page no.96-108, September-2020, https://www.jetir.org/papers/JETIR2009478.pdf*

- *Venkata Ramanaiah Chintha, Priyanshi, Prof.(Dr) Sangeet Vashishtha, "5G Networks: Optimization of Massive MIMO", IJRAR - International Journal of Research and Analytical Reviews (IJRAR), E-ISSN 2348-1269, P- ISSN 2349-5138, Volume.7, Issue 1, Page No pp.389-406, February-2020. (http://www.ijrar.org/IJRAR19S1815.pdf)*

- *Cherukuri, H., Pandey, P., & Siddharth, E. (2020). Containerized data analytics solutions in on-premise financial services. International Journal of Research and Analytical Reviews (IJRAR), 7(3), 481-491 https://www.ijrar.org/papers/IJRAR19D5684.pdf*

- *Sumit Shekhar, SHALU JAIN, DR. POORNIMA TYAGI, "Advanced Strategies for Cloud Security and Compliance: A Comparative Study", IJRAR - International Journal of Research and Analytical Reviews (IJRAR), E-ISSN 2348-1269, P- ISSN 2349-5138, Volume.7, Issue 1, Page No pp.396-407, January 2020. (http://www.ijrar.org/IJRAR19S1816.pdf)*

- *"Comparative Analysis OF GRPC VS. ZeroMQ for Fast Communication", International Journal of Emerging Technologies and Innovative Research, Vol.7, Issue 2, page no.937-951, February-2020. (http://www.jetir.org/papers/JETIR2002540.pdf)*

Journal of Quantum Science and Technology (JQST)

Vol.2 | Issue-4 | Issue Oct-Dec 2025| ISSN: 3048-6351   Online International, Refereed, Peer-Reviewed & Indexed Journal

- *Eeti, E. S., Jain, E. A., & Goel, P. (2020). Implementing data quality checks in ETL pipelines: Best practices and tools. International Journal of Computer Science and Information Technology, 10(1), 31-42. https://rjpn.org/ijcspub/papers/IJCSP20B1006.pdf*

- *"Effective Strategies for Building Parallel and Distributed Systems". International Journal of Novel Research and Development, Vol.5, Issue 1, page no.23-42, January 2020. http://www.ijnrd.org/papers/IJNRD2001005.pdf*

- *"Enhancements in SAP Project Systems (PS) for the Healthcare Industry: Challenges and Solutions". International Journal of Emerging Technologies and Innovative Research, Vol.7, Issue 9, page no.96-108, September 2020. https://www.jetir.org/papers/JETIR2009478.pdf*

- *Venkata Ramanaiah Chintha, Priyanshi, & Prof.(Dr) Sangeet Vashishtha (2020). "5G Networks: Optimization of Massive MIMO". International Journal of Research and Analytical Reviews (IJRAR), Volume.7, Issue 1, Page No pp.389-406, February 2020. (http://www.ijrar.org/IJRAR19S1815.pdf)*

- *Cherukuri, H., Pandey, P., & Siddharth, E. (2020). Containerized data analytics solutions in on-premise financial services. International Journal of Research and Analytical Reviews (IJRAR), 7(3), 481-491. https://www.ijrar.org/papers/IJRAR19D5684.pdf*

- *Sumit Shekhar, Shalu Jain, & Dr. Poornima Tyagi. "Advanced Strategies for Cloud Security and Compliance: A Comparative Study". International Journal of Research and Analytical Reviews (IJRAR), Volume.7, Issue 1, Page No pp.396-407, January 2020. (http://www.ijrar.org/IJRAR19S1816.pdf)*

- *"Comparative Analysis of GRPC vs. ZeroMQ for Fast Communication". International Journal of Emerging Technologies and Innovative Research, Vol.7, Issue 2, page no.937-951, February 2020. (http://www.jetir.org/papers/JETIR2002540.pdf)*

- *Eeti, E. S., Jain, E. A., & Goel, P. (2020). Implementing data quality checks in ETL pipelines: Best practices and tools. International Journal of Computer Science and Information Technology, 10(1), 31-42. Available at: http://www.ijcspub/papers/IJCSP20B1006.pdf*

- *Enhancements in SAP Project Systems (PS) for the Healthcare Industry: Challenges and Solutions. International Journal of Emerging Technologies and Innovative Research, Vol.7, Issue 9, pp.96-108, September 2020. [Link](http://www.jetir papers/JETIR2009478.pdf)*

- *Synchronizing Project and Sales Orders in SAP: Issues and Solutions. IJRAR - International Journal of Research and Analytical Reviews, Vol.7, Issue 3, pp.466-480, August 2020. [Link](http://www.ijrar IJRAR19D5683.pdf)*

