# Project Report

# EQUITY INSIGHT TRENDS EXPLORER

**CIS:602 BIG DATA ANALAYTICS**

**Submitted By**

*Shubham Singh (53)*

**Special Thanks To**

***Dr. Ashokkumar Patel***

**Department of Data Science**

**Department of Computer & Information Science**

August 14, 2024

# DESCRIPTION

This project, titled "Equity Insight Trends Explorer," aims to analyze the performance trends and correlations of various global stock exchanges using a real-time equity dataset. By examining diverse stock exchanges from different geographical regions and market sectors, the project provides a comprehensive view of international financial markets. The analysis is supported by a robust data pipeline built on AWS infrastructure, which ensures efficient data storage, processing, and continuous integration for handling large datasets. The primary goal is to gain insights into market trends over time, leveraging advanced AWS services like S3, Glue, CloudWatch, Lambda, Athena, and Sage Maker to deliver accurate and timely analytics.

# DATASET DESCRIPTION:

The dataset utilized in this project consists of real-time equity data from a diverse range of global stock exchanges, representing various geographical regions and market sectors. The stock exchanges included are HSI (Hang Seng Index), NYA (NYSE Composite Index), IXIC (NASDAQ Composite Index), 000001.SS (Shanghai Composite Index), N225 (Nikkei 225), N100 (Euronext 100 Index), 399001.SZ (Shenzhen Component Index), GSPTSE (S&P/TSX Composite Index), NSEI (Nifty 50), GDAXI (DAX Index), SSMI (Swiss Market Index), TWII (Taiwan Weighted Index), and J203.JO (Johannesburg Stock Exchange Top 40 Index). The dataset captures key financial metrics, trading volumes, and index values over time, providing a rich source of information for trend analysis and correlation studies across different markets.

# TECHNOLOGIES:

The project leverages a suite of AWS cloud services to build and manage the data pipeline and perform analytics on the real-time equity dataset. Key technologies include:

- **AWS S3**: Used for scalable storage of large equity datasets, ensuring secure and durable data storage.
- **AWS Glue**: Employed for data extraction, transformation, and loading (ETL), enabling seamless integration and preparation of data for analysis.
- **AWS CloudWatch**: Utilized for monitoring the performance and operational health of the data pipeline, ensuring real-time visibility into system operations.
- **AWS Lambda**: Provides serverless computing capabilities, triggering automated processes for data processing and analysis without the need for managing servers.
- **AWS Athena**: Allows for interactive query analysis directly on the stored datasets, facilitating quick insights through SQL queries on S3 data.
- **AWS Sage Maker**: Deployed for building, training, and deploying machine learning models to predict and analyze stock market trends based on the processed data.

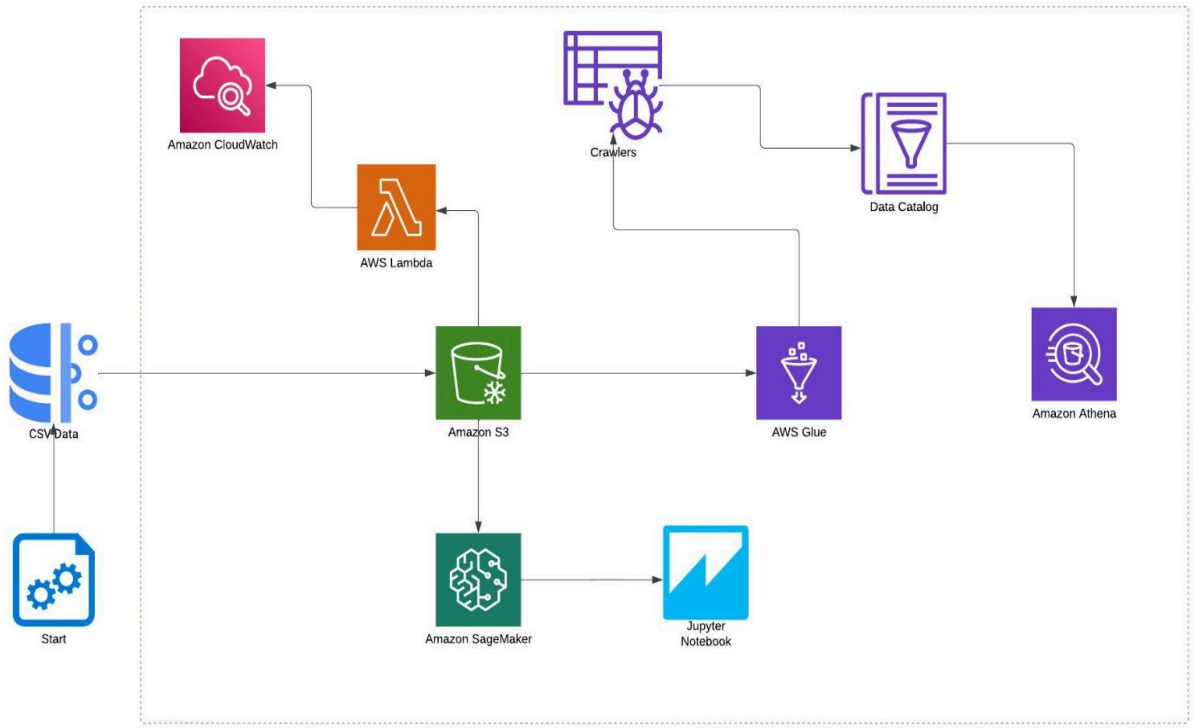
These technologies work together to create a powerful, efficient, and scalable infrastructure capable of handling complex data analytics tasks in the cloud.

