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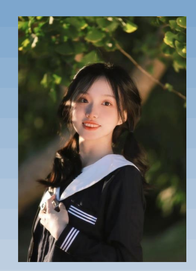
Artificial Intelligence Applied Researches on Online Monitoring

Shuihan Zhang[1,2], Xiaolu Ji[1], Wenxi Pei [1,2], Huangteng Hu [1,2], Fei Li[1] , Kejun Zhu [1,2]

(1) State Key Laboratory of Particle Detection and Electronics, Institute of High Energy Physics, CAS, Beijing 100049, China
(2) University of Chinese Academy of Sciences, Beijing 100049, China



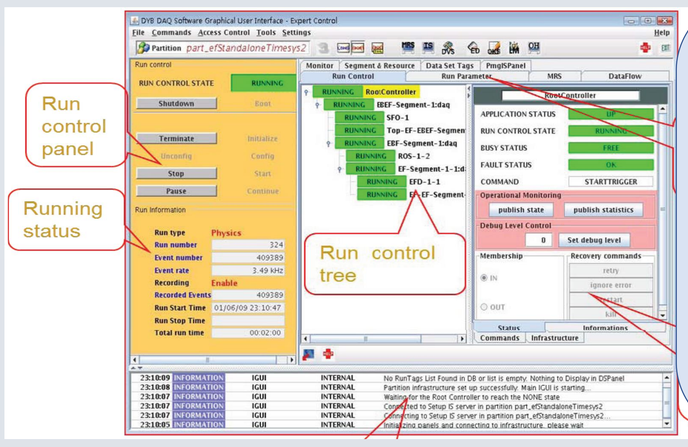
Introduction

The online monitoring system is an essential component of the data acquisition system, delivering swift, efficient, and comprehensive real-time monitoring for the readout chain. However, traditional online monitoring systems primarily rely on preset rules for data selection and inspection, which are unable to cope with complex operating conditions and large data volumes in real time. There are also problems that rely on manual monitoring and inspection, which is prone to omissions and inefficiency. This limitation makes it difficult for monitoring systems to accurately predict abnormal situations, severely impacting production efficiency and equipment safety. To address these challenges, the application of artificial intelligence technology has become a choice. A solution that **combines machine learning and large language model technology** for application on online monitoring systems has been designed to enhance the accuracy and efficiency of data inspection.

Requirements

Real-time, accurate, and comprehensive dynamic data quality monitoring

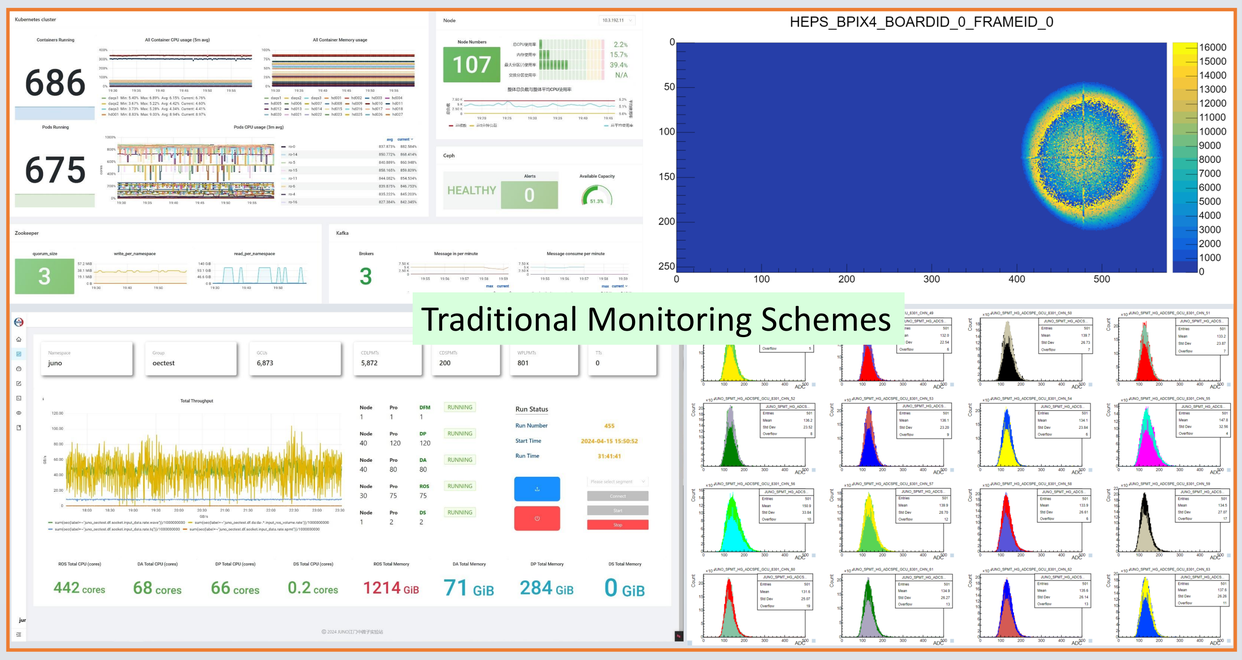
- Real-time feedback
- Promptly detect anomalies
- Improve data taking efficiency