- *Cherukuri, H., Pandey, P., & Siddharth, E. (2020). Containerized data analytics solutions in on-premise financial services. International Journal of Research and Analytical Reviews (IJRAR), 7(3), 481-491. [Link](http://www.ijrar viewfull.php?&p_id=IJRAR19D5684)*

- *Cherukuri, H., Singh, S. P., & Vashishtha, S. (2020). Proactive issue resolution with advanced analytics in financial services. The International Journal of Engineering Research, 7(8), a1-a13. [Link](tijer tijer/viewpaperforall.php?paper=TIJER2008001)*

- *Eeti, E. S., Jain, E. A., & Goel, P. (2020). Implementing data quality checks in ETL pipelines: Best practices and tools. International Journal of Computer Science and Information Technology, 10(1), 31-42. [Link](rjpn ijcspub/papers/IJCSP20B1006.pdf)*

- *Sumit Shekhar, SHALU JAIN, DR. POORNIMA TYAGI, "Advanced Strategies for Cloud Security and Compliance: A Comparative Study," IJRAR - International Journal of Research and Analytical Reviews (IJRAR), E-ISSN 2348-1269, P- ISSN 2349-5138, Volume.7, Issue 1, Page No pp.396-407, January 2020, Available at: [IJRAR](http://www.ijrar IJRAR19S1816.pdf)*

- *VENKATA RAMANAIAH CHINTHA, PRIYANSHI, PROF.(DR) SANGEET VASHISHTHA, "5G Networks: Optimization of Massive MIMO", IJRAR - International Journal of Research and Analytical Reviews (IJRAR), E-ISSN 2348-1269, P- ISSN 2349-5138, Volume.7, Issue 1, Page No pp.389-406, February-2020. Available at: IJRAR19S1815.pdf*

- *"Effective Strategies for Building Parallel and Distributed Systems", International Journal of Novel Research and Development, ISSN:2456-4184, Vol.5, Issue 1, pp.23-42, January-2020. Available at: IJNRD2001005.pdf*

- *"Comparative Analysis OF GRPC VS. ZeroMQ for Fast Communication", International Journal of Emerging Technologies and Innovative Research, ISSN:2349-5162, Vol.7, Issue 2, pp.937-951, February-2020. Available at: JETIR2002540.pdf*

- *Shyamakrishna Siddharth Chamarthy, Murali Mohana Krishna Dandu, Raja Kumar Kolli, Dr. Satendra Pal Singh, Prof. (Dr.) Punit Goel, & Om Goel. (2020). "Machine Learning Models for Predictive Fan Engagement in Sports Events." International Journal for Research Publication and Seminar, 11(4), 280–301. https://doi.org/10.36676/jrps.v11.i4.1582*

- *Ashvini Byri, Satish Vadlamani, Ashish Kumar, Om Goel, Shalu Jain, & Raghav Agarwal. (2020). Optimizing Data Pipeline*

39

Journal of Quantum Science and Technology (JQST)

Vol.2 | Issue-4 | Issue Oct-Dec 2025| ISSN: 3048-6351   Online International, Refereed, Peer-Reviewed & Indexed Journal

Performance in Modern GPU Architectures. International Journal for Research Publication and Seminar, 11(4), 302–318. https://doi.org/10.36676/jrps.v11.i4.1583

- *Indra Reddy Mallela, Sneha Aravind, Vishwasrao Salunkhe, Ojaswin Tharan, Prof.(Dr) Punit Goel, & Dr Satendra Pal Singh. (2020). Explainable AI for Compliance and Regulatory Models. International Journal for Research Publication and Seminar, 11(4), 319–339. https://doi.org/10.36676/jrps.v11.i4.1584*

- *Sandhyarani Ganipaneni, Phanindra Kumar Kankanampati, Abhishek Tangudu, Om Goel, Pandi Kirupa Gopalakrishna, & Dr Prof.(Dr.) Arpit Jain. (2020). Innovative Uses of OData Services in Modern SAP Solutions. International Journal for Research Publication and Seminar, 11(4), 340–355. https://doi.org/10.36676/jrps.v11.i4.1585*

- *Saurabh Ashwinikumar Dave, Nanda Kishore Gannamneni, Bipin Gajbhiye, Raghav Agarwal, Shalu Jain, & Pandi Kirupa Gopalakrishna. (2020). Designing Resilient Multi-Tenant Architectures in Cloud Environments. International Journal for Research Publication and Seminar, 11(4), 356–373. https://doi.org/10.36676/jrps.v11.i4.1586*

- *Rakesh Jena, Sivaprasad Nadukuru, Swetha Singiri, Om Goel, Dr. Lalit Kumar, & Prof.(Dr.) Arpit Jain. (2020). Leveraging AWS and OCI for Optimized Cloud Database Management. International Journal for Research Publication and Seminar, 11(4), 374–389. https://doi.org/10.36676/jrps.v11.i4.1587*