# IMPLEMENTATIONS:

The project involves the implementation of a robust and scalable data pipeline designed to analyze real-time equity data from global stock exchanges. The key implementations include:

1. **Data Ingestion**: Real-time equity data from various stock exchanges is ingested into AWS S3, where it is securely stored in a structured format, ready for processing.
2. **ETL Processes**: AWS Glue is employed to extract, transform, and load (ETL) the ingested data, ensuring it is clean, consistent, and optimized for further analysis. This includes handling missing data, standardizing formats, and aggregating metrics.
3. **Serverless Data Processing**: AWS Lambda functions are used to automate data processing tasks, such as triggering ETL jobs, running periodic analyses, and responding to specific data events, enabling real-time analytics without the need for dedicated servers.
4. **Interactive Querying**: AWS Athena is utilized to perform interactive SQL queries on the processed data directly in S3. This allows for quick and flexible exploration of the dataset to uncover trends and insights.
5. **Machine Learning Integration**: AWS SageMaker is used to build and deploy machine learning models that analyze the processed data to predict market trends and identify significant correlations across different stock exchanges.
6. **Monitoring and Logging**: AWS CloudWatch monitors the entire pipeline, providing real-time logs and performance metrics. This ensures the reliability and efficiency of the system, with alerts set up for any anomalies or failures in the pipeline.

# ARCHITECTURE



• **Amazon S3**: Stores raw and processed data. Acts as the central data lake for your data pipeline, where all data is ingested and persisted before further processing.

• **AWS Glue**: Performs ETL (Extract, Transform, Load) operations. It extracts data from S3, transforms it based on business rules, and loads the processed data back into S3 or directly into a data warehouse.

• **AWS Glue Crawler**: Automatically discovers and catalogs metadata from data stored in S3. It updates the AWS Glue Data Catalog with the schema and structure of the data.

• **AWS Glue Data Catalog**: Serves as a centralized metadata repository that stores and manages schema information for your datasets. It enables efficient querying and analysis by keeping track of data structure and location.

• **Amazon Athena**: Allows you to query data directly from S3 using standard SQL queries. It leverages the metadata from the AWS Glue Data Catalog to perform ad-hoc queries and analysis.

• **Amazon SageMaker**: Provides machine learning capabilities. It uses the processed data to build, train, and deploy machine learning models for predictive analytics and insights.

• **Jupyter Notebook**: Used within SageMaker for interactive data analysis and model development. It provides a user-friendly interface for running Python code, visualizing data, and experimenting with machine learning models.

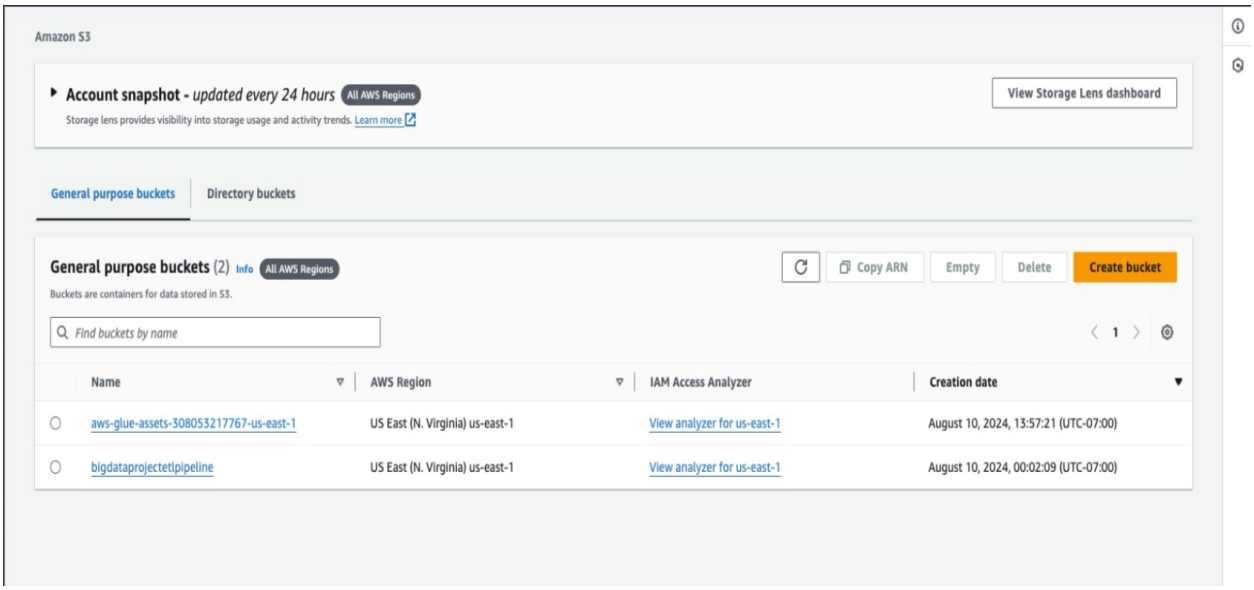
• **AWS Lambda**: Triggers automatic actions based on events. For instance, it can be configured to invoke an ETL job or a data processing workflow whenever new data is uploaded to the S3 bucket.

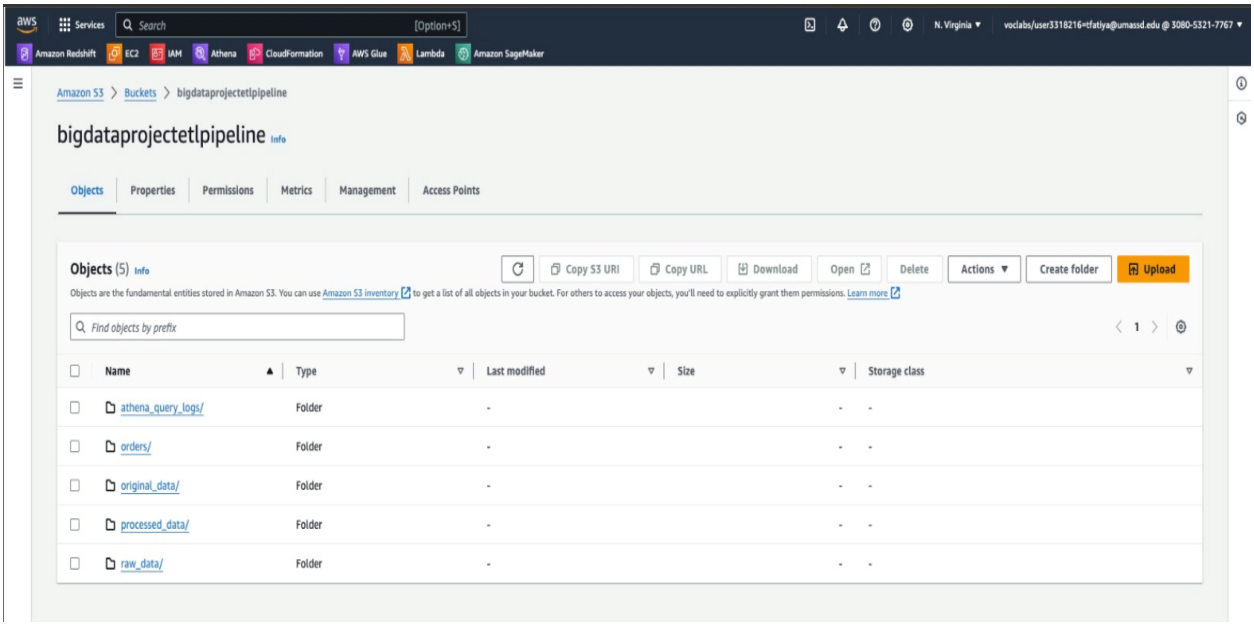
• **Amazon CloudWatch**: Monitors and logs the operations within the AWS environment. It tracks the performance and health of AWS services, including Lambda functions and ETL jobs, and can trigger alerts based on predefined conditions.

