

AGENTIC AI-BASED ANOMALY DETECTION AND DECISION SYSTEM

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Abstract - In today's data-driven world, the need for intelligent systems capable of automatically detecting anomalies and making decisions has become increasingly important. This project presents an Agentic AI-Based Anomaly Detection and Intelligent Decision System designed to monitor data, identify abnormal patterns, and provide real-time decision support. The system integrates machine learning and deep learning techniques, particularly LSTM, to analyze sequential data and detect anomalies efficiently.

An agent-based architecture is implemented where multiple agents collaborate to evaluate system states and take appropriate actions. Additionally, a language-based component is incorporated to generate human-readable explanations, improving system interpretability. The proposed system is visualized through an interactive dashboard that displays metrics, alerts, and decisions in real time. The system provides a scalable and efficient solution for intelligent monitoring and automated decision-making.

Key Words: Agentic AI, Anomaly Detection, LSTM, Machine Learning, Deep Learning, Intelligent Systems, Dashboard, LLM

1. INTRODUCTION

With the rapid growth of data in modern applications, monitoring and analyzing large datasets manually has become increasingly difficult. Traditional systems rely on static rules or human intervention, which are often inefficient and unable to adapt to dynamic environments. As a result, critical anomalies may go undetected or delayed, leading to reduced system performance.

To address these challenges, intelligent systems based on machine learning and deep learning have been introduced. However, most existing solutions focus only on detection and lack decision-making and explainability. This project proposes an integrated Agentic AI system that combines anomaly detection, decision-making, and explanation into a unified framework, enabling real-time intelligent analysis.

2. Body of Paper

A. Overview of the System

The proposed system continuously monitors input data and processes it through multiple stages, including preprocessing, anomaly detection, agent-based decision-making, and visualization. The system is designed to operate in real time and adapt to changing data patterns.

Data Input and Collection

The system begins by collecting structured data from sources such as CSV files or logs. This data represents system activities that need to be monitored. It acts as the foundation for further processing and analysis.

Anomaly Detection Using LSTM

The processed data is then checked using a deep learning model, specifically LSTM (Long Short-Term Memory). This model is capable of understanding sequential patterns and detecting deviations from normal behaviour. It classifies the input as either normal or anomalous..

Agent-Based Decision System

After detecting anomalies, the system uses an agentic AI framework where multiple agents collaborate to make decisions. The Detection Agent evaluates the system state, the Response Agent determines the necessary action, and the Supervisor Agent manages escalation or final decisions. This enables automated and intelligent decision-making.

Explanation Generation

To improve interpretability, the system generates human-readable explanations using a language-based component. This helps users understand why a particular decision was made and increases trust in the system.

Dashboard Visualization

Finally, the system displays results through an interactive dashboard. It presents alerts, anomaly trends, and system metrics in real time, allowing users to monitor and understand system behavior effectively

B. Existing System

Most existing anomaly detection systems rely on traditional machine learning or rule-based approaches. These systems are limited in handling complex data and often require manual intervention. Deep learning models improve accuracy but lack interpretability and decision-making capabilities. Additionally, existing systems do not provide integrated solutions combining detection, action, and explanation.

Deep Learning Approaches

Deep learning models such as CNNs and LSTM are used to improve detection accuracy by capturing complex patterns. However, they require large datasets, high computational resources, and longer training time, making them difficult to implement efficiently.

Limitations of Existing Systems

Existing systems lack integration, interpretability, and automated decision-making. They mainly focus on detection and require human intervention for analysis and action, which increases response time and reduces overall system efficiency.

C. Methodology

The proposed Agentic AI-Based Anomaly Detection and Intelligent Decision System follows a structured approach to process data, detect anomalies, and generate intelligent outputs. The methodology is designed to ensure efficient data handling, accurate prediction, and automated decision-making.

Data Collection and Preprocessing

The system begins by collecting structured data from sources such as CSV files or logs. This data is then preprocessed to remove noise, handle missing values, and convert it into a suitable format. Feature extraction is performed to prepare the data for model input, ensuring better accuracy in analysis.

Anomaly Detection Using LSTM

The processed data is analyzed using a deep learning model, specifically LSTM (Long Short-Term Memory). This model is capable of capturing sequential patterns and identifying deviations from normal behavior. Based on the analysis, the model classifies the data as normal or anomalous.

Agent-Based Decision and Output Generation

After anomaly detection, the system uses an agentic AI framework where multiple agents collaborate to make decisions. The detection agent evaluates the system state, the response agent determines appropriate actions,

and the supervisor agent manages final decisions. A language-based component then generates human-readable explanations, and the results are displayed through an interactive dashboard for monitoring and analysis.

Table -1: Sample Table format=

Evaluation Parameter	Existing System	Proposed System
Anomaly Detection Accuracy	Moderate ($\approx 65-70\%$)	High ($\approx 90-95\%$)
Data Handling	Static / Rule-Based	Dynamic & Adaptive (ML + DL)
Decision Making	Manual	Automated (Agentic AI)
Response Time	Slow	Fast (Real-Time Processing)
Interpretability	Low	High (LLM-based Explanation)

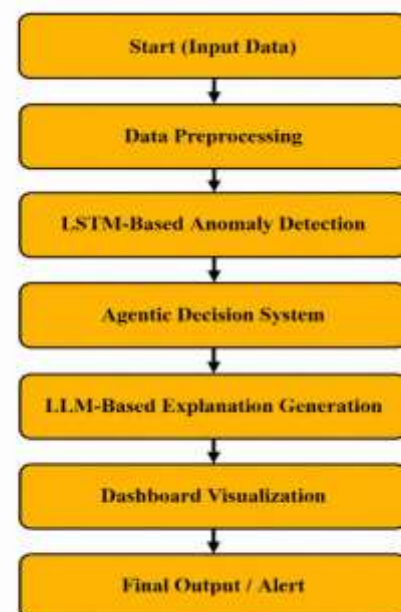
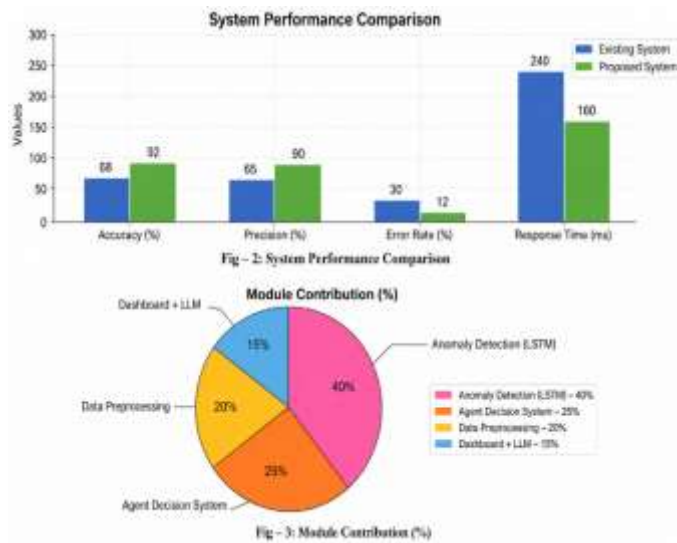


Fig - 1: System Architecture Diagram

Fig -1: Figure

Charts



3. CONCLUSIONS

The proposed Agentic AI-Based Anomaly Detection System provides an effective solution for intelligent data monitoring and decision-making. By integrating machine learning, deep learning, agent systems, and language models, the system achieves accurate anomaly detection and automated response generation.

The system is scalable, adaptable, and suitable for real-time applications. Future improvements may include real-time data integration, advanced models, and enhanced agent collaboration.

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