



# F.A.C.E.T.S. LLM

## ► Project

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What does FACETS stand for?

# Forecasting and AI-Driven Customer Segmentation System



# FACETS Overview

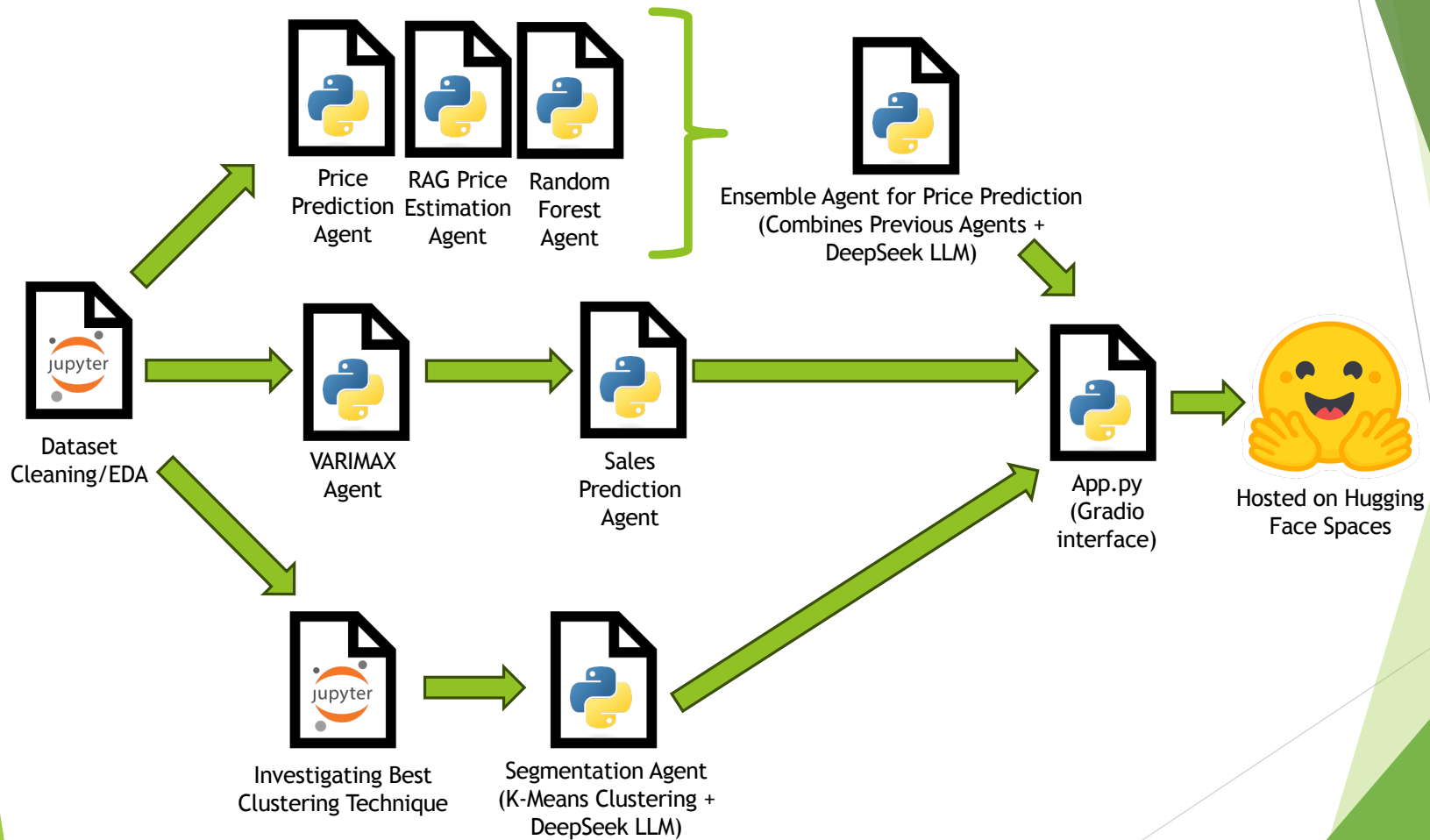
- ▶ Designed to enhance business decision-making by providing actionable insights in natural language while bridging the gap between complex machine learning models and non-technical business users.
- ▶ **Objective:** The system takes customer transaction data as input and outputs customer segmentation visualizations, demand forecasts, and LLM-generated insights to help businesses optimize their strategies.
- ▶ **Key Components:**
  - ▶ **Segmentation Model:** K-Means Clustering
  - ▶ **Forecasting Model:** Random Forest, VARIMAX Forecasting (Time-Series)
  - ▶ **Language Model:** DeepSeek-R1:1.5b, DeepSeek-coder-7b-instruct