# IMPLEMENTATION OF CI/CD PIPELINE

## Data Ingestion

Real-time equity data from various global stock exchanges is ingested into AWS S3, where it is securely stored in a structured and scalable format. This step ensures that the data is readily accessible for further processing and analysis in the pipeline.

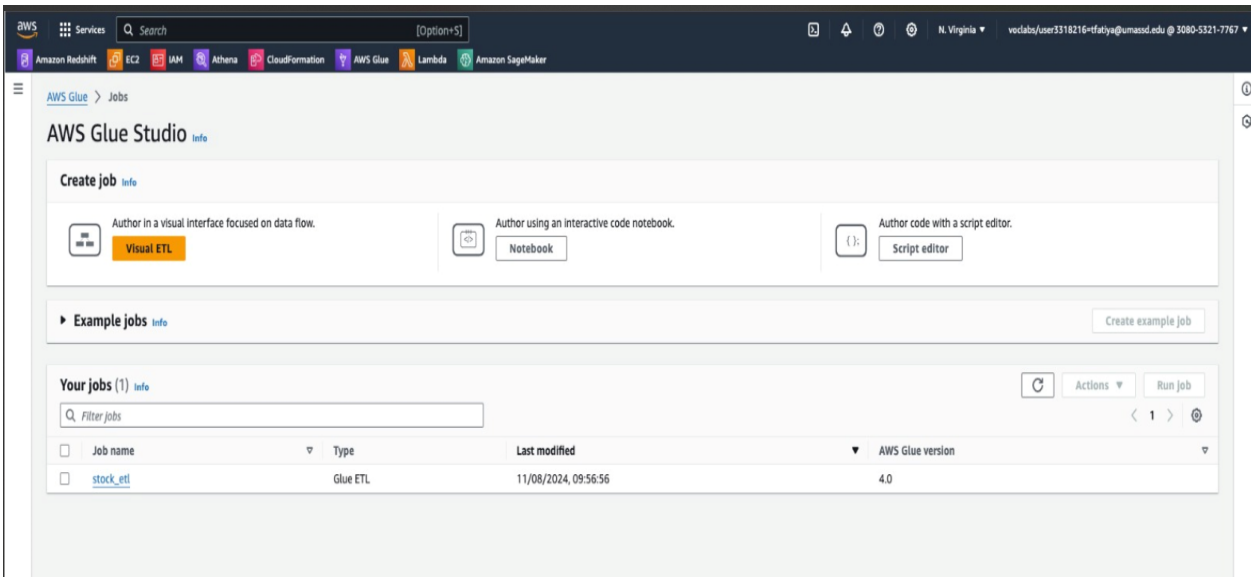



# AWS GLUE

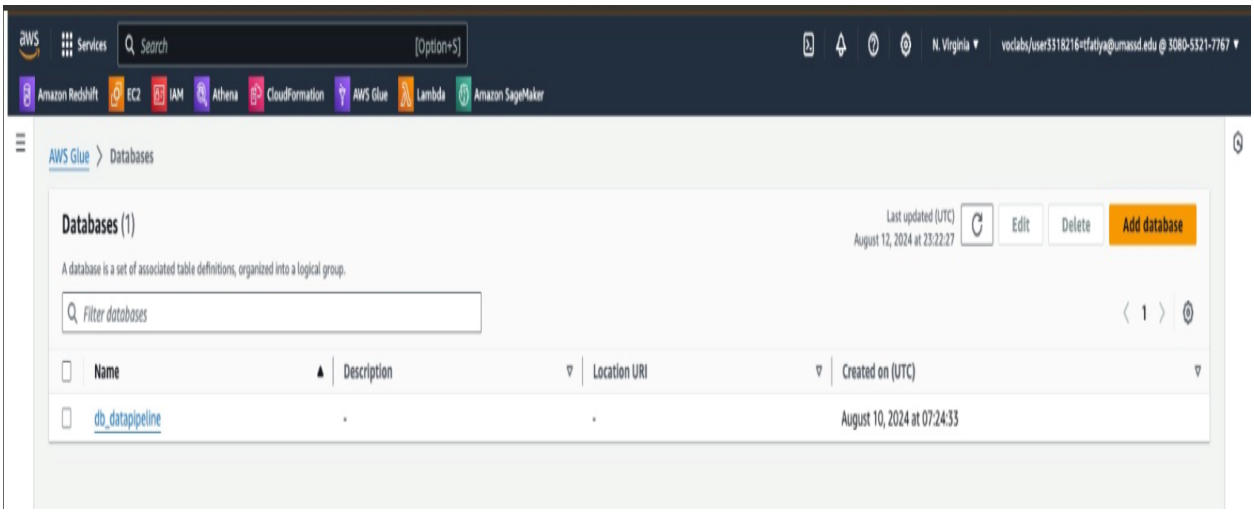
**ETL Processes**

AWS Glue is used to extract, transform, and load (ETL) the ingested data, ensuring it is clean, consistent, and optimized for analysis. This process prepares the data for efficient querying and machine learning tasks.