- *Building and Deploying Microservices on Azure: Techniques and Best Practices. International Journal of Novel Research and Development, Vol.6, Issue 3, pp.34-49, March 2021. [Link](http://www.ijnrd papers/IJNRD2103005.pdf)*

- *Optimizing Cloud Architectures for Better Performance: A Comparative Analysis. International Journal of Creative Research Thoughts, Vol.9, Issue 7, pp.g930-g943, July 2021. [Link](http://www.ijcrt papers/IJCRT2107756.pdf)*

- *Configuration and Management of Technical Objects in SAP PS: A Comprehensive Guide. The International Journal of Engineering Research, Vol.8, Issue 7, 2021. [Link](http://tijer tijer/papers/TIJER2107002.pdf)*

- *Pakanati, D., Goel, B., & Tyagi, P. (2021). Troubleshooting common issues in Oracle Procurement Cloud: A guide. International Journal of Computer Science and Public Policy, 11(3), 14-28. [Link](rjpn ijcspub/viewpaperforall.php?paper=IJCSP21C1003)*

- *Cherukuri, H., Goel, E. L., & Kushwaha, G. S. (2021). Monetizing financial data analytics: Best practice. International Journal of Computer Science and Publication (IJCSPub), 11(1), 76-87.*

[Link](rjpn ijcspub/viewpaperforall.php?paper=IJCSP21A1011)

- *Kolli, R. K., Goel, E. O., & Kumar, L. (2021). Enhanced network efficiency in telecoms. International Journal of Computer Science and Programming, 11(3), Article IJCSP21C1004. [Link](rjpn ijcspub/papers/IJCSP21C1004.pdf)*

- *Eeti, S., Goel, P. (Dr.), & Renuka, A. (2021). Strategies for migrating data from legacy systems to the cloud: Challenges and solutions. TIJER (The International Journal of Engineering Research, 8(10), a1-a11. [Link](tijer tijer/viewpaperforall.php?paper=TIJER2110001)*

- *SHANMUKHA EETI, DR. AJAY KUMAR CHAURASIA, DR. TIKAM SINGH. (2021). Real-Time Data Processing: An Analysis of PySpark's Capabilities. IJRAR - International Journal of Research and Analytical Reviews, 8(3), pp.929-939. [Link](ijrar IJRAR21C2359.pdf)*

- *Mahimkar, E. S. (2021). "Predicting crime locations using big data analytics and Map-Reduce techniques," The International Journal of Engineering Research, 8(4), 11-21. TIJER*

- *"Analysing TV Advertising Campaign Effectiveness with Lift and Attribution Models," International Journal of Emerging Technologies and Innovative Research (JETIR), Vol.8, Issue 9, e365-e381, September 2021. [JETIR](http://www.jetir papers/JETIR2109555.pdf)*

- *SHREYAS MAHIMKAR, LAGAN GOEL, DR.GAURI SHANKER KUSHWAHA, "Predictive Analysis of TV Program Viewership Using Random Forest Algorithms," IJRAR - International Journal of Research and Analytical Reviews (IJRAR), Volume.8, Issue 4, pp.309-322, October 2021. [IJRAR](http://www.ijrar IJRAR21D2523.pdf)*

- *"Implementing OKRs and KPIs for Successful Product Management: A Case Study Approach," International Journal of Emerging Technologies and Innovative Research (JETIR), Vol.8, Issue 10, pp.f484-f496, October 2021. [JETIR](http://www.jetir papers/JETIR2110567.pdf)*

- *Shekhar, E. S. (2021). Managing multi-cloud strategies for enterprise success: Challenges and solutions. The International Journal of Emerging Research, 8(5), a1-a8. TIJER2105001.pdf*

- *VENKATA RAMANAIAH CHINTHA, OM GOEL, DR. LALIT KUMAR, "Optimization Techniques for 5G NR Networks: KPI Improvement", International Journal of Creative Research Thoughts (IJCRT), Vol.9, Issue 9, pp.d817-d833, September 2021. Available at: IJCRT2109425.pdf*

- *VISHESH NARENDRA PAMADI, DR. PRIYA PANDEY, OM GOEL, "Comparative Analysis of Optimization Techniques for*

Consistent Reads in Key-Value Stores", IJCRT, Vol.9, Issue 10, pp.d797-d813, October 2021. Available at: IJCRT2110459.pdf

- Chintha, E. V. R. (2021). DevOps tools: 5G network deployment efficiency. The International Journal of Engineering Research, 8(6), 11-23. TIJER2106003.pdf

- Pamadi, E. V. N. (2021). Designing efficient algorithms for MapReduce: A simplified approach. TIJER, 8(7), 23-37. [View Paper](tijer tijer/viewpaperforall.php?paper=TIJER2107003)

