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INFORMATICS

Transforming Data Management for Business Applications:

Migrating from NoSQL to Relational DBMS

A CASE STUDY

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Overview

This case study examines the successful migration from **NoSQL** to **RDBMS**. The transition addressed critical challenges related to schema design, data integrity, and leveraging actionable insights through advanced visualizations implemented via Python scripts. Key elements of this transformation include:

- **Context and Problem:** Transition from NoSQL's dynamic schema flexibility to the structured framework of a Relational DBMS.
- **Data Used:** A comprehensive e-commerce dataset stored in JSON format.
- **Techniques Applied:** Custom Python scripts for data transformation and normalization, along with database-integrated visualizations.
- **Key Findings:** Improved querying capabilities and actionable insights into sales patterns and customer behavior.

Introduction

Background Information:

Organizations often use NoSQL databases for handling unstructured, dynamic data. However, as data complexity grows, limitations in complex queries and transactions arise. To address this, many switch to RDBMS, benefiting from structured data management, robust transactions and improved query performance.

Objective:

The migration aimed to transform JSON data into tabular formats compatible with Relational DBMS while maintaining data integrity. Another critical goal was to generate actionable insights by employing Python scripts to directly connect with the database and produce meaningful visualizations.

Problem Statement

Description of the Problem:

1. Bridging the schema disparity between NoSQL's flexible design and Relational DBMS's structured approach.
2. Optimizing data organization to facilitate efficient querying and transactional workflows.
3. Extracting and visualizing meaningful insights from the extensive e-commerce dataset.

Data Collection:

Data Sources:

Static JSON files exported from NoSQL databases.

Data Preprocessing:

- Flattened hierarchical JSON structures to fit relational table formats.
- Identified and rectified missing or inconsistent records.
- Converted data types to ensure compatibility with MySQL schemas.

Methodology

Data Transformation:

Python scripts processed static JSON data and loaded it into normalized MySQL tables.

Feature Engineering:

Designed relational schemas with one-to-many and many-to-many relationships for optimized data structure.

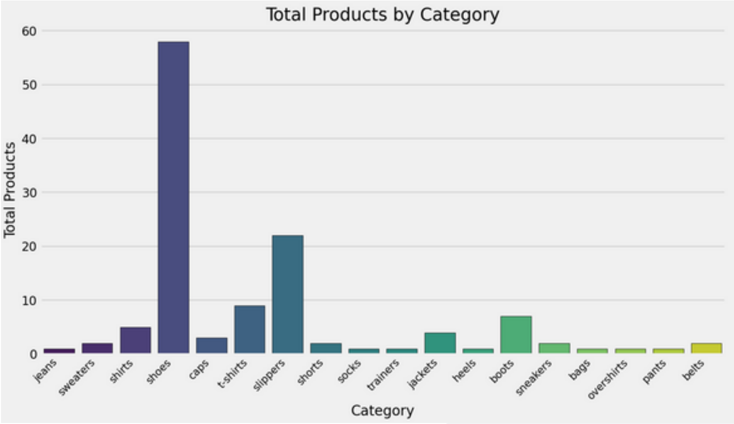
Tools and Technologies:

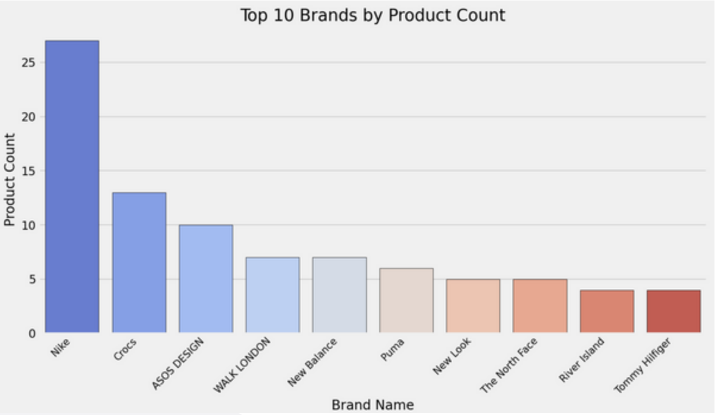
- Python for data preprocessing, transformation, and visualization.
- MySQL as the relational database for structured storage and querying.