▶ **Monitoring Parameters**

- Real-time data quality monitoring
- Throughput & Rate
- System running status
- System resource utilization

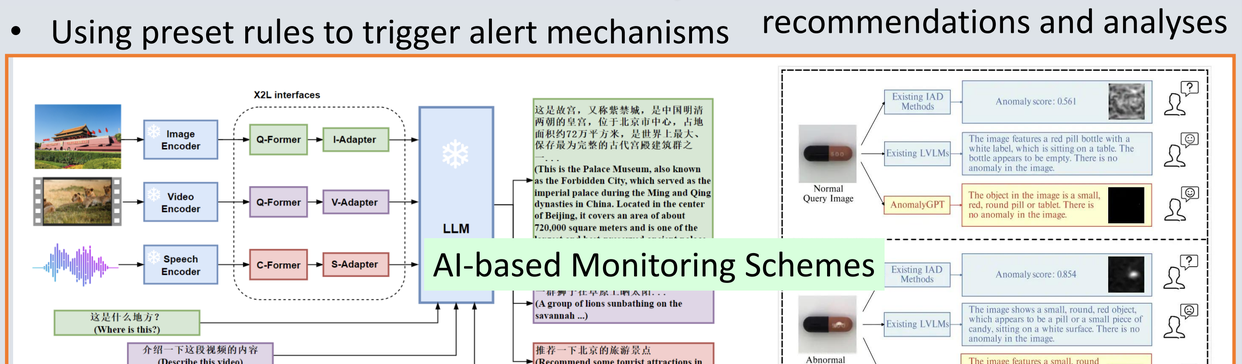
Method Research



Traditional monitoring method:

- Calculate various physical parameters
- Compare with reference values
- Using preset rules to trigger alert mechanisms

AI-based monitoring method: Deploy different deep Learning models to automatically provide real-time intelligent recommendations and analyses

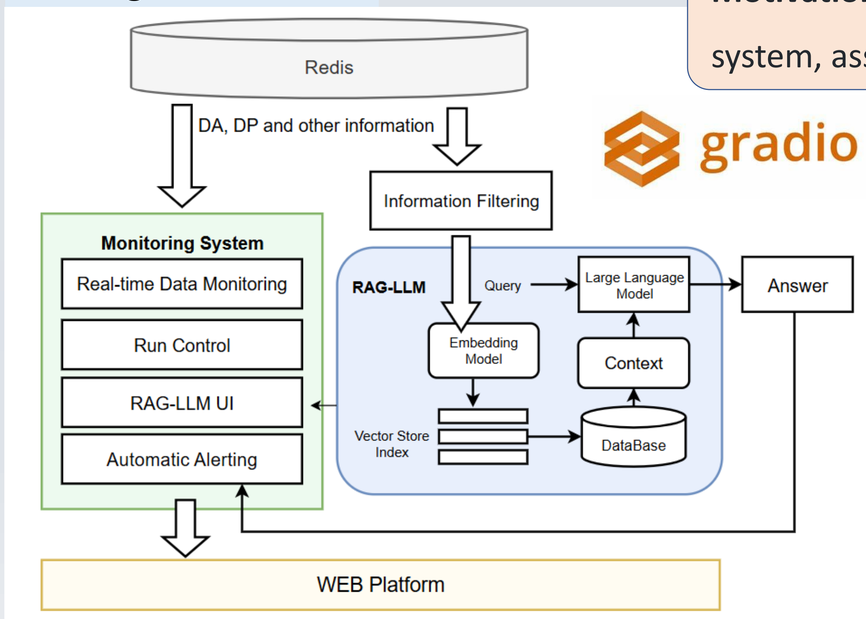


Aspect	Traditional Methods	AI-Based Methods
Data Analysis	Basic statistical methods	Machine learning for complex patterns
Response Mechanism	Human intervention required	Automated and faster responses

Current Research Progress

▸ **Intelligent interaction**

Motivation: Intelligent Q&A system, assisting with shifts



Establishing a local knowledge base → Expanding proprietary domain knowledge → Deploying local models → Prompt

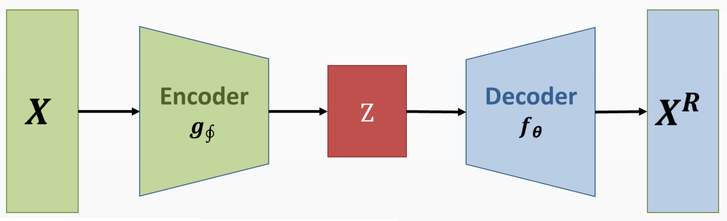
RAG: Document precise retrieval, reduce illusion answers

