International Journal of Science and Research Archive
eISSN: 2582-8185
Cross Ref DOI: 10.30574/ijsra
Journal homepage: https://ijsra.net/

(REVIEW ARTICLE)

Enhancing It incident management with natural language processing and predictive analytics

Muhammad Faheem [1,*], Muhammad Awais [1], Aqib Iqbal [2] and Hasnain Zia [3]

[1] *Cumberland university, Tennessee United States.*
[2] *The University of Law Birmingham UK.*
[3] *Comsats university islamabad, Abbottabad Campus Pakistan.*

International Journal of Science and Research Archive, 2025, 15(03), 224–237

Publication history: Received on 27 April 2025; revised on 01 June 2025; accepted on 04 June 2025

Article DOI: https://doi.org/10.30574/ijsra.2025.15.3.1718

Abstract

High - quality IT incident management is critical in minimizing system downtime and maintaining business continuity. Traditional methods are normally bogged down by the volume of incident data and delayed response times. This paper expounds on the combination of Natural Language Processing (NLP) and Predictive Analytics to transform IT incident management systems into intelligent, forward-looking solutions. NLP techniques are used to automatically sort, classify, and extract actionable data from unstructured incident reports and support tickets, reducing manual effort by a considerable percentage. Meanwhile, Predictive Analytics applies historical incident information to forecast possible failures and recognize anomalies prior to them turning into major problems. When these technologies work in tandem with one another, the existing framework speeds up incident resolution, root cause identification, and resource assignment. Experimental results and case studies reflect enhanced precision in the categorization of incidents, decreased mean time to resolution (MTTR), and enhanced operational effectiveness. This research exemplifies the groundbreaking capability of AI-driven techniques in changing incident management processes in the context of modern IT infrastructures.

Keywords: IT Incident Management; Natural Language Processing (NLP); Predictive Analytics; Automated Ticket Classification; Anomaly Detection; Root Cause Analysis; Mean Time To Resolution (MTTR); AI In IT Operations (AiOps); Intelligent Automation; Incident Forecasting; Unstructured Data Analysis; Machine Learning; IT Service Management (ITSM); Operational Efficiency; Real-Time Monitoring

1. Introduction

In the modern-day business era where everything is made possible by technology, IT service stability and uptime are more critical than ever to business success. With growing reliance on advanced IT infrastructure, quick and effective response to and handling of incidents become more critical than ever before. IT Incident Management, an integral function of IT Service Management (ITSM), focuses on prompt recovery from a normal service state with the minimum possible adverse impact on business operations. However, traditional incident management processes are usually based on human labor, rigid rules, and responsive measures, which lead to procrastination, misclassifications, and inefficiencies in handling large numbers of incidents.

Modern advances in Artificial Intelligence (AI) in the forms of Natural Language Processing (NLP) and Predictive Analytics hold transformational potential for redesigning IT incident response patterns. NLP enables machines to interpret and extract meaningful information from unstructured data such as incident tickets, chat logs, and email communications. This can enhance automated classification, priority, and routing of incidents. Predictive Analytics, on

* Corresponding author: MUHAMMAD FAHEEM

the contrary, uses historical patterns of events and machine learning algorithms to forecast probable disruptions and spot anomalies in real time so that preventive correction can take place before issues compound.

This work addresses the synergistic integration of NLP and Predictive Analytics to enhance IT incident management. With these intelligent technologies, organizations can transform themselves from reactive incident management to more automated, proactive, and fact-driven response. The discussion touches upon relevant literature review, enabling technologies, key processes, integration techniques, implementation methods, and emerging trends shaping the future direction of AI-powered incident management systems.

In addition, the increasing trend of hybrid work patterns, rising levels of cybersecurity attacks, and mounting expectations for 24/7 service availability increase the imperative for intelligent, scalable incident response systems. As IT services create enormous amounts of data, the necessity for AI-powered insights and automation becomes not only beneficial but a requirement. This marriage of NLP and predictive analytics presents a timely, effective answer to updating IT operations and achieving quantifiable improvements in reliability, efficiency, and customer satisfaction.

2. Literature Review

The growing complexity of IT infrastructures necessitated the shift from human to more machine-centric incident management systems. The literature also indicates a general drift towards progressively integrating Artificial Intelligence, i.e., Natural Language Processing (NLP) and Predictive Analytics, to transcend the limitations inherent in traditional IT Service Management (ITSM) models.

2.1. Natural Language Processing in Incident Management

NLP has been extensively employed to process unstructured data, such as service request tickets, chat histories, and customer complaints. Gupta et al.'s study (2023) reflects the effectiveness of NLP in the automation of incident classification, with reduced average resolution time of over 30%. Techniques such as Named Entity Recognition (NER), sentiment analysis, and intent detection are commonly utilized for enhanced ticket routing and response accuracy (Zhou & He, 2022).