# Technical Problem Formulation

- ▶ We aim to segment customers based on RFM (Recency, Frequency, Monetary) data, forecast future demand using time-series sales forecasting, and generate actionable insights using agentic workflow.
- ▶ **Features:** The RFM features are extracted from transaction data. For forecasting, we use time-series features like sales trends and seasonality.
- ▶ **Dataset:** We used datasets like `rossman_sales.csv` and `online_retail_II.csv` for training and evaluation. These datasets include transaction-level data with timestamps, customer IDs, and purchase amounts.
- ▶ **Output:** The outputs include visualizations and LLM-generated reports that the user/stakeholder can download directly from the interface

# System Flowchart




# System Interface

## FACETS Assistant

### Upload Your Data

[RFM Data](#) | [Sales Data](#)

Upload RFM Data (CSV/Parquet)

  
Drop File Here  
- or -  
Click to Upload

Should contain: Customer ID, Recency, Frequency, Monetary

Generate Sample RFM Data

### Download Files

Available files

Refresh

Download

Download

Chat with Analytics Assistant

Hello! I'm your FACETS assistant. How can I help you today?

Ask a question

Try 'perform customer segmentation' or 'help'

Send

Clear Chat



# Results and Evaluation

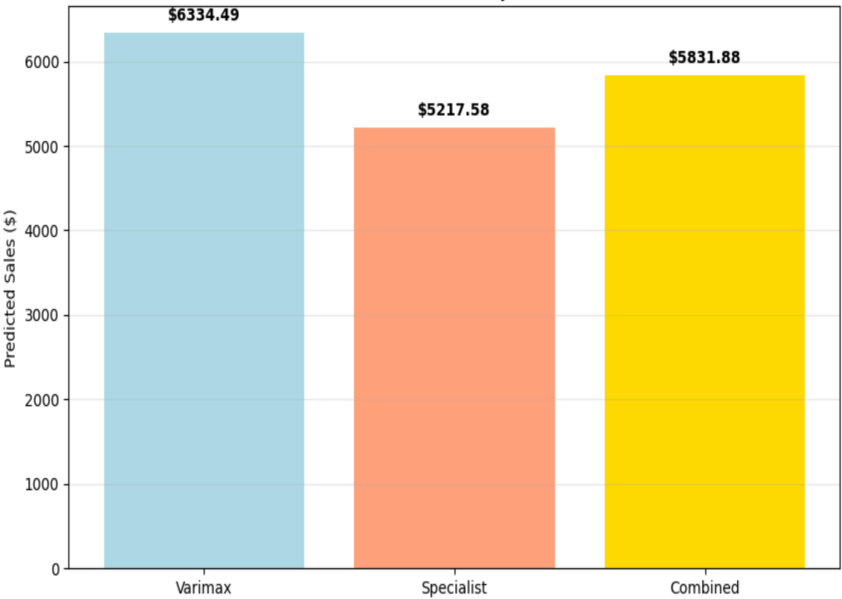
Making predictions for:

Store 20 is a type c store with a basic assortment.  
It has no nearby competition.  
The store does not run regular promotions.  
The store is located in a rural area with low foot traffic.  
What are the expected average daily sales on 2023-12-24?