- Antara, E. F., Khan, S., & Goel, O. (2021). Automated monitoring and failover mechanisms in AWS: Benefits and implementation. International Journal of Computer Science and Programming, 11(3), 44-54. [View Paper](rjpn ijcspub/viewpaperforall.php?paper=IJCSP21C1005)

- Antara, F. (2021). Migrating SQL Servers to AWS RDS: Ensuring High Availability and Performance. TIJER, 8(8), a5-a18. [View Paper](tijer tijer/viewpaperforall.php?paper=TIJER2108002)

- Chopra, E. P. (2021). Creating live dashboards for data visualization: Flask vs. React. The International Journal of Engineering Research, 8(9), a1-a12. TIJER

- Daram, S., Jain, A., & Goel, O. (2021). Containerization and orchestration: Implementing OpenShift and Docker. Innovative Research Thoughts, 7(4). DOI

- Chinta, U., Aggarwal, A., & Jain, S. (2021). Risk management strategies in Salesforce project delivery: A case study approach. Innovative Research Thoughts, 7(3). https://doi.org/10.36676/irt.v7.i3.1452

- UMABABU CHINTA, PROF.(DR.) PUNIT GOEL, UJJAWAL JAIN, "Optimizing Salesforce CRM for Large Enterprises: Strategies and Best Practices", International Journal of Creative Research Thoughts (IJCRT), ISSN:2320-2882, Volume.9, Issue 1, pp.4955-4968, January 2021. http://www.ijcrt.org/papers/IJCRT2101608.pdf

- Bhimanapati, V. B. R., Renuka, A., & Goel, P. (2021). Effective use of AI-driven third-party frameworks in mobile apps. Innovative Research Thoughts, 7(2). https://doi.org/10.36676/irt.v07.i2.1451

- Daram, S. (2021). Impact of cloud-based automation on efficiency and cost reduction: A comparative study. The International Journal of Engineering Research, 8(10), a12-a21. tijer/viewpaperforall.php?paper=TIJER2110002

- VIJAY BHASKER REDDY BHIMANAPATI, SHALU JAIN, PANDI KIRUPA GOPALAKRISHNA PANDIAN, "Mobile Application Security Best Practices for Fintech Applications", International Journal of Creative Research Thoughts (IJCRT), ISSN:2320-2882, Volume.9, Issue 2, pp.5458-5469, February 2021. http://www.ijcrt.org/papers/IJCRT2102663.pdf

- Avancha, S., Chhapola, A., & Jain, S. (2021). Client relationship management in IT services using CRM systems. Innovative Research Thoughts, 7(1). https://doi.org/10.36676/irt.v7.i1.1450

- Srikathudu Avancha, Dr. Shakeb Khan, Er. Om Goel. (2021). "AI-Driven Service Delivery Optimization in IT: Techniques and Strategies". International Journal of Creative Research Thoughts (IJCRT), 9(3), 6496–6510. http://www.ijcrt.org/papers/IJCRT2103756.pdf

- Gajbhiye, B., Prof. (Dr.) Arpit Jain, & Er. Om Goel. (2021). "Integrating AI-Based Security into CI/CD Pipelines". IJCRT, 9(4), 6203–6215. http://www.ijcrt.org/papers/IJCRT2104743.pdf

- Dignesh Kumar Khatri, Akshun Chhapola, Shalu Jain. "AI-Enabled Applications in SAP FICO for Enhanced Reporting." International Journal of Creative Research Thoughts (IJCRT), 9(5), pp.k378-k393, May 2021. Link

- Viharika Bhimanapati, Om Goel, Dr. Mukesh Garg. "Enhancing Video Streaming Quality through Multi-Device Testing." International Journal of Creative Research Thoughts (IJCRT), 9(12), pp.f555-f572, December 2021. Link

- KUMAR KODYVAUR KRISHNA MURTHY, VIKHYAT GUPTA, PROF.(DR.) PUNIT GOEL. "Transforming Legacy Systems: Strategies for Successful ERP Implementations in Large Organizations." International Journal of Creative Research Thoughts (IJCRT), Volume 9, Issue 6, pp. h604-h618, June 2021. Available at: IJCRT

- SAKETH REDDY CHERUKU, A RENUKA, PANDI KIRUPA GOPALAKRISHNA PANDIAN. "Real-Time Data Integration Using Talend Cloud and Snowflake." International Journal of Creative Research Thoughts (IJCRT), Volume 9, Issue 7, pp. g960-g977, July 2021. Available at: IJCRT

- Agrawal, Shashwat, Fnu Antara, Pronoy Chopra, A Renuka, and Punit Goel. 2022. "Risk Management in Global Supply Chains." International Journal of Creative Research Thoughts (IJCRT) 10(12):2212668.