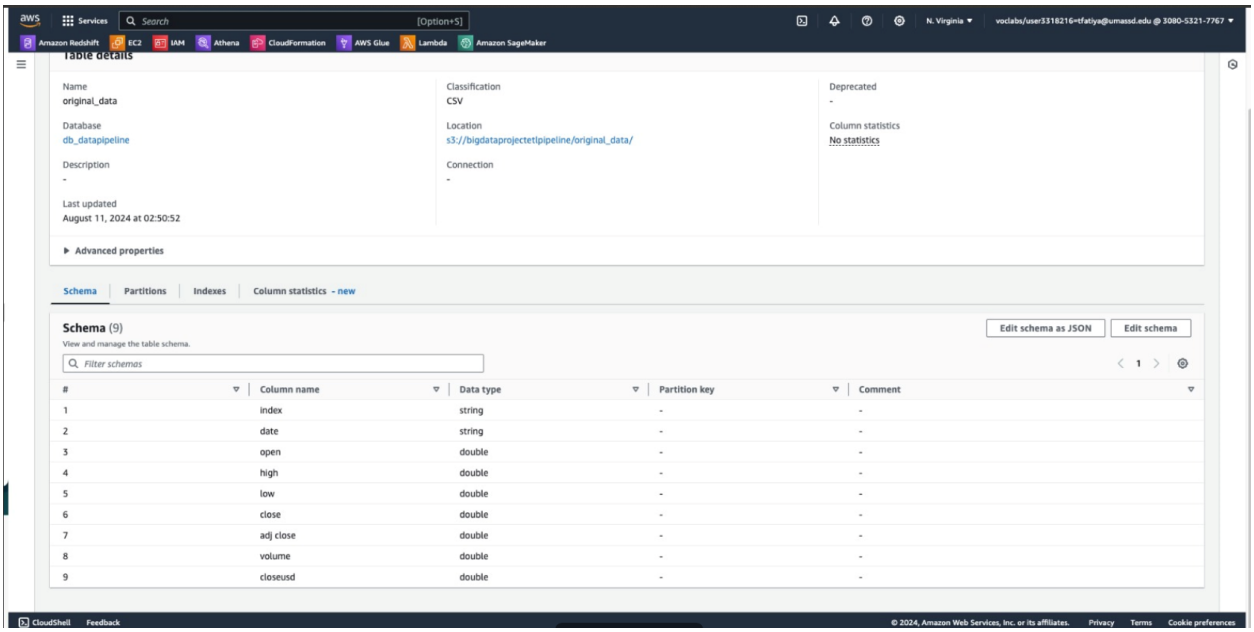

# DATA CATALOG

AWS Glue automatically creates a data catalog, organizing metadata from the ingested datasets. This catalog allows for easy discovery, indexing, and management of data, facilitating seamless access and efficient querying across the pipeline.



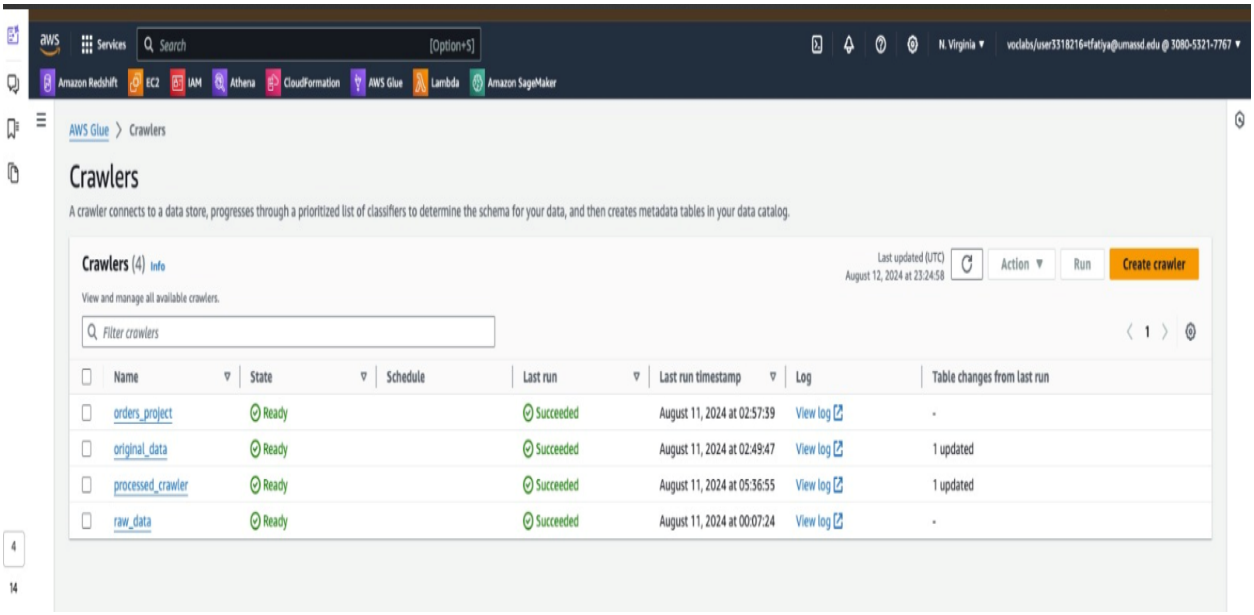

# TABLE AND SCHEMA

Data is organized into tables with well-defined schemas in AWS Glue, ensuring structured storage and easy access for querying. The schema design supports efficient data retrieval and integration across various analytics and machine learning tasks.

