

# Multi-Agent Data Analysis Report

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## Executive Summary

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## Insights

### ***Key Findings***

- This analysis reveals key drivers of business performance, focusing on sales, profit, customers, and satisfaction. Profit is the most important factor influencing sales, followed by customer acquisition and retention. While customer satisfaction is positive, its impact is less significant. The data also indicates variability in sales and instances of losses, highlighting areas for improvement.
- Top Key Findings
  - \* Profit is the primary driver of sales: Profit has the highest feature importance score (0.563), indicating its critical role.
  - \* Customer acquisition and retention are crucial: Customer count is the second most important factor (0.225), emphasizing the need for customer growth.
  - \* Customer satisfaction is generally high but less impactful: Satisfaction scores are positive but have a lower feature importance (0.088).
- Detected 11 anomalies across numeric columns.
- profit important (score=0.563)
- customers important (score=0.225)
- satisfaction important (score=0.088)

### ***Recommendations***

- \* Sales have high variability and potential outliers: The standard deviation of sales is high, and outliers exist, suggesting inconsistent performance.
- \* Profit margins are relatively consistent, but with some losses: The profit standard deviation is lower, but negative profit values indicate instances of losses.
- Actionable Recommendations
  - \* Optimize Profit: Analyze profit drivers, prioritize high-margin products/services, and implement cost reduction strategies.
  - \* Focus on Customer Growth: Invest in targeted marketing, referral programs, and customer retention initiatives.
  - Investigate outliers for data quality or business trends.
  - Leverage top features to improve predictive modeling and decision-making.

## Agent Execution Summary

Agent	Status	Execution Time (s)
Data Cleaning Agent	SUCCESS	37.877
EDA Agent	SUCCESS	39.315
Anomaly Detection Agent	SUCCESS	0.097
ML Agent	SUCCESS	7.775

### Insights Agent

The Business Insights Agent consolidates outputs from all other agents, transforms them into actionable findings, and generates recommendations. It acts as the decision-making layer of the pipeline, summarizing complex analyses into clear business-focused insights.

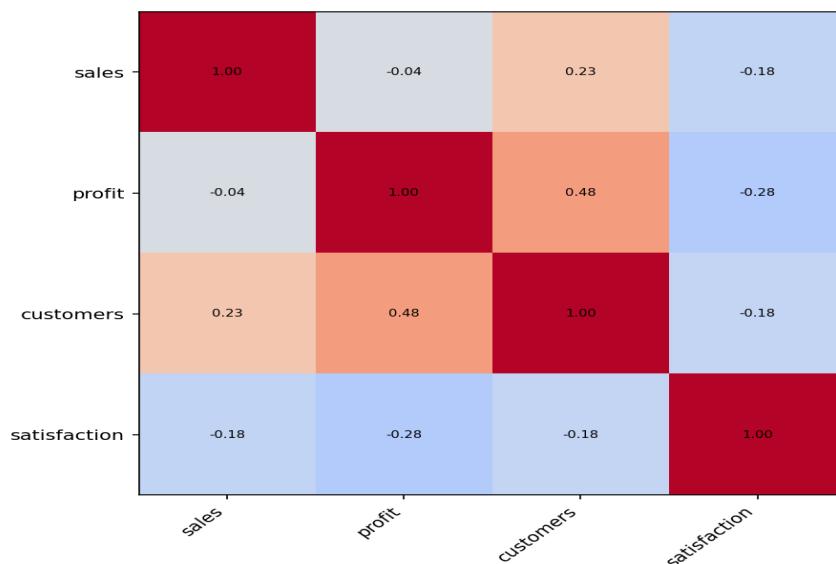
### Data Cleaning Agent - Results

This agent is responsible for preparing the dataset for analysis. It handles missing values, resolves inconsistent formats, removes duplicate entries, and applies recommendations when available. Its purpose is to ensure that downstream agents work with clean, reliable, and standardized data.