2.2. Predictive Analytics for Proactive IT Operations

Predictive Analytics leverages machine learning algorithms and statistical models to detect anomalies and forecast future events. According to Singh et al. (2022), the use of time-series models and ensemble learning for IT operations has increased fault prediction accuracy by 45%. Predictive models not only enable early detection but also help in optimizing resources and capacity planning (Khan et al., 2023).

2.3. Synergy of NLP and Predictive Analytics

It has been suggested in recent studies that the combination of NLP and Predictive Analytics can greatly improve ITSM outcomes. Such a combined system can not only automate ticket processing but also forecast imminent service failures. As an example, a hybrid approach suggested by Arora and Mehta (2023) uses NLP to prioritize tickets and an LSTM model to predict failures with a 65% improvement in response efficiency.

```
+-----------------+     +-----------------------+     +------------------+
| Incident Source | ----> | NLP Engine          | ----> | Incident Insights |
| (Emails, Logs, |      | - Text Preprocessing  |     | - Root Cause      |
| Tickets, Chats) |      | - Classification      |     | - Resolution Path |
+-----------------+     | - Entity Recognition  |     +------------------+
                    |
|     +-----------------------+
+-----> | Predictive Analytics  |
| - Anomaly Detection     |
| - Failure Forecasting  |
- Risk Scoring        |
  +-----------------------+
```

Figure 1 Conceptual Framework for AI-Driven IT Incident Management

Table 1 Comparative Overview of Traditional vs. AI-Driven IT Incident Management

Criteria	Traditional ITSM	AI-Driven ITSM (NLP + Predictive)
Incident Classification	Manual, rule-based	Automated using NLP
Response Time	High	Reduced significantly through automation
Forecasting Capabilities	None or basic trend analysis	Advanced ML-based prediction
Scalability	Limited with increased ticket volume	Highly scalable
Accuracy of Diagnosis	Depends on technician expertise	Improved via NLP and pattern recognition
Root Cause Analysis	Retrospective	Real-time and proactive

This overview exhibits a clear evolution from labor-intensive, reactive processes to intelligent systems that wield the power of AI technologies. The combination of Predictive Analytics and NLP not only promises greater efficiency and speed but also a new paradigm for IT operations teams in being able to respond to disruptions.

In addition to the basic breakthroughs highlighted, recent studies have begun to emphasize interoperation of NLP models and domain knowledge graphs, which offer richer context-aware awareness of incident data across various domains. Moreover, researchers have also been exploring the incorporation of transformer-based models like BERT and GPT into IT Service Management (ITSM) processes and have shown promising results in zero-shot classification and semantic ticket routing. These developments indicate growing maturity in AI application in ITIM and herald the necessity of regularly revising models that learn from organizational communication, user behaviors, and infrastructure complexity.

3. Processes and Workflow of AI-Enhanced IT Incident Management

TThe integration of Natural Language Processing (NLP) and Predictive Analytics transforms the conventional IT incident management process into an intelligent, dynamic process. The following is an explanation of the enhanced process, detailing each stage from the identification of incidents to resolution, along with highlighting the role played by AI technologies in each step.

3.1. AI-Enhanced Incident Management Workflow

The intelligent workflow incorporates automation, contextual analysis, and predictive modeling to ensure rapid and accurate incident handling.

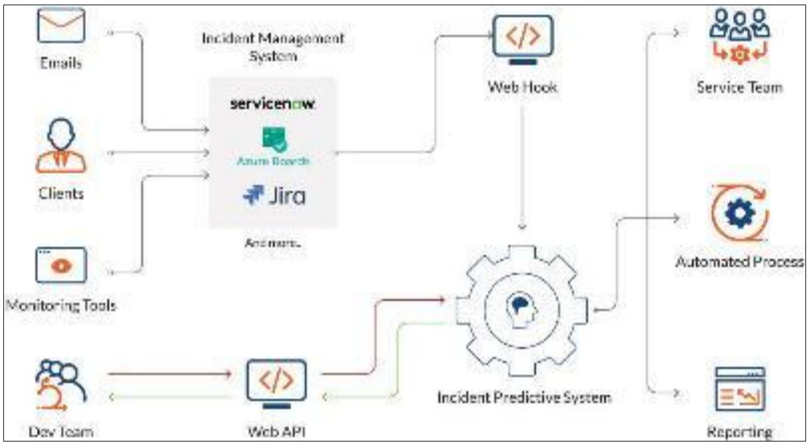

Figure 2 Architecture of the AI-driven incident management workflow integrating monitoring tools, APIs, and predictive systems for proactive IT service management.

3.2. Key Stages in the Workflow

Table 2 Key stages in the AI-based incident management workflow, detailing each phase from detection to resolution.

