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Enhancing Airline Revenue Management Intelligence through Large Language Models and Machine Learning

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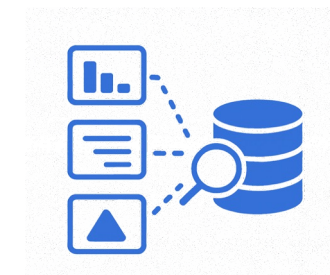
FlightBI

Agenda

The background features a light gray sky with white, stylized clouds. Several small blue airplane icons are scattered across the scene. In the bottom left corner, there is a larger, detailed illustration of a white commercial airplane with a blue tail and blue accents, flying towards the right.

- 1 Limitations of Traditional Aviation BI Systems
- 2 Transforming Aviation BI with AI
- 3 LLMs for Automated Query Generation
- 4 Data Analysis & Recommendation
- 5 AI-Powered Data Visualization
- 6 Next-Gen Demand Forecasting
- 7 Question & Answer

Limitations of Traditional Aviation BI Systems



Traditional BI System

Manual Reporting

Fragmented Tools

Description

Depends on specialized analysts to write and execute SQL queries and generate data reports and charts

Navigate multiple interfaces with predefined queries and reports for different types of intelligence

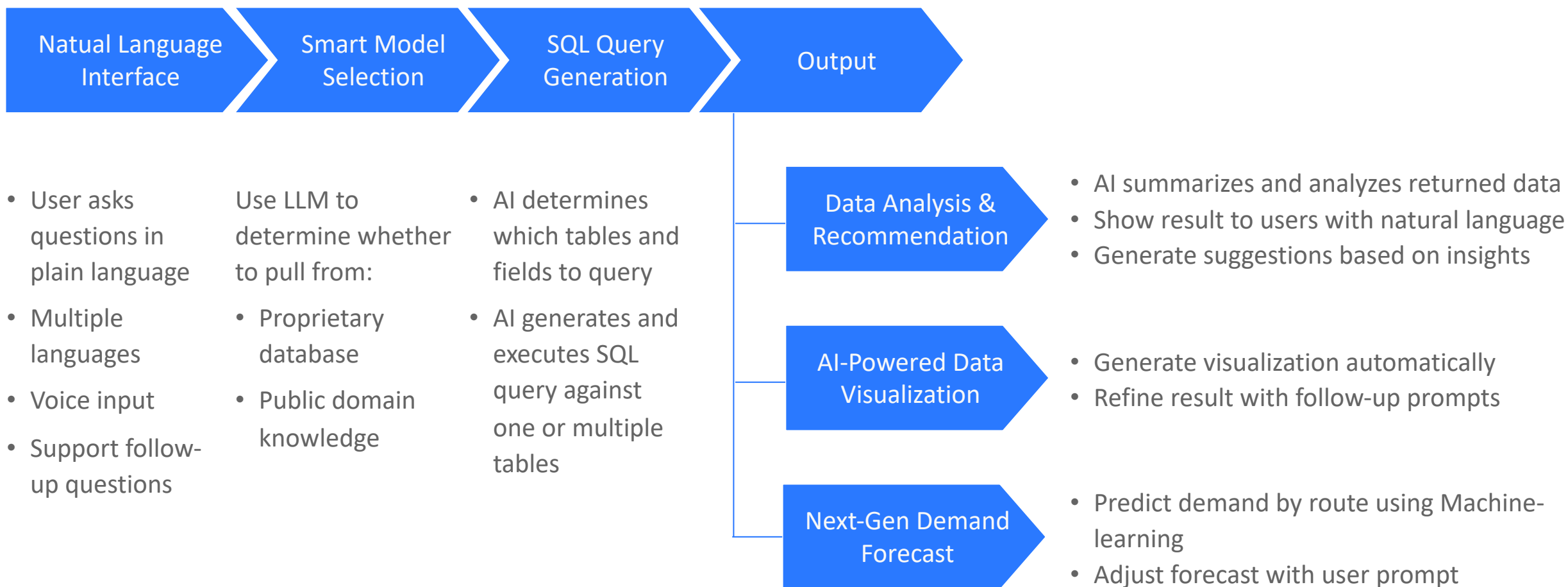
Limitations

- Time-consuming: require back-and-forth communication with data analyst
- Different departments compete for the scarce data analyst resource
- High cost