Varimax Agent: \$6334.49  
Specialist Agent: \$5217.58

COMBINED PREDICTION: \$5831.88 (recommended)

Sales Predictions by Model



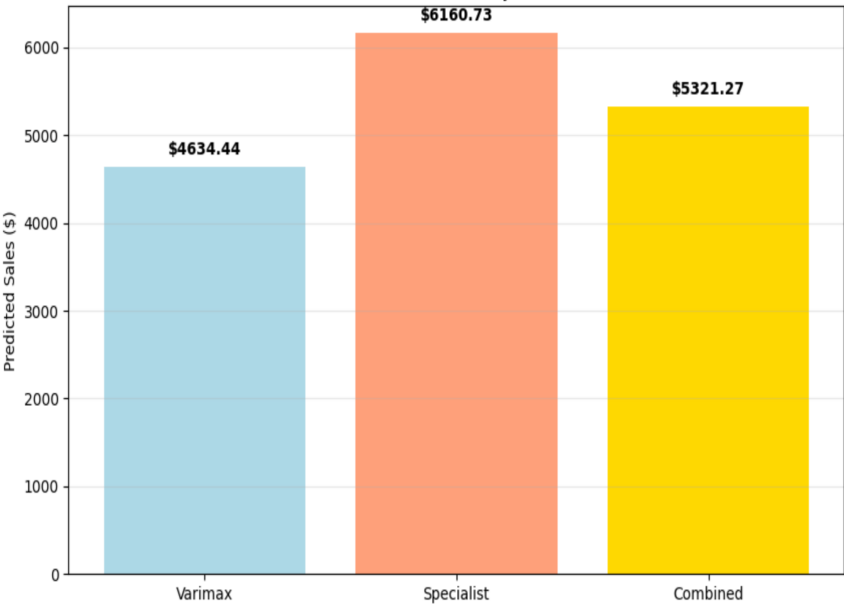
Making predictions for:

Store 10 is a type b store with an extended assortment.  
It has competition 1500 meters away since 2018-03-15.  
The store runs regular promotions during Feb,May,Aug,Nov.  
What are the expected average daily sales on 2023-08-15?

Varimax Agent: \$4634.44  
Specialist Agent: \$6160.73

COMBINED PREDICTION: \$5321.27 (recommended)

Sales Predictions by Model



# Results and Evaluation

```
INFO:root:[Retail Price Specialist] Analyzing: FELTCRAFT BUTTERFLY HEARTS
INFO:root:[Retail Price Specialist] Local price estimate: $5.00
INFO:root:[Frontier Agent] Frontier Agent is searching for similar products
INFO:root:[Frontier Agent] Vector search unavailable - using fallback
INFO:root:[Frontier Agent] Using fallback similar products
INFO:root:[Frontier Agent] Using local inference (no API client)
INFO:root:[Frontier Agent] Frontier Agent local inference - predicting $11.56
INFO:root:[Random Forest Agent] Random Forest Agent is starting a prediction
Getting predictions for: FELTCRAFT BUTTERFLY HEARTS
```

Specialist Agent: \$5.00

Frontier Agent: \$11.56

Batches: 100%  1/1 [00:00<00:00, 1.53it/s]