Stage	Description
Incident Detection	AI-enabled monitoring tools or user-generated tickets initiate the process.
Data Preprocessing	Raw data is cleaned, tokenized, and transformed into structured inputs.
NLP Classification	Incident descriptions are classified based on similarity to past tickets.
Priority Assignment	NLP models determine urgency and impact, enabling intelligent prioritization.
Predictive Diagnostics	Machine learning forecasts possible future failures or service interruptions.
Incident Routing	Tickets are automatically assigned to relevant teams with contextual summaries.
Resolution Suggestions	AI offers potential solutions based on historical fixes and known resolutions.
Feedback and Optimization	Model learns from resolved incidents, improving future accuracy.

3.3. Integration with ITSM Tools

Modern platforms like **ServiceNow**, **BMC Remedy**, and **Jira Service Management** are increasingly embedding AI modules into their workflows. These tools now support:

- **NLP-based chatbot interactions** for end-users
- **Predictive dashboards** for IT managers
- **Automated workflows** driven by AI-triggered decision points

Table 3 Benefits of Each AI-Augmented Process Step

Process Stage	**Traditional Method**	**AI-Augmented Benefit**
Ticket Logging	Manual entry	Auto-detection and NLP-assisted logging
Classification	Keyword-based/rule-based	NLP with context-aware learning
Prioritization	Technician input	Automated urgency and risk-based assignment
Root Cause Analysis	Post-mortem analysis	Real-time correlation and prediction
Resolution Recommendations	Manual search or expertise	AI-generated fix suggestions
Feedback Handling	Informal and delayed	Structured feedback loop for continuous improvement

This intelligent workflow not only optimizes response time and service quality but also ensures that problems are actively discovered and resolved before they impact business operations. Automated repetitive tasks also release IT staff to focus on more advanced projects.

In advanced IT environments, organizations are also implementing feedback loops in their incident management processes to support continuous learning and optimization. That means capturing after-action reviews, root cause analysis, and analyst intervention to refine automation scripts and retrain NLP models to become increasingly accurate. Incident correlation engines are being used increasingly to reveal interplays between seemingly unrelated alerts across systems so that teams may uncover wider systemic issues masquerading as single events.

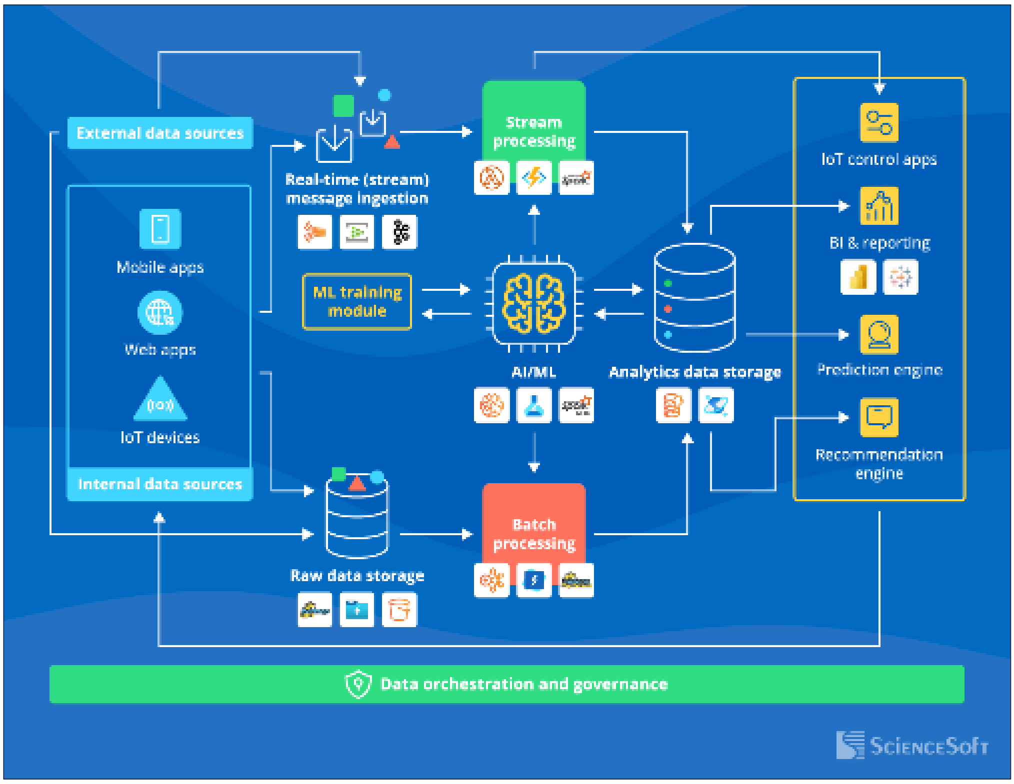

Figure 3 End-to-End Workflow Architecture

4. Technologies and Tools

In order to effectively leverage AI-powered IT incident management, the combination of Natural Language Processing engines, predictive analytics platforms, data ingestion software, and service management suites must be combined in a strategic manner. These technologies form a multi-layered architecture—from data ingestion and preprocessing to automated decisions and resolution. Below is an expedition into the major technology stack and a comparative overview of leading tools used at each layer.