- Steep learning curves for different types of analysis
- Predefined queries and reports constrain users from exploring data freely or responding quickly to new business questions

Transforming Aviation BI with AI: The New Model

AI-Powered Aviation BI System



Natural Language Interface & Contextual Intelligence



Conversational Queries: Ask complex questions in everyday language without technical SQL knowledge
Multilingual Support: Interact with data in your preferred language, removing international usage barriers
LLM Example: OpenAI GPT-4, Google Gemini, Anthropic Claude, Meta LLaMA3



Voice-Activated Analysis: Fast hands-free input while reviewing other materials or in transit
Model Example: OpenAI Whisper, Google Speech-to-text, Amazon Transcribe, Apple Speech Framework



Follow-up Questions: Remember previous conversations and context

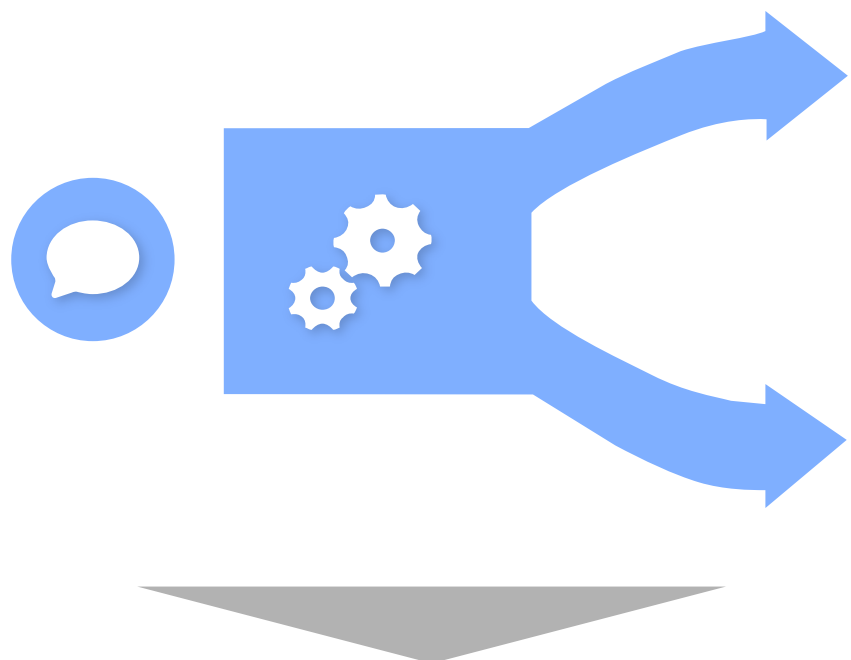
Approach 1: Front-end memory

- Remember conversations at the front-end
- Framework Example: Angular, React

Approach 2: Back-end memory

- Enable AI Agent Memory (User name based or User session based)
- Agent Example: LangChain, LlamaIndex, Haystack

Smart Model Selection



Closed-Book Model

A regular AI model that generates responses only from its internal training data, i.e., public domain knowledge

RAG (Retrieval-Augmented Generation)

Combine a large language model (LLM) with proprietary knowledge sources (e.g., documents, websites, databases)

Approach 1: Rule-based data model selection (based on keywords or specific prompt)

Approach 2: ML-based categorization (learn from examples)

Approach 3: LLM-Based Meta Reasoning (self reflective LLM)