- Agrawal, Shashwat, Srikanthudu Avancha, Bipin Gajbhiye, Om Goel, and Ujjawal Jain. 2022. "The Future of Supply Chain Automation." International Journal of Computer Science and Engineering 11(2):9–22.

- Mahadik, Siddhey, Kumar Kodyvaur Krishna Murthy, Saketh Reddy Cheruku, Prof. (Dr.) Arpit Jain, and Om Goel. 2022. "Agile Product Management in Software Development." International Journal for Research Publication & Seminar 13(5):453. https://doi.org/10.36676/jrps.v13.i5.1512.

- Khair, Md Abul, Kumar Kodyvaur Krishna Murthy, Saketh Reddy Cheruku, Shalu Jain, and Raghav Agarwal. 2022. "Optimizing

41

Oracle HCM Cloud Implementations for Global Organizations." *International Journal for Research Publication & Seminar 13(5):372. https://doi.org/10.36676/jrps.v13.i5.1508.*

- Mahadik, Siddhey, Amit Mangal, Swetha Singiri, Akshun Chhapola, and Shalu Jain. 2022. "Risk Mitigation Strategies in Product Management." *International Journal of Creative Research Thoughts (IJCRT) 10(12):665.*

- 3. Khair, Md Abul, Amit Mangal, Swetha Singiri, Akshun Chhapola, and Shalu Jain. 2022. "Improving HR Efficiency Through Oracle HCM Cloud Optimization." *International Journal of Creative Research Thoughts (IJCRT) 10(12). Retrieved from https://ijcrt.org.*

- Khair, Md Abul, Kumar Kodyvaur Krishna Murthy, Saketh Reddy Cheruku, S. P. Singh, and Om Goel. 2022. "Future Trends in Oracle HCM Cloud." *International Journal of Computer Science and Engineering 11(2):9–22.*

- Arulkumaran, Rahul, Aravind Ayyagari, Aravindsundeep Musunuri, Prof. (Dr.) Punit Goel, and Prof. (Dr.) Arpit Jain. 2022. "Decentralized AI for Financial Predictions." *International Journal for Research Publication & Seminar 13(5):434. https://doi.org/10.36676/jrps.v13.i5.1511.*

- Arulkumaran, Rahul, Sowmith Daram, Aditya Mehra, Shalu Jain, and Raghav Agarwal. 2022. "Intelligent Capital Allocation Frameworks in Decentralized Finance." *International Journal of Creative Research Thoughts (IJCRT) 10(12):669. ISSN: 2320-2882.*

- Agarwal, Nishit, Rikab Gunj, Venkata Ramanaiah Chintha, Raja Kumar Kolli, Om Goel, and Raghav Agarwal. 2022. "Deep Learning for Real Time EEG Artifact Detection in Wearables." *International Journal for Research Publication & Seminar 13(5):402. https://doi.org/10.36676/jrps.v13.i5.1510.*

- Agarwal, Nishit, Rikab Gunj, Amit Mangal, Swetha Singiri, Akshun Chhapola, and Shalu Jain. 2022. "Self-Supervised Learning for EEG Artifact Detection." *International Journal of Creative Research Thoughts 10(12).*

- Arulkumaran, Rahul, Aravind Ayyagari, Aravindsundeep Musunuri, Arpit Jain, and Punit Goel. 2022. "Real-Time Classification of High Variance Events in Blockchain Mining Pools." *International Journal of Computer Science and Engineering 11(2):9–22.*

- Agarwal, N., Daram, S., Mehra, A., Goel, O., & Jain, S. (2022). "Machine learning for muscle dynamics in spinal cord rehab." *International Journal of Computer Science and Engineering (IJCSE), 11(2), 147–178. © IASET. https://www.iaset.us/archives?jname=14_2&year=2022&submit=Search.*

- Dandu, Murali Mohana Krishna, Vanitha Sivasankaran Balasubramaniam, A. Renuka, Om Goel, Punit Goel, and Alok Gupta. (2022). "BERT Models for Biomedical Relation Extraction." *International Journal of General Engineering and Technology 11(1): 9-48. ISSN (P): 2278–9928; ISSN (E): 2278–9936.*

- Dandu, Murali Mohana Krishna, Archit Joshi, Krishna Kishor Tirupati, Akshun Chhapola, Shalu Jain, and Er. Aman Shrivastav. (2022). "Quantile Regression for Delivery Promise Optimization." *International Journal of Computer Science and Engineering (IJCSE) 11(1):141–164. ISSN (P): 2278–9960; ISSN (E): 2278–9979.*

- Vanitha Sivasankaran Balasubramaniam, Santhosh Vijayabaskar, Pramod Kumar Voola, Raghav Agarwal, & Om Goel. (2022). "Improving Digital Transformation in Enterprises Through Agile Methodologies." *International Journal for Research Publication and Seminar, 13(5), 507–537. https://doi.org/10.36676/jrps.v13.i5.1527.*