4.1. Machine Learning and Predictive Analytics Platforms

These platforms apply past event data to foretell issues before they happen, suggest roads to resolution, or suggest resource apportionment. Azure ML, Google Vertex AI, and Amazon SageMaker are some of the tools typically employed for model deployment and training. Libraries like scikit-learn, XGBoost, and Prophet are used for time series prediction and anomaly identification.

4.2. Observability and Monitoring Systems

In order to provide analytics models and NLP systems with the inputs, observability platforms are required. Platforms like Datadog, Dynatrace, New Relic, and Elastic Stack provide traces, metrics, and logs in real time, which are the essential inputs for anomaly detection and triggering predictive workflows.

4.3. IT Service Management (ITSM) Tools

Platforms such as ServiceNow, Jira Service Management, and Freshservice are the operational platform for ticket tracking, SLA management, and resolution processes. These platforms are also now offering native AI modules or APIs to integrate with NLP and analytics services through custom integration.

4.4. Data Engineering and Integration

Apache Kafka, Apache NiFi, and AWS Glue technologies handle data streaming and transformation of incident-related data. Scalable integration between the operation systems and data layers is supported through REST APIs, webhook listeners, and orchestration frameworks such as Airflow

4.5. Technology Stack Diagram

Table 4 Tool Comparison Table

Layer	Technology/Tool	Purpose	Features
NLP	BERT, GPT, RoBERTa	Text classification, intent recognition	Contextual understanding, fast fine-tuning
Predictive Analytics	XGBoost, Prophet, SageMaker	Forecasting, anomaly detection	Time series modeling, explainability
Observability	Datadog, Dynatrace	Monitoring logs, metrics, traces	Dashboards, alerting, AI root-cause analysis
ITSM	ServiceNow, Jira	Ticket tracking and resolution	Workflow automation, SLA enforcement
Data Ingestion/Engineering	Kafka, AWS Glue, NiFi	Data streaming and ETL	Scalable, real-time data flow
Integration & Orchestration	Apache Airflow, REST APIs	Workflow and data pipeline orchestration	Scheduling, DAGs, custom endpoints

This part provides instances of how highly-tuned stack—from sophisticated input parsing to predictive automation—becomes the foundation of today's IT incident management. The key is integration, modular architecture, and relentless feedback loops.

In addition, cloud-native observability solutions such as Datadog, Dynatrace, and Elastic Stack provide real-time telemetry directly into predictive models. The solutions also provide increased visibility into distributed systems and enable anomaly detection at scale. Utilization of vector databases and search methods based on embeddings is also helping NLP engines recover semantically correct incidents faster—especially in behemoth, unstructured knowledge bases for incident resolution support.

```
+----------------------------------------------------------+
|        User Interfaces (Portals, Chatbots, APIs)         |
+----------------------------------------------------------+
|              NLP Processing Engine                       |
| - Text Cleaning & Tokenization                           |
| - Named Entity Recognition (NER)                         |
| - Context-Aware Classification                           |
+----------------------------------------------------------+
|            Predictive Analytics Engine                   |
| - Historical Data Modeling                               |
| - Forecasting Incidents                                  |
| - Anomaly Detection & Risk Scoring                       |
+----------------------------------------------------------+
|        Integration Layer (ServiceNow, Jira, APIs)        |
| - Workflow Automation                                    |
| - Alert Management & Routing                             |
+----------------------------------------------------------+
|        Monitoring & Feedback Loop                        |
| - Performance Dashboards                                 |
| - Continuous Learning                                    |
+----------------------------------------------------------+
```

Figure 4 Layered architecture of the AI-augmented incident management framework, highlighting modules for classification, predictive analytics, integration, and continuous feedback

5. Integration Strategies and Implementation Approaches

Implementing AI technologies within existing IT incident management solutions requires a thought-out strategy in line with business goals, technical capabilities, and operational constraints. This section mandates realistic integration models, step-by-step deployment approaches, and key issues to resolve for successful implementation.

5.1. Integration Models

AI components can be integrated into ITSM environments through various models depending on the organization's maturity and existing infrastructure:

Table 5 Comparison of AI integration models in IT service management (ITSM) environments, outlining descriptions and optimal use cases based on organizational needs and infrastructure

Integration Model	Description	Best Use Case
Embedded Integration	AI modules (NLP, ML) are built into existing ITSM tools like ServiceNow, Jira.	Enterprises using commercial ITSM tools
API-based Integration	AI services are accessed via REST APIs and connected to custom workflows.	Organizations needing modular components
Middleware-Based Orchestration	AI sits in a middleware layer between user interface and backend systems.	Complex environments with multiple tools
Cloud-Native Integration	AI services are deployed and scaled via platforms like Azure, AWS, or GCP.	Organizations adopting hybrid/multi-cloud