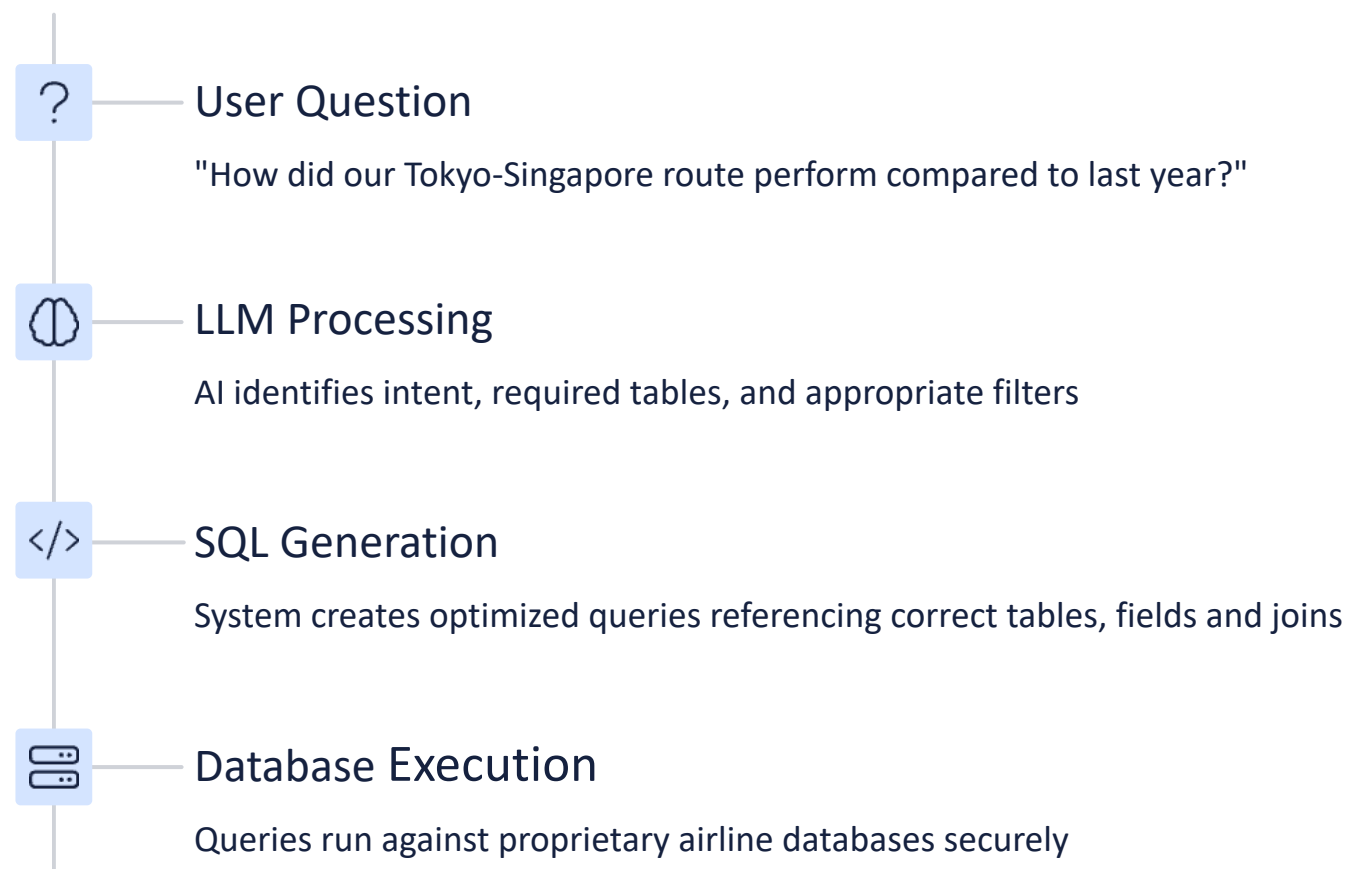
Approach 4: Confidence Scoring (LLM + RAG fallback)