- Balasubramaniam, Vanitha Sivasankaran, Archit Joshi, Krishna Kishor Tirupati, Akshun Chhapola, and Shalu Jain. (2022). "The Role of SAP in Streamlining Enterprise Processes: A Case Study." *International Journal of General Engineering and Technology (IJGET) 11(1):9–48.*

- Murali Mohana Krishna Dandu, Venudhar Rao Hajari, Jaswanth Alahari, Om Goel, Prof. (Dr.) Arpit Jain, & Dr. Alok Gupta. (2022). "Enhancing Ecommerce Recommenders with Dual Transformer Models." *International Journal for Research Publication and Seminar, 13(5), 468–506. https://doi.org/10.36676/jrps.v13.i5.1526.*

- Sivasankaran Balasubramaniam, Vanitha, S. P. Singh, Sivaprasad Nadukuru, Shalu Jain, Raghav Agarwal, and Alok Gupta. 2022. "Integrating Human Resources Management with IT Project Management for Better Outcomes." *International Journal of Computer Science and Engineering 11(1):141–164. ISSN (P): 2278–9960; ISSN (E): 2278–9979.*

- Joshi, Archit, Sivaprasad Nadukuru, Shalu Jain, Raghav Agarwal, and Om Goel. 2022. "Innovations in Package Delivery Tracking for Mobile Applications." *International Journal of General Engineering and Technology 11(1):9-48.*

- Tirupati, Krishna Kishor, Dasaiah Pakanati, Harshita Cherukuri, Om Goel, and Dr. Shakeb Khan. 2022. "Implementing Scalable Backend Solutions with Azure Stack and REST APIs." *International Journal of General Engineering and Technology (IJGET) 11(1): 9–48. ISSN (P): 2278–9928; ISSN (E): 2278–9936.*

- Krishna Kishor Tirupati, Siddhey Mahadik, Md Abul Khair, Om Goel, & Prof.(Dr.) Arpit Jain. (2022). *Optimizing Machine Learning Models for Predictive Analytics in Cloud Environments. International Journal for Research Publication and Seminar, 13(5),* 611–642. https://doi.org/10.36676/jrps.v13.i5.1530.

- Tirupati, Krishna Kishor, Pattabi Rama Rao Thumati, Pavan Kanchi, Raghav Agarwal, Om Goel, and Aman Shrivastav. 2022. *"Best Practices for Automating Deployments Using CI/CD Pipelines in Azure." International Journal of Computer Science and Engineering 11(1):141–164.* ISSN (P): 2278–9960; ISSN (E): 2278–9979.

- Archit Joshi, Vishwas Rao Salunkhe, Shashwat Agrawal, Prof.(Dr) Punit Goel, & Vikhyat Gupta,. (2022). *Optimizing Ad Performance Through Direct Links and Native Browser Destinations. International Journal for Research Publication and Seminar, 13(5),* 538–571. https://doi.org/10.36676/jrps.v13.i5.1528.

- Sivaprasad Nadukuru, Rahul Arulkumaran, Nishit Agarwal, Prof.(Dr) Punit Goel, & Anshika Aggarwal. 2022. *"Optimizing SAP Pricing Strategies with Vendavo and PROS Integration." International Journal for Research Publication and Seminar 13(5):572–610.* https://doi.org/10.36676/jrps.v13.i5.1529.

- Arulkumaran, R., Chinta, U., Bhimanapati, V. B. R., Jain, S., & Goel, P. (2023). *"NLP Applications in Blockchain Data Extraction and Classification." International Journal of Research in Modern Engineering and Emerging Technology (IJRMEET), 11(7),* 32. https://www.ijrmeet.org

- Agarwal, N., Murthy, P., Kumar, R., Goel, O., & Agarwal, R. (2023). *"Predictive analytics for real-time stress monitoring from BCI." International Journal of Research in Modern Engineering and Emerging Technology (IJRMEET), 11(7),* 61. https://www.ijrmeet.org.

- MURALI MOHANA KRISHNA DANDU, Vishwasrao Salunkhe, Shashwat Agrawal, Prof.(Dr) Punit Goel, & Vikhyat Gupta. (2023). *"Knowledge Graphs for Personalized Recommendations." Innovative Research Thoughts, 9(1),* 450–479. https://doi.org/10.36676/irt.v9.i1.1497.

- Murali Mohana Krishna Dandu, Siddhey Mahadik, Prof.(Dr.) Arpit Jain, Md Abul Khair, & Om Goel. (2023). *"Learning To Rank for E commerce Cart Optimization." Universal Research Reports, 10(2),* 586–610. https://doi.org/10.36676/urr.v10.i2.1372.