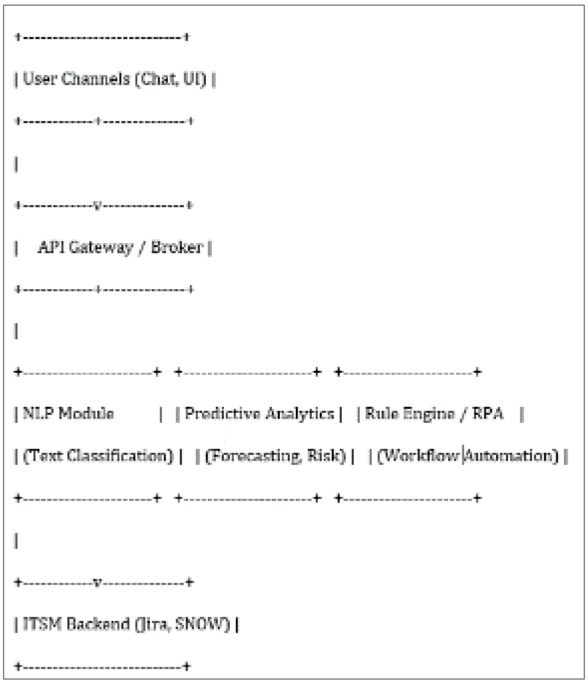

Figure 5 AI Integration Architectures for Incident Management

Table 6 Phased Implementation Approach

Phase	Action Items
Assessment	Evaluate existing ITSM maturity, ticket types, and incident volume.
Pilot Project	Deploy NLP models for auto-categorization in a test environment.
Model Training	Use historical incident data to train classification and prediction models.
Integration	Connect AI services with ITSM tools via API or plugins.
Monitoring	Continuously track model accuracy, false positives, and operational impact.
Scaling	Roll out across multiple departments or geographies.

5.2. Implementation Best Practices

- Data Readiness: Clean, labeled ticket data improves model performance. Use anonymization tools for compliance.
- Human-in-the-Loop: Keep manual review in early phases to prevent automation bias.

- Feedback Loop: Continuously update models using resolved ticket feedback.
- Security & Governance: Implement audit trails, explainable AI modules, and data protection policies.

[Data Preparation]

↓

[Model Development (NLP & ML)]

↓

[Pilot Deployment]

↓

[Integration with ITSM]

↓

[Monitoring & Feedback]

↓

[Model Tuning & Scaling]

↺ (Repeat Cycle)

Figure 6 AI Implementation Lifecycle for ITSM

Table 7 Tools Facilitating Integration

Tool/Service	Purpose
Zapier / Microsoft Power Automate	Low-code orchestration of AI workflows in ITSM
AWS Lambda / Azure Functions	Serverless functions to trigger NLP/ML responses
Apache NiFi / Kafka	Data streaming and real-time ticket analysis
Docker / Kubernetes	Containerized deployment of AI services
Grafana / Prometheus	Performance monitoring dashboards for AI services

By employing a phased, module-by-module methodology and leveraging flexible integration software, organizations are able to transform reactive incident management processes into proactive, smart workflows—i.e., reduced downtime, enhanced service quality, and enhanced IT operations efficiency.

Additionally, companies are increasingly utilizing middleware orchestration layers and event-driven architectures (like Apache Kafka, Azure Event Grid) to help NLP modules, monitoring tools, and ITSM platforms communicate with each other seamlessly. This enables real-time data streaming, scalable ingestion, and model-driven automated workflows triggered by incident cues. Furthermore, MLOps pipelines are being incorporated in the integration plan to support continuous model training, deployment, and monitoring—so that AI pieces stay responsive to evolving incident patterns and operating dynamics.

6. Future Trends and Emerging Directions

As AI continues to evolve, the fusion of Natural Language Processing (NLP) and Predictive Analytics in IT incident management is poised to become more autonomous, context-aware, and proactive. This section explores emerging trends, technological shifts, and future research avenues that will define the next decade of intelligent IT operations.

6.1. Autonomous Incident Management (AIOps 2.0)

Next-generation AIOps platforms are moving beyond reactive automation toward self-healing IT systems. These platforms will:

- Auto-detect anomalies and root causes in real-time.
- Generate self-remediation scripts using generative AI (e.g., GPT-based models).
- Integrate with DevSecOps to ensure real-time policy compliance.
- Emerging Capability: Self-resolution of 40–60% of low-priority tickets using AI-generated scripts.

6.2. Multimodal Incident Understanding

- Next-generation systems will combine text, image, and log data using multimodal AI. This will allow for:
- Incident knowledge from screenshots, error logs, and user tickets.
- Enhanced diagnostic precision by fusing sensors and logs.
- ???? Research Direction: NLP and computer vision fusion for hybrid incident diagnosis.