LLM: Question and Answer

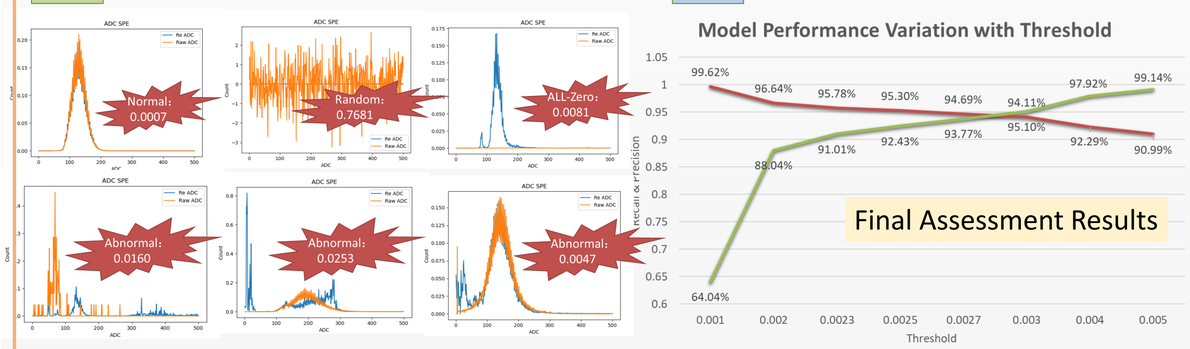
▸ **Automated anomaly detection**

Model Training: nearly 200,000 samples

Model Optimization: parameter evaluation & structural optimization



Motivation: Real-time detect anomaly, reduce manual workload

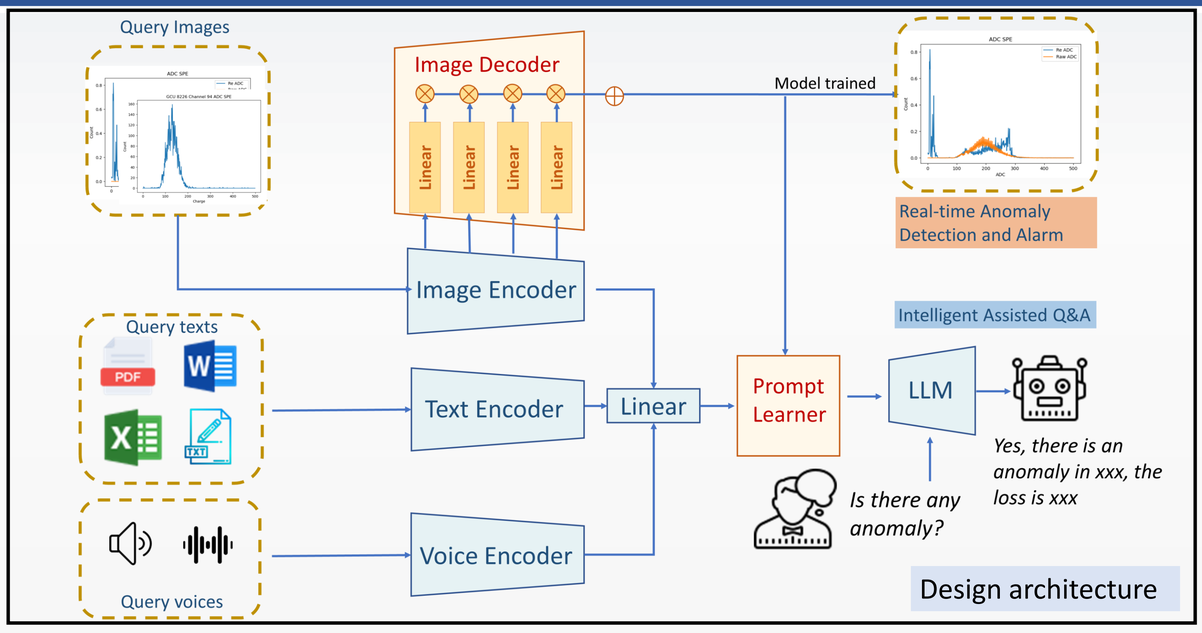


CPU	Number of images	Detection time	Precision
AE model	2560	0.2324s	0.64
statistical methods	2560	2.3433s	0.33

▶ **Current results**

- Reduced manual workload by 60%
- Predicted 99% of the anomaly data

Future Work



▸ **Enhanced Natural Language Processing Capabilities**: Multilingual support & Contextual understanding & Automated report generation

▸ **Intelligent Anomaly Detection and Prediction**: Multisource data fusion

▸ **Human-Machine Collaboration and Interaction:** Interactive interfaces and assistants & Feedback loop

▸ **In the future, AI technology will provide more options for efficient design solutions**