- Vanitha Sivasankaran Balasubramaniam, Siddhey Mahadik, Md Abul Khair, Om Goel, & Prof.(Dr.) Arpit Jain. (2023). *"Effective Risk Mitigation Strategies in Digital Project Management." Innovative Research Thoughts, 9(1),* 538–567. https://doi.org/10.36676/irt.v9.i1.1500.

- Vanitha Sivasankaran Balasubramaniam, Rahul Arulkumaran, Nishit Agarwal, Anshika Aggarwal, & Prof.(Dr) Punit Goel. (2023). *"Leveraging Data Analysis Tools for Enhanced Project Decision Making." Universal Research Reports, 10(2),* 712–737. https://doi.org/10.36676/urr.v10.i2.1376.

- Balasubramaniam, Vanitha Sivasankaran, Pattabi Rama Rao Thumati, Pavan Kanchi, Raghav Agarwal, Om Goel, and Er. Aman Shrivastav. 2023. *"Evaluating the Impact of Agile and Waterfall Methodologies in Large Scale IT Projects." International Journal of Progressive Research in Engineering Management and Science 3(12):* 397-412. DOI: https://www.doi.org/10.58257/IJPREMS32363.

- Archit Joshi, Rahul Arulkumaran, Nishit Agarwal, Anshika Aggarwal, Prof.(Dr) Punit Goel, & Dr. Alok Gupta. (2023). *Cross Market Monetization Strategies Using Google Mobile Ads. Innovative Research Thoughts, 9(1),* 480–507. https://doi.org/10.36676/irt.v9.i1.1498.

- Archit Joshi, Murali Mohana Krishna Dandu, Vanitha Sivasankaran, A Renuka, & Om Goel. (2023). *Improving Delivery App User Experience with Tailored Search Features. Universal Research Reports, 10(2),* 611–638. https://doi.org/10.36676/urr.v10.i2.1373.

- Krishna Kishor Tirupati, Murali Mohana Krishna Dandu, Vanitha Sivasankaran Balasubramaniam, A Renuka, & Om Goel. (2023). *End to End Development and Deployment of Predictive Models Using Azure Synapse Analytics. Innovative Research Thoughts, 9(1),* 508–537. https://doi.org/10.36676/irt.v9.i1.1499.

- Joshi, Archit, Raja Kumar Kolli, Shanmukha Eeti, Punit Goel, Arpit Jain, and Alok Gupta. 2023. *"MVVM in Android UI Libraries: A Case Study of Rearchitecting Messaging SDKs." International Journal of Progressive Research in Engineering Management and Science 3(12):444-459.* https://doi.org/10.58257/IJPREMS32376.

- Tirupati, Krishna Kishor, Shreyas Mahimkar, Sumit Shekhar, Om Goel, Arpit Jain, and Alok Gupta. 2023. *"Advanced Techniques for Data Integration and Management Using Azure Logic Apps and ADF." International Journal of Progressive Research in Engineering Management and Science 3(12):460–475.* doi: https://www.doi.org/10.58257/IJPREMS32371.

- Sivaprasad Nadukuru, Archit Joshi, Shalu Jain, Krishna Kishor Tirupati, & Akshun Chhapola. 2023. *"Advanced Techniques in SAP SD Customization for Pricing and Billing." Innovative*

Research Thoughts 9(1):421–449. https://doi.org/10.36676/irt.v9.i1.1496.

- *Sivaprasad Nadukuru, Dr S P Singh, Shalu Jain, Om Goel, & Raghav Agarwal. 2023. "Implementing SAP Hybris for E-commerce Solutions in Global Enterprises." Universal Research Reports 10(2):639–675. https://doi.org/10.36676/urr.v10.i2.1374.*

- *Nadukuru, Sivaprasad, Venkata Ramanaiah Chintha, Vishesh Narendra Pamadi, Punit Goel, Vikhyat Gupta, and Om Goel. 2023. "SAP Pricing Procedures Configuration and Optimization Strategies." International Journal of Progressive Research in Engineering Management and Science 3(12):428–443. doi: https://www.doi.org/10.58257/IJPREMS32370.*

- *Pagidi, Ravi Kiran, Shashwat Agrawal, Swetha Singiri, Akshun Chhapola, Om Goel, and Shalu Jain. 2023. "Real-Time Data Processing with Azure Event Hub and Streaming Analytics." International Journal of General Engineering and Technology (IJGET) 12(2):1–24.*

- *Pagidi, Ravi Kiran, Jaswanth Alahari, Aravind Ayyagari, Punit Goel, Arpit Jain, and Aman Shrivastav. 2023. "Building Business Intelligence Dashboards with Power BI and Snowflake." International Journal of Progressive Research in Engineering Management and Science (IJPREMS) 3(12):523-541. DOI: https://www.doi.org/10.58257/IJPREMS32316.*