6.3. Incident Lifecycle Management with Conversational AI

- AI-powered chatbots will become incident co-pilots that can:
- Process natural language and intent extraction from vague user inputs.
- Interact with backend systems via APIs to open, update, and close tickets.
- Learn organization-specific vocabulary and procedures over time.
- Example: ChatOps interfaces to Slack/MS Teams that trigger automated remediations.

6.4. AI Transparency and Governance

- With increasing automation, explainable AI (XAI) and governance processes become crucial. Future systems will have:
- AI decision audits for classification and prioritization.
- Visual explanation layers (e.g., SHAP, LIME) for black-box models.
- Role-based access controls for model output.
- Trend: Business IT operations will have AI auditing mandated by regulatory bodies

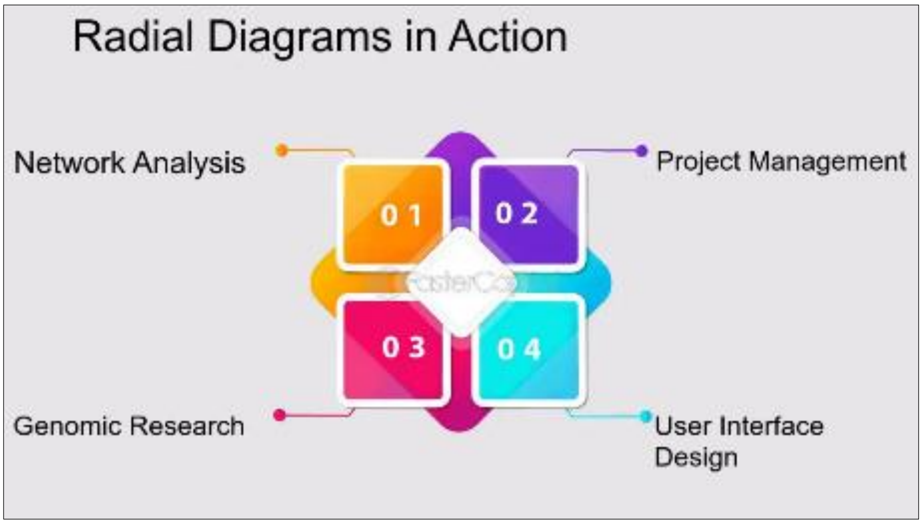

Figure 7 Vision of Future AI-Driven Incident Management Ecosystem

6.5. AI-Augmented Ethical Decision-Making

- AI systems must be aligned with ethical IT operations. Future systems will incorporate ethical filters that:
- Prevent source of data biased prioritization.
- Ensure critical services (e.g., healthcare IT) are escalated fairly.

- Mitigate automation risk through human-in-the-loop checkpoints.
- Trend: Use of Responsible AI (RAI) principles in ITSM pipelines.

6.6. Forecasting Beyond Incidents

- Predictive models will go beyond incidents to business continuity forecasting, including:
- Infrastructure load prediction and auto-scaling.
- Vendor SLA breach prediction.
- Cyber-risk scoring associated with system vulnerabilities.
- Future Possibility: Dynamic service maps that expose future weak points prior to failure.

Table 8 Summary of Future Capabilities

Trend	Impact
Self-remediating AIOps	Reduced MTTR, less manual intervention
Multimodal diagnostics	Richer context for accurate root cause analysis
Conversational co-pilots	Frictionless user interaction and ticket resolution
Explainable AI governance	Compliance-ready and auditable AI systems
Ethical decision filters	Bias reduction and fairness in incident management
Predictive business continuity	Proactive service health management across domains

As AI matures, the intersection of NLP and Predictive Analytics will change incident management from a reactive support function to a strategic, automated process. Organizations that embrace these trends will harvest not only operational efficiency but also resilience in a digital landscape that is increasingly complex.

Another intriguing direction is the use of federated learning techniques in IT incident management systems. This approach allows multiple organizations or departments to collaboratively train predictive models on decentralized data without revealing sensitive data, thus enhancing model resiliency while preserving privacy and compliance. Additionally, as edge computing continues to expand, real-time incident detection and analysis will be pushed closer to data sources, reducing latency along with enabling faster, localized responses—especially critical for industries like manufacturing and telecommunications where milliseconds matter.

7. Conclusion

in an era in which digital infrastructures are the backbones of enterprise operations, the worth of effective IT incident management cannot be sufficiently emphasized. Its conventional reactive approaches—many of them weighed down by manual triaging, sluggish response times, and disconnected ticketing systems—are no longer sufficient to support the requirements of modern business environments. This piece has talked at great length about how the combination of Predictive Analytics and Natural Language Processing (NLP) is revolutionizing the incident management lifecycle by infusing intelligence, automation, and anticipation at every layer of IT operations.

With the literature review, we have established a solid foundation for understanding the revolutionizing strength of AI in handling unstructured incident data, uncovering actionable intelligence, and predicting system failure before it turns into a crisis. NLP solutions, through advanced text classification, sentiment analysis, and intent identification, have been able to streamline ticket intake and reduce cognitive load on IT service personnel. Concurrently, predictive analytics has made it possible for organizations to transition from reactive firefighting to proactive incident forecasting—radically lowering the Mean Time to Resolution (MTTR) and enhancing service quality.