Automated Query Generation

Key Success Factors

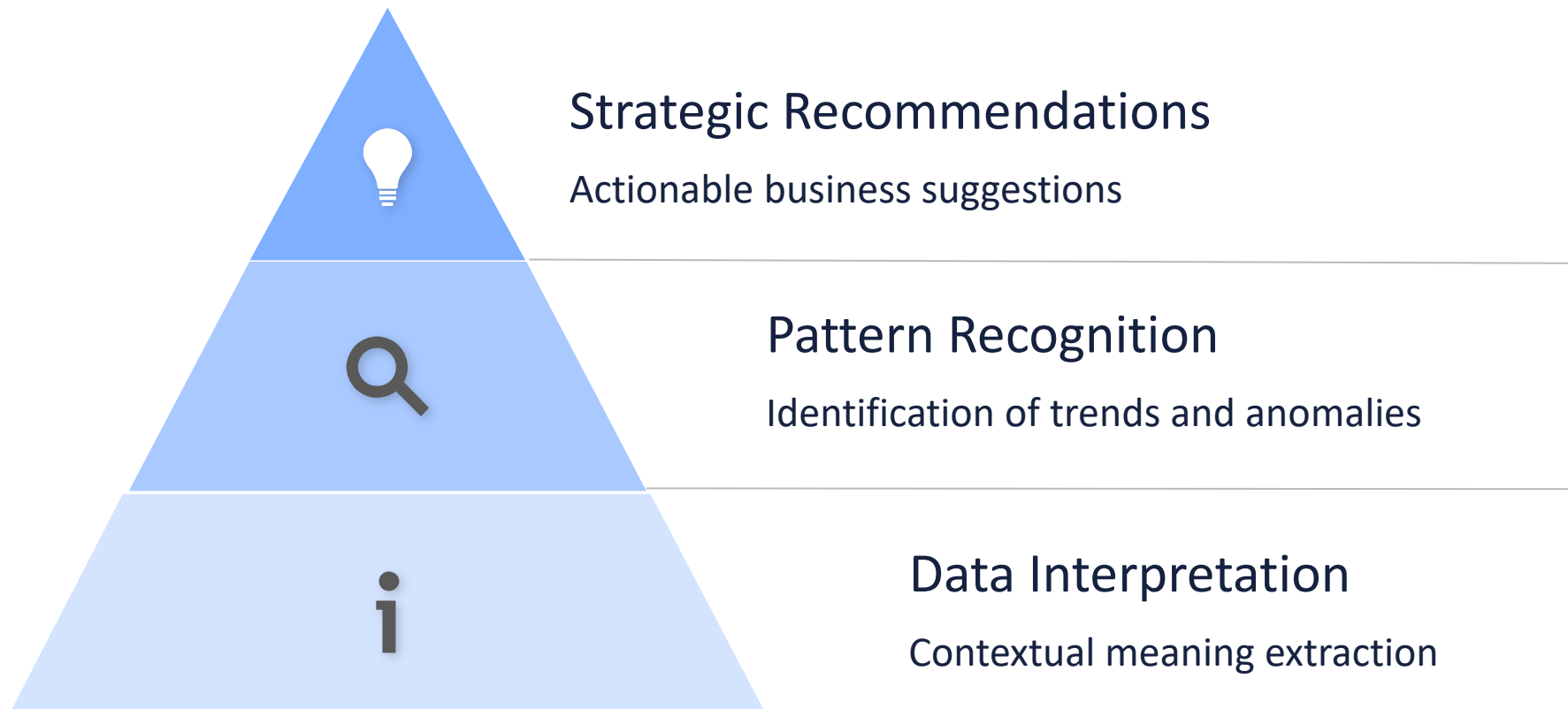
- **Table Metadata** (e.g. Dom_Mkt_AL)
 - Database View
 - Metadata Table
- **Accurate Prompt**
 - SQL dialect (e.g., Snowflake)
 - System prompt (data analyst)
- **Model Selection**
 - Different vendors, e.g., ChatGPT vs. Gemini vs. DeepSeek
 - Different models, e.g., ChatGPT 4o vs. ChatGPT 3.5 turbo
- **Model Fine-Tuning**

RAG Process



AI Summarization, Analysis & Recommendation

AI-Powered Data Analysis



AI-Powered Data Visualization

Definition

- Generated directly from AI responses
- Visuals updated through conversational requests and follow-up questions



Direct AI Visualization

- Use AI models to directly create the visualization from data
e.g., GPT-4+, Gemini, Claude, Excel Copilot