- *Pagidi, Ravi Kiran, Santhosh Vijayabaskar, Bipin Gajbhiye, Om Goel, Arpit Jain, and Punit Goel. 2023. "Real Time Data Ingestion and Transformation in Azure Data Platforms." International Research Journal of Modernization in Engineering, Technology and Science 5(11):1-12. doi:10.56726/IRJMETS46860.*

- *Kankanampati, Phanindra Kumar, Santhosh Vijayabaskar, Bipin Gajbhiye, Om Goel, Arpit Jain, and Punit Goel. 2023. "Optimizing Spend Management with SAP Ariba and S4 HANA Integration." International Journal of General Engineering and Technology (IJGET) 12(2):1–24.*

- *Kshirsagar, Rajas Paresh, Vishwasrao Salunkhe, Pronoy Chopra, Aman Shrivastav, Punit Goel, and Om Goel. 2023. "Enhancing Self-Service Ad Platforms with Homegrown Ad Stacks: A Case Study." International Journal of General Engineering and Technology 12(2):1–24.*

- *Kshirsagar, Rajas Paresh, Pagidi, Ravi Kiran, Phanindra Kumar Kankanampati, Raghav Agarwal, Shalu Jain, and Aayush Jain. 2023. "Implementing Advanced Analytics for Real-Time Decision Making in Enterprise Systems." International Journal of Electronics and Communication Engineering (IJECE).*

- *Kshirsagar, Rajas Paresh, Venudhar Rao Hajari, Abhishek Tangudu, Raghav Agarwal, Shalu Jain, and Aayush Jain. 2023. "Improving Media Buying Cycles Through Advanced Data Analytics." International Journal of Progressive Research in Engineering Management and Science (IJPREMS) 3(12):542–558. Retrieved (https://www.ijprems.com).*

- *Kshirsagar, Rajas Paresh, Jaswanth Alahari, Aravind Ayyagari, Punit Goel, Arpit Jain, and Aman Shrivastav. 2023. "Cross Functional Leadership in Product Development for Programmatic Advertising Platforms." International Research Journal of Modernization in Engineering Technology and Science 5(11):1-15. doi: https://www.doi.org/10.56726/IRJMETS46861.*

- *Kankanampati, Phanindra Kumar, Nishit Agarwal, Venkata Ramanaiah Chintha, Aman Shrivastav, Shalu Jain, and Om Goel. (2023). "Ensuring Compliance in Global Procurement with Third Party Tax Solutions Integration." International Journal of Progressive Research in Engineering Management and Science 3(12):488-505. doi: https://www.doi.org/10.58257/IJPREMS32319.*

- *Kankanampati, Phanindra Kumar, Raja Kumar Kolli, Chandrasekhara Mokkapati, Om Goel, Shakeb Khan, and Arpit Jain. (2023). "Agile Methodologies in Procurement Solution Design Best Practices." International Research Journal of Modernization in Engineering, Technology and Science 5(11). doi: https://www.doi.org/10.56726/IRJMETS46859.*

- *Vadlamani, Satish, Jaswanth Alahari, Aravind Ayyagari, Punit Goel, Arpit Jain, and Aman Shrivastav. (2023). "Optimizing Data Integration Across Disparate Systems with Alteryx and Informatica." International Journal of General Engineering and Technology 12(2):1–24.*

- *Vadlamani, Satish, Phanindra Kumar Kankanampati, Punit Goel, Arpit Jain, and Vikhyat Gupta. (2023). "Enhancing Business Intelligence Through Advanced Data Analytics and Real-Time Processing." International Journal of Electronics and Communication Engineering (IJECE) 12(2):1–20.*

- *Gannamneni, Nanda Kishore, Siddhey Mahadik, Shanmukha Eeti, Om Goel, Shalu Jain, and Raghav Agarwal. (2023). "Leveraging SAP GTS for Compliance Management in Global Trade Operations." International Journal of General Engineering and Technology (IJGET) 12(2):1–24.*

- *Vadlamani, Satish, Nishit Agarwal, Venkata Ramanaiah Chintha, Er. Aman Shrivastav, Shalu Jain, and Om Goel. (2023). "Cross Platform Data Migration Strategies for Enterprise Data Warehouses." International Research Journal of Modernization*

in Engineering, Technology and Science 5(11):1-10. https://doi.org/10.56726/IRJMETS46858.

- Gannamneni, Nanda Kishore, Pramod Kumar Voola, Amit Mangal, Punit Goel, and S. P. Singh. 2023. "Implementing SAP S/4 HANA Credit Management: A Roadmap for Financial and Sales Teams." International Research Journal of Modernization in Engineering Technology and Science, 5(11). DOI: https://doi.org/10.56726/IRJMETS46857