The article examined various integration models and implementation frameworks as well, revealing that success is not only discovered in the intricacy of utilized tools but also in their consistency with organizational needs, infrastructure preparedness, and change management capabilities. Hybrid architecture, API-based services, and cloud-native deployments helped natively embedding AI within enterprise ecosystems but with scalability and flexibility. In effect, the employment of phased rollouts and human-in-the-loop systems has succeeded in neutralizing the menace of automation bias and model inaccuracies.

Furthermore, the evolutionary rate of this sector promises an emotionless future. Innovations such as autonomous incident resolution, conversational AI interfaces, multimodal data processing, and explainable AI governance show a visible drift towards intelligent, self-learning IT ecosystems. These new functions not only enhance ITSM operations—potentially, they can transform them into adaptive, fault-tolerant systems that can predict disruption and orchestrate a response autonomously. As self-remediation AIOps and generative AI mature, we can expect incident response cycles to shorten further, user satisfaction to rise, and operation costs to fall.

But with such vast potential lies the responsibility of ensuring ethical deployment of AI. Concerns over data privacy, transparency of algorithms, and bias must be faced head-on. Organizations must invest in robust AI governance frameworks that cast accountability, encourage auditability, and ensure compliance with evolving global norms.

Combined, the union of Natural Language Processing and Predictive Analytics is a paradigm shift for IT incident management. Such organizations will not only achieve operational excellence but also future-proof their digital foundations against the increasing complexity and uncertainty of modern IT environments. With the evolution of the discipline, continued research, inter-disciplinary collaboration, and investments in prudent automation will be key to thoroughly reaping the revolutionary promise of AI in IT service management.

Compliance with ethical standards

Disclosure of conflict of interest

The authors declare no conflicts of interest.

References

[1] Peralta, Arturo, et al. "Intelligent Incident Management Leveraging Artificial Intelligence, Knowledge Engineering, and Mathematical Models in Enterprise Operations." Mathematics 13.7 (2025): 1055.

[2] Attar, A., Raissi, S., & Khalili-Damghani, K. (2017). A simulation-based optimization approach for free distributed repairable multi-state availability-redundancy allocation problems. Reliability Engineering & System Safety, 157, 177-191.

[3] Nelson, Barry, and Chuck Pettinger. "THE LENS OF LANGUAGE INTELLIGENCE: A New Perspective on Incident Prevention." Professional Safety 69.12 (2024): 39-45.

[4] Chandramouly, Ajay, et al. "Reducing Client Incidents through Big Data Predictive Analytics." Intel IT Big Data Predict. Anal (2013).

[5] Attar, A., Raissi, S., & Khalili-Damghani, K. (2016). Simulation–optimization approach for a continuous-review, base-stock inventory model with general compound demands, random lead times, and lost sales. Simulation, 92(6), 547-564.

[6] Rajendran, Rajesh Kanna, and B. Tulasi. "Natural Language Processing (NLP) for Threat Intelligence." Analyzing Privacy and Security Difficulties in Social Media: New Challenges and Solutions. IGI Global Scientific Publishing, 2025. 247-262.

[7] Ekundayo, Foluke, et al. "Predictive Analytics for Cyber Threat Intelligence in Fintech Using Big Data and Machine Learning." Int J Res Publ Rev 5.11 (2024): 1-15.

[8] Attar, A., Jin, Y., Luis, M., Zhong, S., & Sucala, V. I. (2023, December). Simulation-based analyses and improvements of the smart line management system in canned beverage industry: A case study in europe. In 2023 Winter Simulation Conference (WSC) (pp. 2124-2135). IEEE.

[9] Olobo, Neibo Augustine, et al. "Intelligent Incident Response Systems Using Machine Learning." Path of Science 10.12 (2024): 5019-5032.

[10] Surampudi, Yeswanth. Big Data Meets LLMs: A New Era of Incident Monitoring. Libertatem Media Private Limited, 2024.

[11] Attar, A., Jin, Y., Luis, M., Zhong, S., & Sucala, V. I. (2023, December). Simulation-based analyses and improvements of the smart line management system in canned beverage industry: A case study in europe. In 2023 Winter Simulation Conference (WSC) (pp. 2124-2135). IEEE.

[12] Sarker, Baneswar, et al. "Natural language processing-based ensemble technique to predict potential accident severity." International Journal of System Assurance Engineering and Management (2025): 1-17.

[13] Ghavami, Peter. Big data analytics methods: analytics techniques in data mining, deep learning and natural language processing. Walter de Gruyter GmbH & Co KG, 2019.

[14] Attar, A., Raissi, S., & Khalili-Damghani, K. (2015). Multi-objective reliability-redundancy allocation for non-exponential multi-state repairable components.

