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AI-Powered Customer Review Analytics & Summarization System Using AWS

1. Introduction

This project focuses on building a complete end-to-end AI-powered customer review analytics system using AWS. The rapid growth of e-commerce platforms has resulted in millions of reviews that companies cannot process manually. This report explores the implementation of a scalable, serverless, cloud-native analytics pipeline that uses AWS services such as S3, Lambda, DynamoDB, Comprehend, SageMaker, and QuickSight. The purpose of this system is to extract sentiment, key phrases, entities, and generate machine learning-based summaries from large volumes of unstructured text.

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2. Problem Statement

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3. Objectives

The objectives of the system include building a scalable ingestion pipeline, performing automated sentiment analysis, extracting key insights, storing structured results in NoSQL, creating summaries with a SageMaker model, and visualizing patterns in QuickSight.

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4. Literature Review

Prior studies in sentiment analysis show the importance of supervised ML models such as Naive Bayes, logistic regression, and transformer-based NLP models. Cloud-managed NLP

services like Amazon Comprehend simplify deployment by removing the need for manual model training. Research also shows the need for summarization systems to extract meaningful insights from large text corpora.

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5. System Architecture

The architecture consists of S3 for input storage, Lambda for ETL processing, Comprehend for NLP, DynamoDB as a storage layer, SageMaker endpoint for summarization, and QuickSight for dashboard analytics. This forms a fully serverless pipeline.

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6. AWS Services Used

Detailed breakdown of AWS services used: S3 handles raw CSV storage; Lambda executes ingestion and NLP automation; Comprehend processes text; DynamoDB stores results; SageMaker JumpStart provides pre-trained summarization models; QuickSight builds business dashboards.

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7. Data Pipeline Design

The pipeline begins with an S3 upload event. Lambda reads the CSV, applies NLP, and stores results in DynamoDB. Another Lambda fetches reviewed data and sends it to SageMaker for summarization. Processed results appear in QuickSight.

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8. Implementation Details

Implementation includes writing Lambda functions, configuring triggers, creating IAM roles, setting environment variables, setting up DynamoDB schema, enabling CORS, and validating logs in CloudWatch.

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9. NLP with Amazon Comprehend

Amazon Comprehend performs sentiment detection, entity recognition, language detection, and key phrase extraction. Comprehend uses deep learning-based NLP models optimized for production workloads.

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10. Summarization with SageMaker

Summarization uses HuggingFace transformer models deployed on SageMaker. The system sends combined review text to the endpoint, which returns a concise summary capturing

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11. DynamoDB Database Design

DynamoDB tables ReviewAnalysis1 and ReviewSummaries1 store structured NLP output and summaries. Primary keys ensure fast queries and scalable performance.

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12. QuickSight Dashboard

Dashboards include sentiment distribution charts, review trends, product category insights, and keyword clouds.

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13. Results & Analysis

Results show clear patterns in customer sentiment, frequently mentioned keywords, and product performance.

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14. Challenges & Solutions

Challenges included handling long text, Comprehend throttling, IAM permission errors, and QuickSight integration. All issues were resolved using best practices like text truncation, retry logic, updated IAM policies, and Glue crawlers.

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15. Future Scope

Future enhancements include using Bedrock LLMs, multilingual analysis, image sentiment detection, and recommendation systems.

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16. Conclusion

The project successfully demonstrates a scalable AWS-based system that transforms unstructured text into actionable insights. It highlights the power of cloud AI services and serverless architecture for real-time analytics.

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