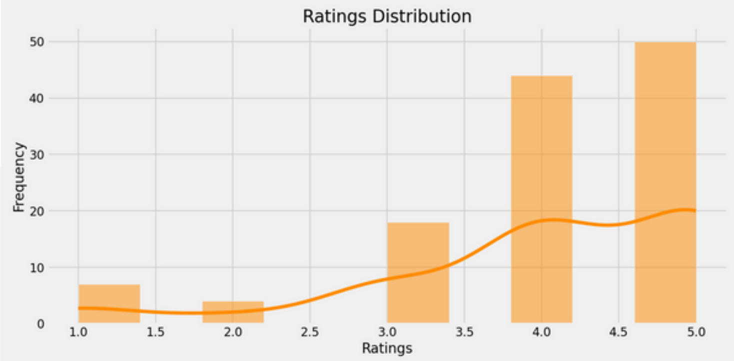
Results

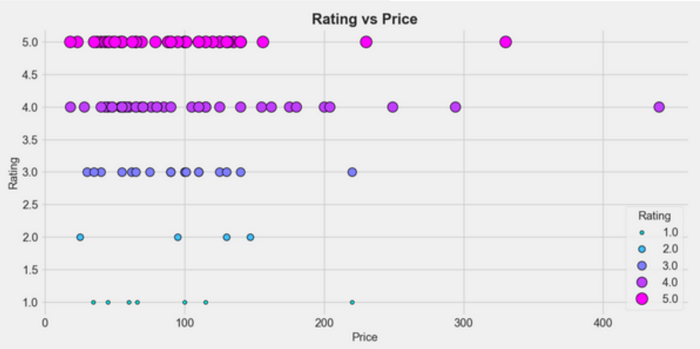
Relational schemas significantly improved query efficiency and data accessibility, enabling the identification of top-performing products and regional sales patterns. Visualizations generated through Python scripts offered actionable insights, including optimizing discount strategies and planning sales campaigns. These visualizations also highlighted seasonal trends and profitability metrics, guiding strategic decision-making effectively.

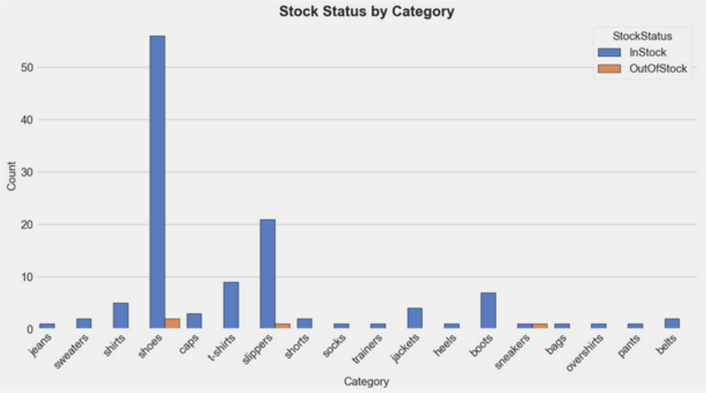
Key Insights

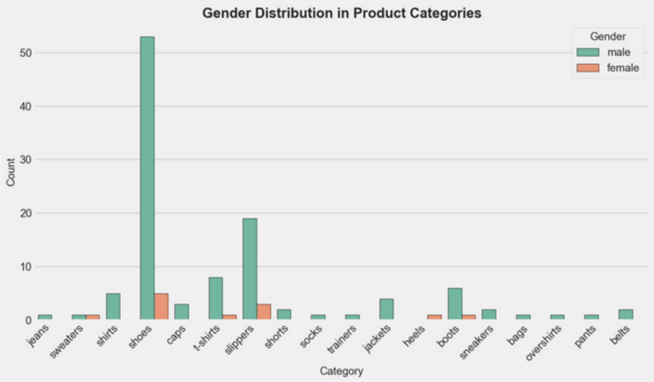


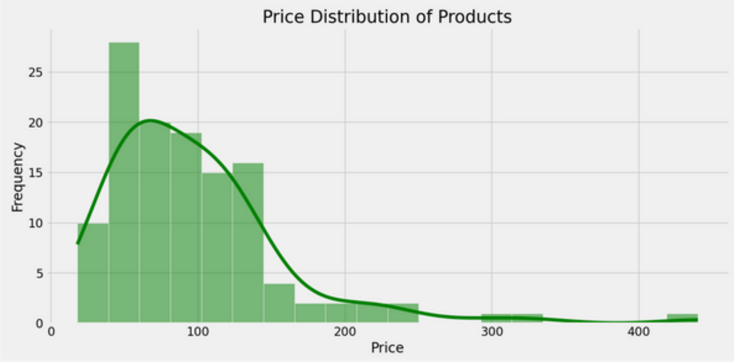


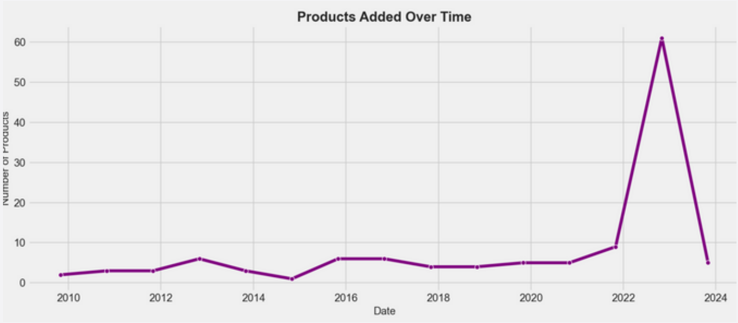












Conclusion

- Migrating from NoSQL to RDBMS offers a structured approach to managing data, enabling better support for complex querying, transactions, and data integrity.
- Transforming JSON data into tabular formats ensures compatibility with relational structures, improving efficiency in data management and analysis.
- Visualization techniques like ER diagrams and performance metrics played a crucial role in simplifying schema mapping and post-migration validation.
- The migration process was streamlined with tools and methodologies such as ETL pipelines, schema normalization, and indexing.
- The visualizations provided valuable insights, enabling data-driven decision-making for the business.

This transformation bridges the gap between flexibility (offered by NoSQL) and reliability (offered by RDBMS), allowing organizations to adapt to evolving business requirements while ensuring robust data management.

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