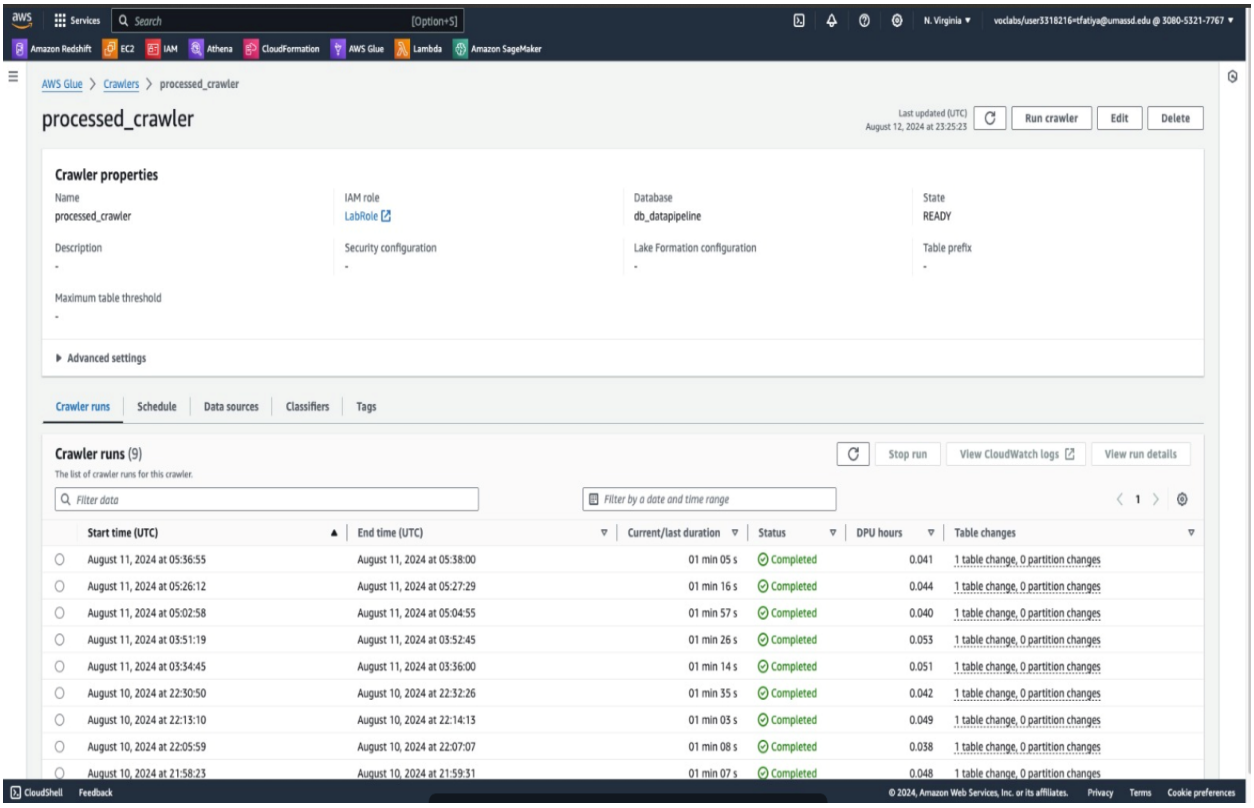



# CRAWLER

A crawler is an automated program that systematically explores the internet, indexing web pages for search engines.

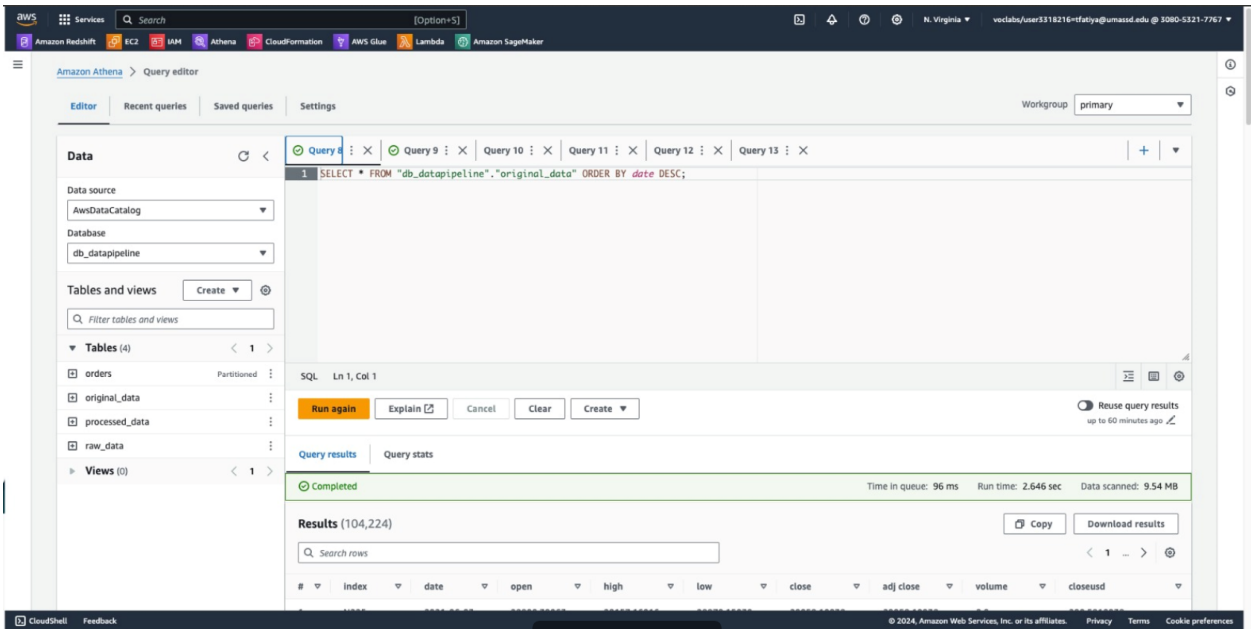


Crawler is working for the original data to transform.