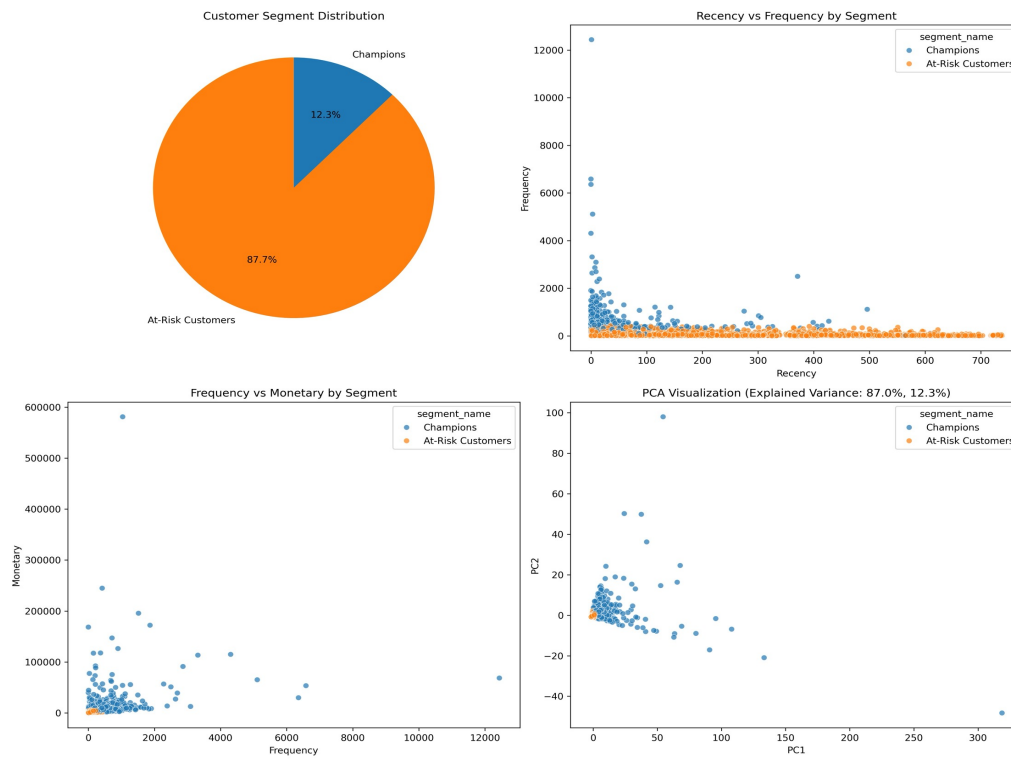
```
INFO:root:[Random Forest Agent] Random Forest Agent completed - predicting $2.19
INFO:root:[Ensemble Agent] Running Ensemble Agent - gathering predictions from all agents
INFO:root:[Retail Price Specialist] Analyzing: FELTCRAFT BUTTERFLY HEARTS
INFO:root:[Retail Price Specialist] Local price estimate: $5.00
INFO:root:[Ensemble Agent] Specialist Agent prediction: $5.00
INFO:root:[Frontier Agent] Frontier Agent is searching for similar products
INFO:root:[Frontier Agent] Vector search unavailable - using fallback
INFO:root:[Frontier Agent] Using fallback similar products
INFO:root:[Frontier Agent] Using local inference (no API client)
INFO:root:[Frontier Agent] Frontier Agent local inference - predicting $11.56
INFO:root:[Ensemble Agent] Frontier Agent prediction: $11.56
INFO:root:[Random Forest Agent] Random Forest Agent is starting a prediction
Random Forest Agent: $2.19
```

Batches: 100%  1/1 [00:00<00:00, 57.43it/s]

```
INFO:root:[Random Forest Agent] Random Forest Agent completed - predicting $2.19
INFO:root:[Ensemble Agent] Random Forest Agent prediction: $2.19
INFO:root:[Ensemble Agent] Ensemble Agent (weighted model) - predicting $3.17
Ensemble Agent: $3.17
```



# Results and Evaluation



# Future Directions and Conclusion

- ▶ **Personalized Recommendations:-**  
Enhance the segmentation model by integrating personalized product recommendations using collaborative filtering or neural matrix factorization, tailoring strategies for individual customer profiles.
- ▶ **Multi-modal Data Integration**  
Fuse transactional data with other sources like customer reviews, product metadata, or demographic information for richer and more contextual insights.
- ▶ **To conclude** this system bridges the technical-business divide by combining traditional ML models and cutting-edge LLMs into a user-friendly decision support tool.
- ▶ By leveraging customer segmentation, demand forecasting, and natural language reports, the solution empowers stakeholders with clear, actionable insights. The modular architecture allows for scalability and extensibility, ensuring that the platform can evolve with emerging data, business needs, and AI advancements.

The slide features abstract green geometric shapes. On the left, a single green triangle points downwards. On the right, a complex arrangement of overlapping green triangles in various shades (from light lime to dark forest green) forms a larger, irregular shape. A thin, light gray line extends from the bottom left towards the right, passing behind the green shapes.

# Thank you!

Any questions?