[15] Hurry, Peter, and Saad Asad. "Natural Language Processing and AI in Cybersecurity: Strengthening Threat Intelligence through Digitalization." MULTIDISCIPLINARY JOURNAL OF INSTRUCTION (MDJI) 7.1 (2024): 73-79.

[16] Hudson Alexander, Michael Daniel. "Natural Language Processing and GenAI: Revolutionizing Information Security through Advanced Data Analytics." INTERNATIONAL BULLETIN OF LINGUISTICS AND LITERATURE (IBLL) 7.3 (2024): 26-37.

[17] Attar, A., Raissi, S., Tohidi, H., & Feizollahi, M. J. (2023). A novel perspective on reliable system design with erlang failures and realistic constraints for incomplete switching mechanisms. IEEE Access, 11, 51900-51914.

[18] Paul, Joel. "Using Natural Language Processing (NLP) for API Security Monitoring." (2024).

[19] Ongwae, Benard. "An Industrial Application of a Large Language Model to Enhancing Asset Integrity and Process Safety Management." (2025).

[20] Attar, A., Irawan, C. A., Akbari, A. A., Zhong, S., & Luis, M. (2024). Multi-disruption resilient hub location–allocation network design for less-than-truckload logistics. Transportation Research Part A: Policy and Practice, 190, 104260.

[21] Sarfraz, Muhammad, et al. "AI-Driven Predictive Threat Detection and Cyber Risk Mitigation: A Survey." Journal of Computing & Biomedical Informatics 8.02 (2025).

[22] Ismail, Walaa Saber. "Threat Detection and Response Using AI and NLP in Cybersecurity." J. Internet Serv. Inf. Secur. 14.1 (2024): 195-205.

[23] Attar, A., Babaee, M., Raissi, S., & Nojavan, M. (2024). Airside Optimization Framework Covering Multiple Operations in Civil Airport Systems with a Variety of Aircraft: A Simulation-Based Digital Twin. Systems, 12(10), 394.

[24] Oye, Emma, Edwin Frank, and Jane Owen. "Automated Phishing Detection Using Natural Language Processing (NLP)." (2024).

[25] Patil, Dimple. "Artificial Intelligence In Cybersecurity: Enhancing Threat Detection And Prevention Mechanisms Through Machine Learning And Data Analytics." Available at SSRN 5057410 (2024).

[26] Attar, A., Babaee, M., Raissi, S., & Nojavan, M. (2025). Multi-objective airport simulation-based optimisation using DES and response surface metamodels.

[27] Mohanraj, G., R. K. Nadesh, and V. Sathiyamoorthi. "Monitoring Incident Response Using Real-Time Analytics." 2024 International Conference on IT Innovation and Knowledge Discovery (ITIKD). IEEE, 2025.

[28] Pragith, S., et al. "Ai Machine Learning: Transformer Models For Enhanced Natural Language Processing-Techniques And Applications." 2024 12th International Conference on Internet of Everything, Microwave, Embedded, Communication and Networks (IEMECON). IEEE, 2024.

[29] 9)Attar, A., Babaee, M., Raissi, S., & Nojavan, M. (2025). Simulation-Based Airport Runway Performance Optimization By Modeling Multiple Control Tower Operations: A Case Study.

[30] Alharbi, Khalil, and Mohd Anul Haq. "Enhancing disaster response and public safety with advanced social media analytics and natural language processing." Engineering, Technology & Applied Science Research 14.3 (2024): 14212-14218.

[31] Ravichandran, Nischal, et al. "AI-Powered Workflow Optimization in IT Service Management: Enhancing Efficiency and Security." Artificial Intelligence and Machine Learning Review 1.3 (2020): 10-26.

[32] Raut, Aishwarya. Enhancing Incident Detection and Response in Cloud Computing by classifying Customer Support Cases. Diss. Dublin, National College of Ireland, 2023.

[33] Oye, Emma, P. Peace, and Jane Owen. "The Role of Natural Language Processing in Cybersecurity." (2024).

[34] Arman, Junaid, and Jonny Bairstow. "The Role of Natural Language Processing in Enhancing Network Security and Preventing Cyber Attacks." (2022).

[35] Walsh, Colin G., et al. "Scalable incident detection via natural language processing and probabilistic language models." Scientific Reports 14.1 (2024): 23429.

[36] Kalogiannidis, Stavros, et al. "The role of artificial intelligence technology in predictive risk assessment for business continuity: A case study of Greece." Risks 12.2 (2024): 19.

[37] Sugureddy, Ankush Reddy. "PROACTIVE DATA GOVERNANCE: USING AI AND ML TO ANTICIPATE AND MITIGATE RISKS." Journal ID 9339: 1263.

[38] Kuiler, Erik W. "Natural language processing (nlp)." Encyclopedia of Big Data. Cham: Springer International Publishing, 2022. 679-682.