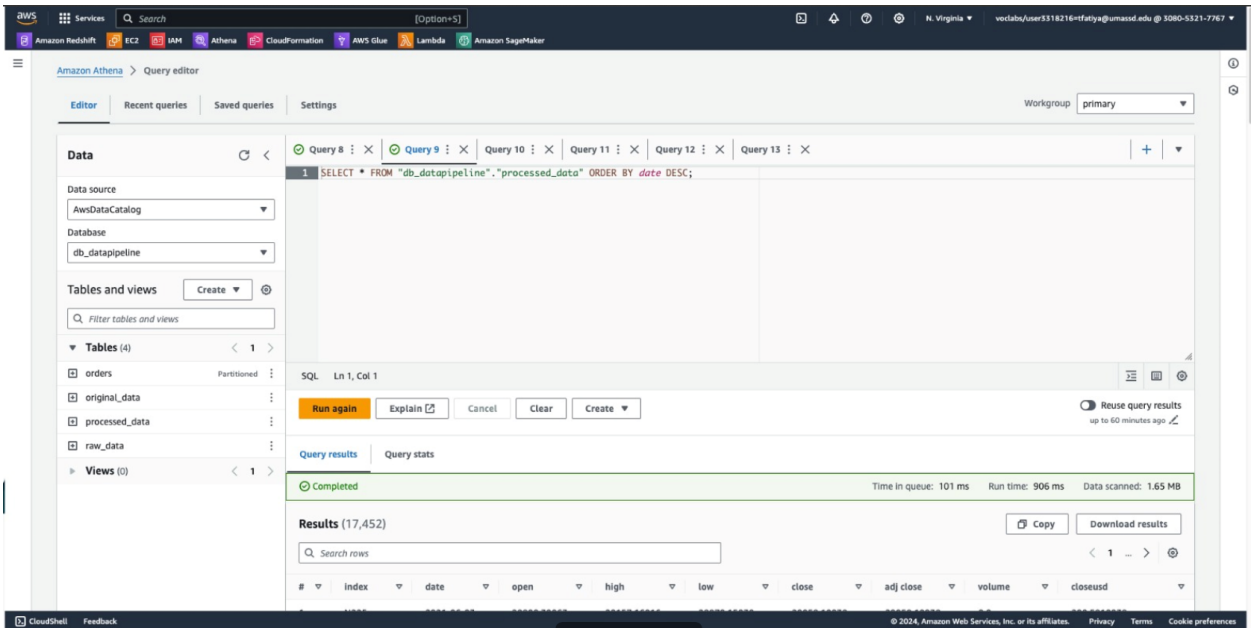

# ATHENA

Data populated for the original dataset in which the number of data points are 104,224.



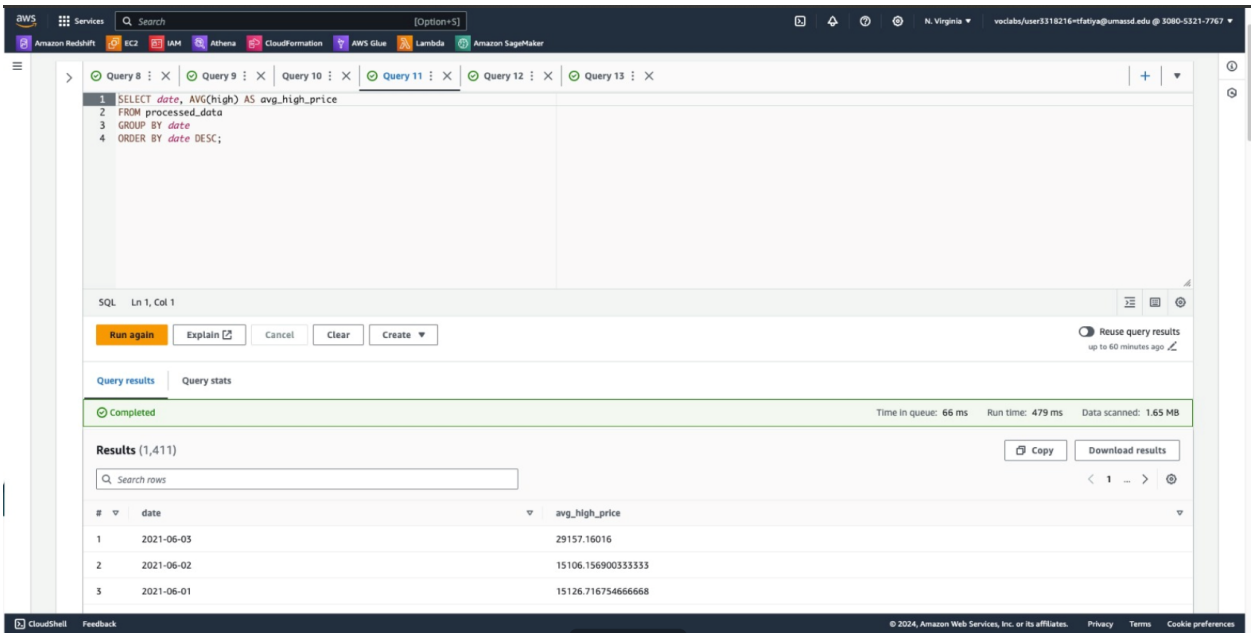
# Transformed Data

Transformed data is data that has been modified or restructured from its original format to serve a specific purpose or improve its usability.