No Library Dependency & Future Proof



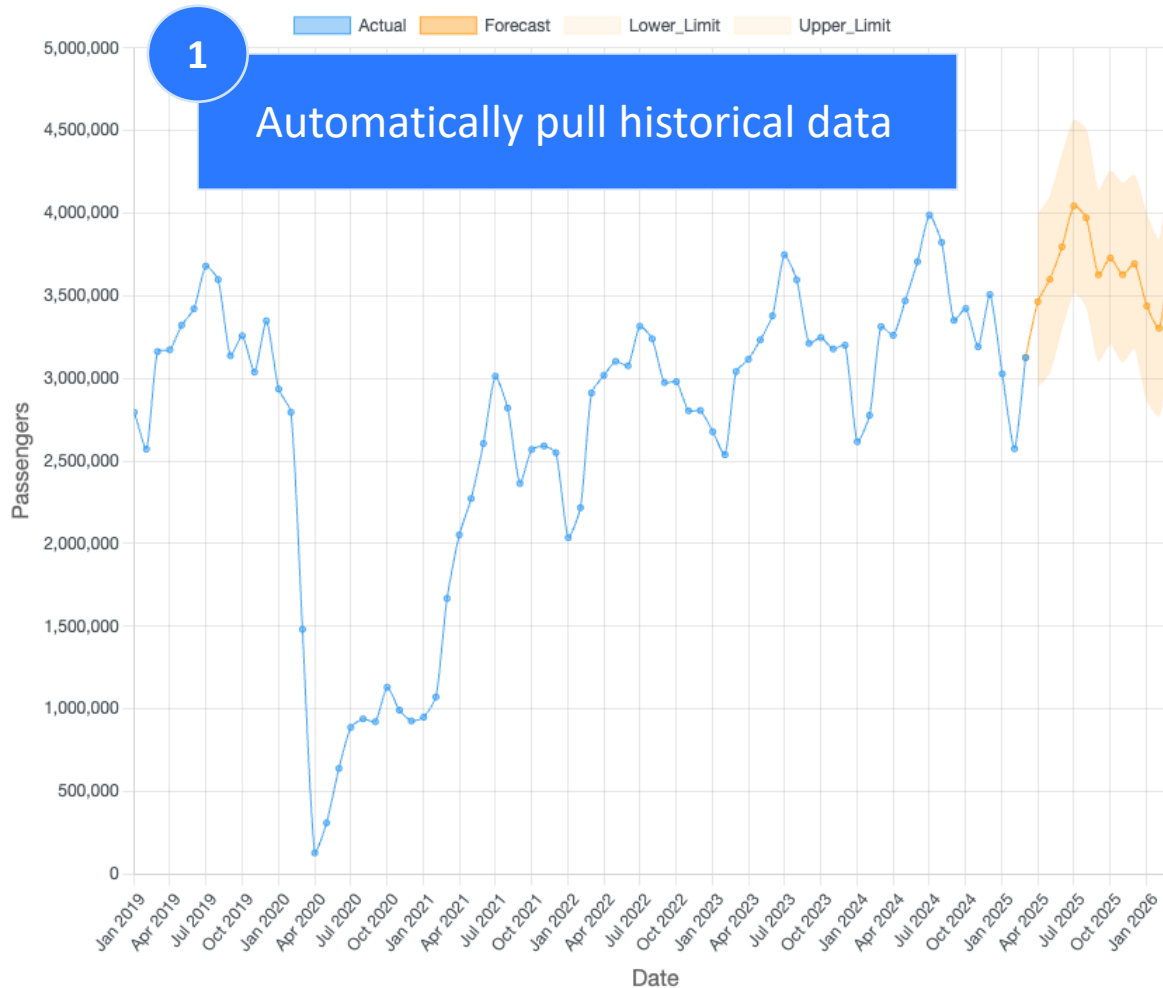
AI Chart Configuration

- Use AI models to generate a JSON object with all charting parameters and chart data
- Render the JSON object with a chart library, such as Chart.js

Better Interactivity and Web-native

Next-Gen Demand Forecast

Forecast of Passengers by AS: Alaska Airlines



2

Generate ML-based Forecast

e.g., Prophet, NeuralProphet, DeepAR

3

Interactive Forecast Adjustment

Use prompt and LLM model to

- Remove outliers in the historical data
- Modify forecast period
- Incorporate Holiday & Event database
- Adjust seasonality and trend sensitivity
- Apply cap and floor

Q & A

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