Hands-on Lab: Generative AI for Architecture Design

Learner effort: 30 mins

Introduction

Data architecture design is a crucial yet intricate step in building robust data pipelines. It involves meticulously planning the flow and organization of data, managing data sources, planning for efficient data storage, defining data modeling strategies, and integrating data into organizational process workflow. In this lab, you will learn how to leverage the generative AI tools to create an efficient data architecture plan for different scenarios.

Objectives

By the end of this lab, you will be able to:
Use generative AI to create an efficient data architecture design for the following scenarios:

- Healthcare industry (EHR System):

    Centralize patient information from various sources, strict data security, and robust analytics for clinical decision-making.

- Retail industry (CRM System):

    Consolidate customer data for personalized marketing, prioritize data security, and implement analytics for segmentation and recommendations.

About generative AI classroom lab

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Notes:

1. The prompts used in this lab are for your reference only. You can create your own prompts and generate responses using generative AI.
2. Since AI-generated outputs are dynamic, you may receive different responses even though you've used the same prompt from this lab.

Scenario One: Healthcare industry

Scenario

A hospital network is implementing an electronic health records (EHR) system to centralize patient information, streamline medical records management, and improve patient care delivery. The data engineering team has developed the following considerations for the data architecture design.

1. Integration of data from various sources such as patient registration systems, laboratory systems, imaging systems, and medical devices.
2. Utilization of a secure and scalable data storage solution to store sensitive patient information.
3. Designing a comprehensive data model to represent patient demographics, medical history, diagnoses, treatments, and prescriptions.
4. Implementing strict data governance policies to ensure patient privacy, data security, regulatory compliance, and data quality standards.
5. Implementing robust access controls, encryption, and auditing mechanisms to protect patient data from unauthorized access or breaches.

Solution

You may use the generative AI lab to incorporate these considerations to propose a detailed data architecture design plan. However, giving too much information to the model simultaneously might result in a biased response. So first, run the following prompt and check the response.

```
Create a detailed data architecture design for a hospital network.
```

▶ Click here for a sample response

Data modeling components for patient demographics, medical history, diagnosis, treatment, and quality standards are missing in the response generated. To include that, use the following prompt in the same chat.

```
Add data modeling components for patient demographics, medical history, diagnosis, treatment, and quality standards.
```

▶ Click here for a sample response

You can also see that the consideration of implementing robust access controls, encryption, and auditing mechanisms to protect patient data from unauthorized access or breaches is yet to be included. The same can be included using the following prompt.

```
The design includes implementing robust access controls, encryption, and auditing mechanisms to protect patient data from unauthoriz
```

▶ Click here for a sample response

With this, you have a detailed data architecture design with all considerations accounted for.

Scenario Two: Retail industry

Scenario

A retail company is developing a customer relationship management (CRM) system to enhance customer engagement, personalize marketing efforts, and improve sales performance. The following data architecture design considerations have to be planned for.

1. Integration of customer data from multiple touchpoints such as online transactions, in-store purchases, website interactions, and social media platforms.
2. Implement a centralized data warehouse or customer data platform (CDP) to consolidate customer information and facilitate real-time access.
3. Creation of a unified customer profile with attributes such as demographics, purchase history, browsing behavior, preferences, and interactions.
4. Implement measures to protect customer data integrity and confidentiality, including encryption, role-based access controls, and data masking techniques.
5. Integration of analytics tools for customer segmentation, predictive modeling, campaign performance analysis, and personalized recommendations.

Solution

Start with a basic prompt, as before, and ask the Generative AI model to create a proposed data architecture design for a retail company's CRM.

```
Create a detailed data architecture design for a retail company's customer relationship management system.
```

You will get a response like this.

▶ Click here for a sample response

This response is missing the consideration of creating a unified customer profile with attributes such as demographics, purchase history, browsing behavior, preferences, and interactions. You can include that using the following prompt.

```
In addition to the response, include steps for creating a unified customer profile with attributes such as demographics, purchase hi
```

▶ Click here for a sample response

With this, the intended data architecture design is ready for further processing.

Practice exercise: Finance industry

Scenario

A financial institution is developing a trading and risk management system to optimize investment strategies, monitor market risks, and ensure regulatory compliance. The following considerations for the data architecture design have been decided.

1. Integration of market data feeds, trading platforms, transaction systems, and risk databases to capture real-time market events and trading activities.
2. Deployment of a high-performance data storage infrastructure (for example, in-memory databases and distributed file systems) to handle large volumes of transactional and historical data.

3. Designing complex data models to represent financial instruments, trading positions, market data, risk factors, and regulatory metrics (for example, VaR and stress testing).

4. Implement stringent data governance policies to maintain data quality, accuracy, and consistency across trading systems and risk models.

5. Integration of advanced analytics tools for portfolio optimization, risk analysis, scenario modeling, and regulatory reporting (for example, Basel III, Dodd-Frank).

Use the Generative AI system with appropriate prompts to design a data architecture for the specifications provided.

Conclusion

In this lab, you have used the Generative AI model to create data architecture designs for healthcare, retail, and finance industries. You also learned the merits of developing the prompts iteratively to get the best response from the model.

Author(s)

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