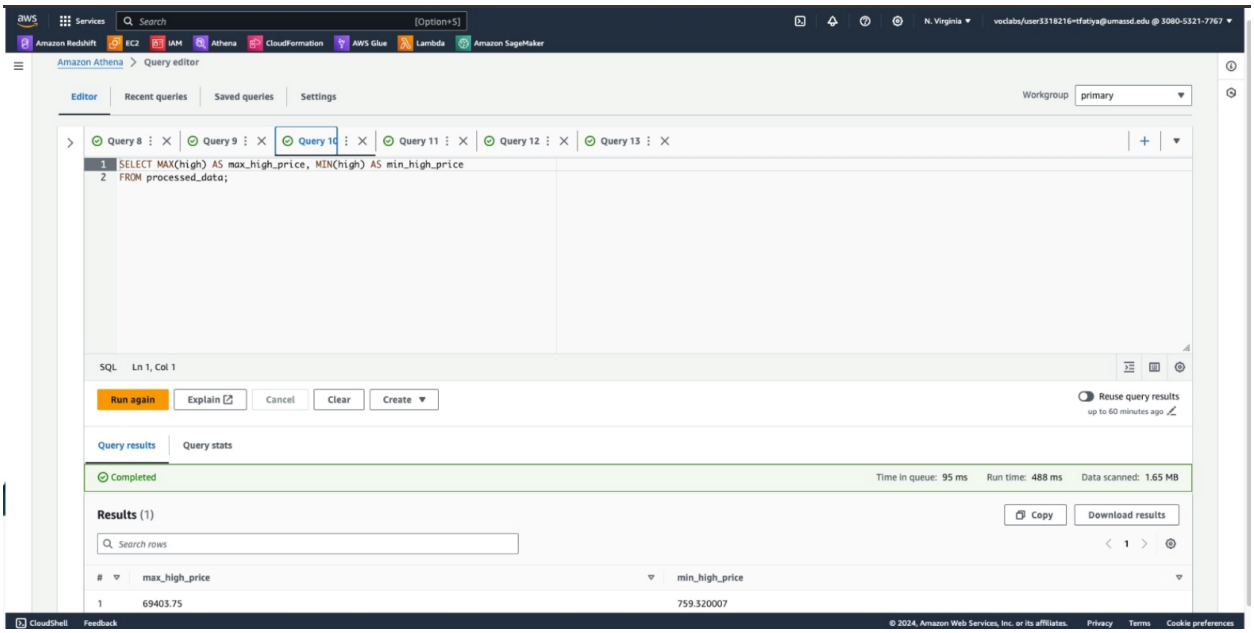



# QUERYING

In this process of extracting specific information from a dataset by formulating and executing a request which is showing the average high price of the stock indexes as per the date.

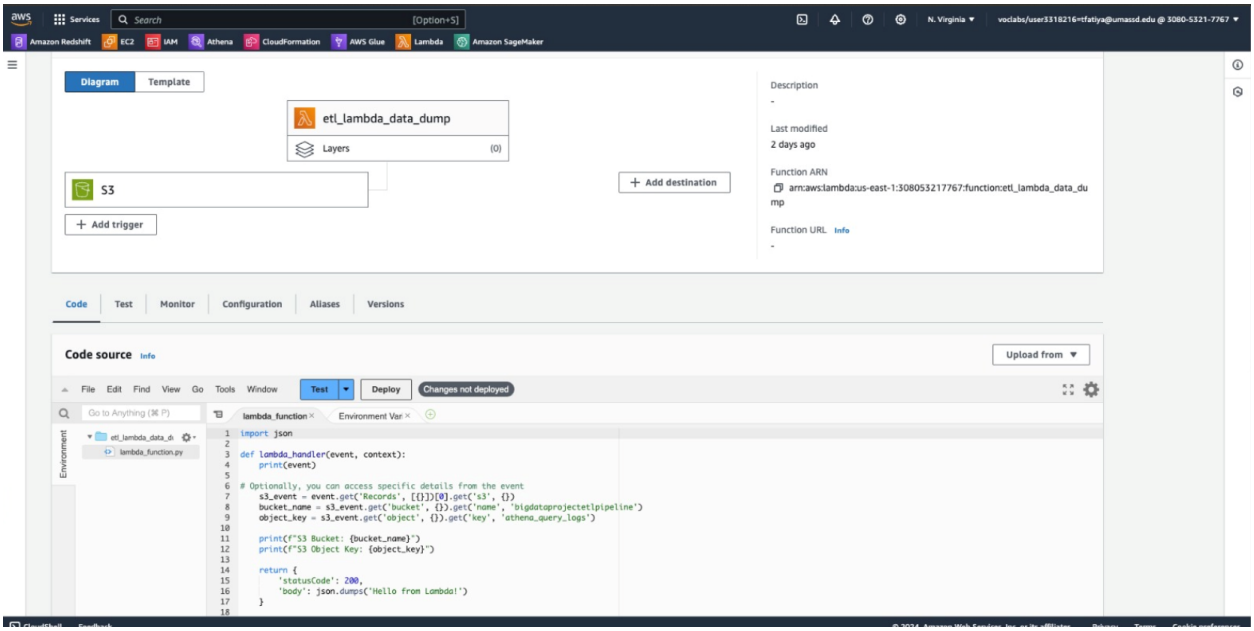


In this query we are populating the data showing the maximum and minimum high price of the stock indexes.



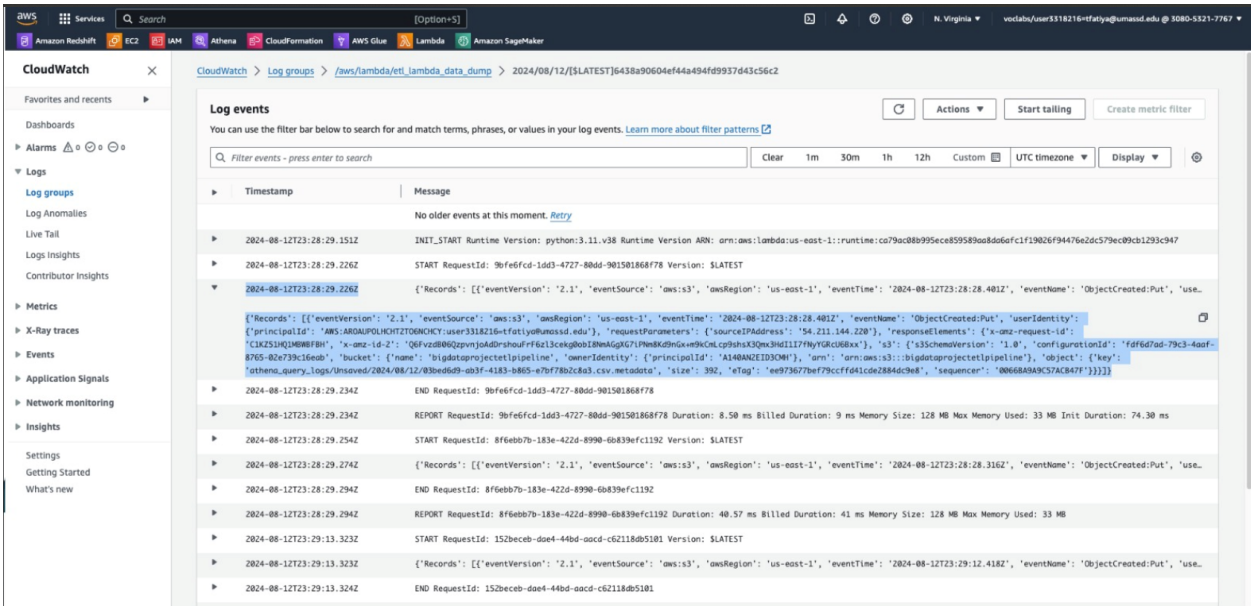

# Lambda Function

A Lambda function in AWS is a serverless compute service that automatically runs code in response to events and triggers, scaling effortlessly based on demand. It eliminates the need for server management, allowing developers to focus on writing code rather than managing infrastructure.



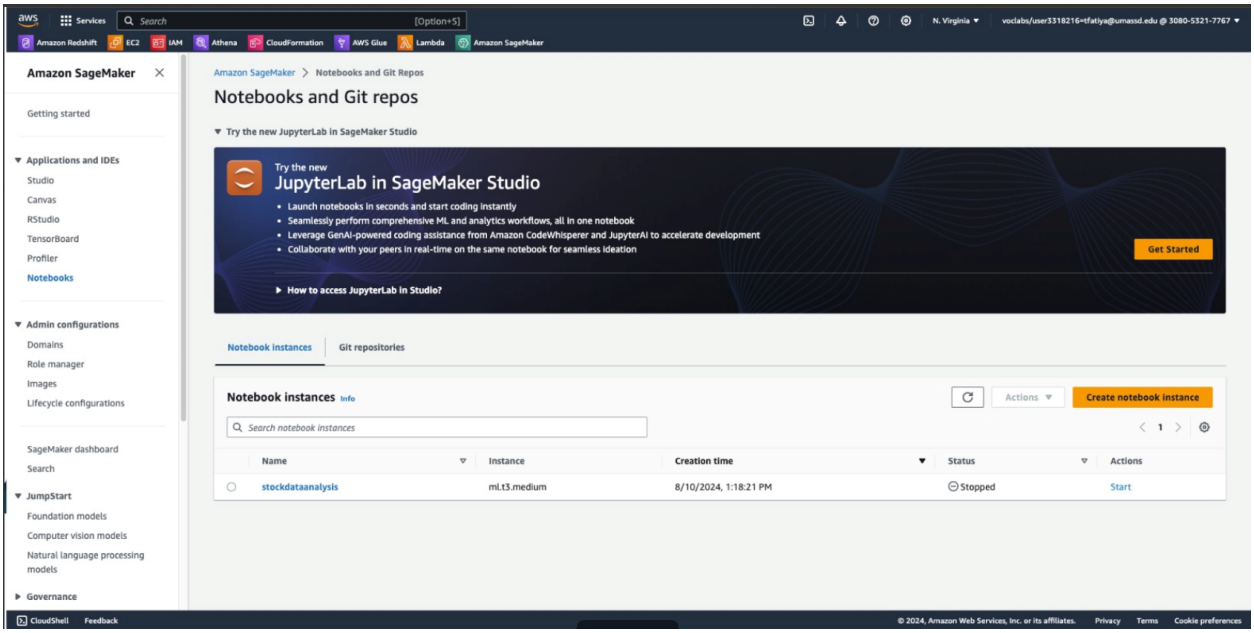
# CLOUD WATCH

Amazon CloudWatch is a monitoring and observability service that provides real-time insights into AWS resources and applications. It helps track metrics, collect logs, and set alarms to ensure the health and performance of your AWS infrastructure.




# AWS SAGEMAKER

Amazon SageMaker is a fully managed service that simplifies building, training, and deploying machine learning models at scale. It offers integrated tools for data preparation, model training, and inference.



# CONCLUSION

The project "Equity Insight Trends Explorer" effectively showcases the ability of AWS cloud technologies to handle and evaluate intricate, real-time equity data sourced from international stock exchanges. Through the utilization of an advanced AWS service such as S3, Glue, Lambda, Athena, and SageMaker, along with a well-designed data pipeline, the project offers significant insights into market patterns and correlations across many geographies and industries. The application of machine learning models, interactive querying, and serverless computing significantly improves the project's capacity to provide precise and rapid insights.

The initiative also shows how democratizing access to advanced financial analytics tools is possible. Innovative financial technology is promoted by the use of cloud technologies, which enable smaller businesses or lone academics to undertake sophisticated data analysis that was previously limited to major financial firms.

The "Equity Insight Trends Explorer" project successfully demonstrates the power of AWS cloud technologies in managing and analyzing complex, real-time equity data from global stock exchanges. By leveraging a well-designed data pipeline and advanced AWS services like S3, Glue, Lambda, Athena, and SageMaker, the project provides valuable insights into market trends and correlations across different regions and sectors. The implementation of serverless computing, interactive querying, and machine learning models further enhances the project's ability to deliver accurate and timely analytics. This project not only highlights the capabilities of modern cloud infrastructure in financial data analysis but also sets a strong foundation for future enhancements and scalability, enabling deeper market insights and more sophisticated predictive models.

By harnessing the power of cloud computing and advanced analytics, it contributes to the ongoing digital transformation of the financial sector, promising more informed decision-making and deeper understanding of global market dynamics.

# REFERENCES


[1] Short-term stock market price trend predictions Journal of Big Data
https://journalofbigdata.springeropen.com/articles/10.1186/s40537-020-00333-6

[2] Stock Analysis: Different Methods for Evaluating Stocks By James Chen Updated March 11, 2023 Reviewed by Gordon Scott Fact checked by Yarilet Perez
https://www.investopedia.com/terms/s/stock-analysis.asp#:~:text=Fundamental%20analysis%20is%20a%20method,find%20under%2D%20or%20overvalued%20stocks.&text=Trend%20analysis%20is%20a%20technique,on%20recently%20observed%20trend%20data..

[3] QuantInsti Blog "Stock Market Data: Obtaining Data, Visualization & Analysis in Python"
https://blog.quantinsti.com/stock-market-data-analysis-python/