### EDA Agent - Results

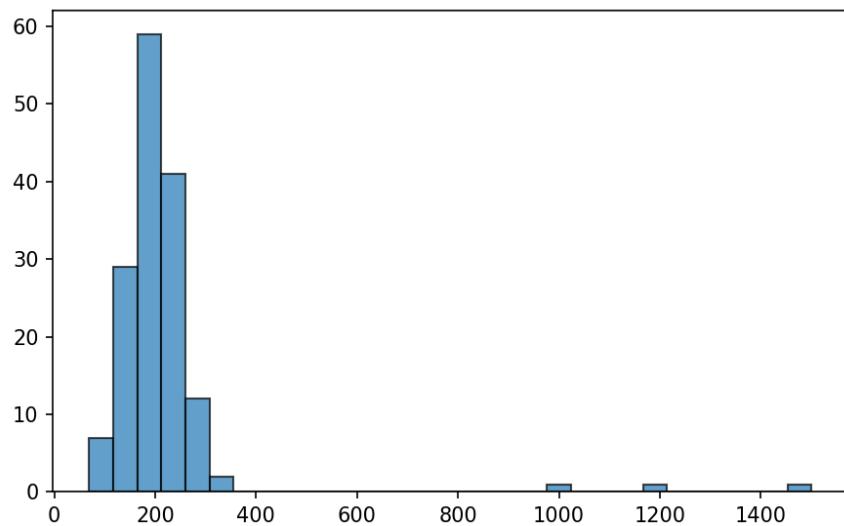
This agent performs exploratory data analysis and pattern discovery within the pipeline. Its purpose is to generate statistical summaries and visualizations that reveal underlying data structures, relationships, and distributions. By identifying trends, correlations, and potential quality issues, it provides critical insights for informed decision-making in subsequent stages.

#### *correlation\_heatmap*



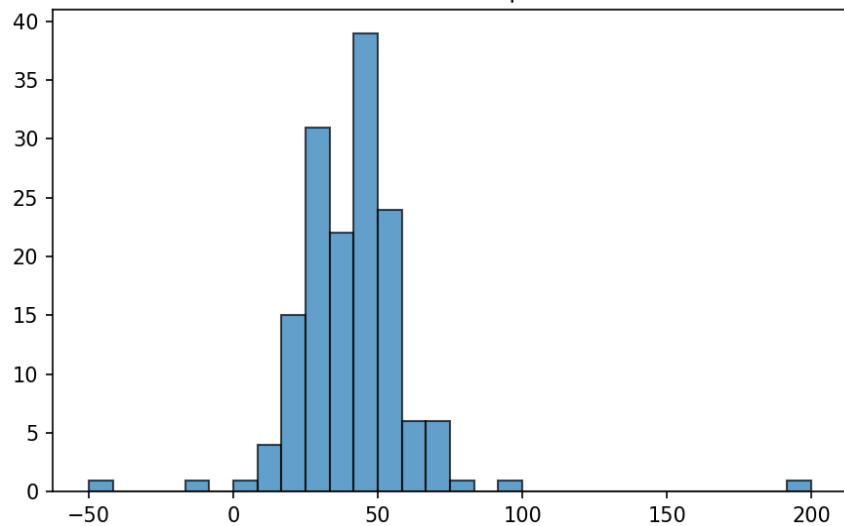
#### *distribution\_sales*

Distribution of sales



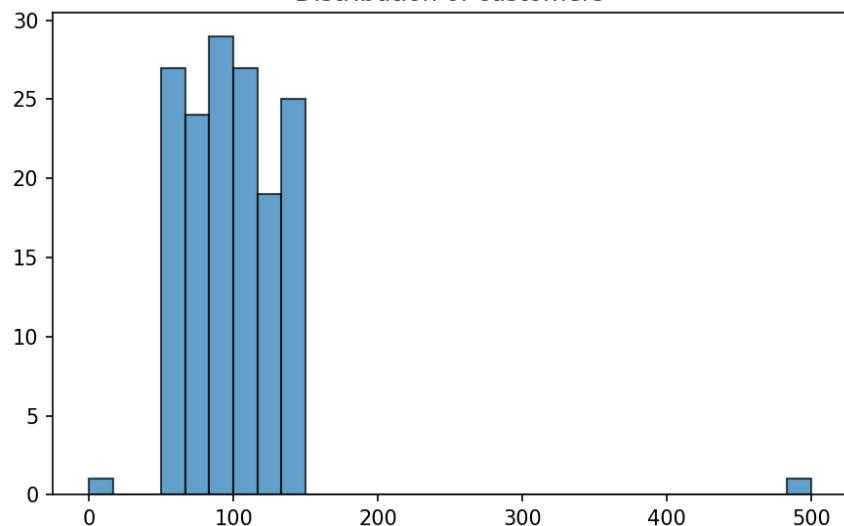
*distribution\_profit*

Distribution of profit



*distribution\_customers*

Distribution of customers



## Anomaly Detection Agent - Results

This agent performs anomaly detection and data quality monitoring within the pipeline. It identifies unusual patterns and outliers in the data using IQR-based statistical methods. The agent flags potential errors or special events, providing a summary of anomalies with affected features and their corresponding counts. Its purpose is to highlight data points that require further investigation, ensuring data integrity and facilitating more accurate analysis.

### ***Anomaly Summary:***

- sales: 5 outliers (3.27%)
- profit: 4 outliers (2.61%)
- customers: 1 outliers (0.65%)
- satisfaction: 1 outliers (0.65%)

## ML Agent - Results

This ML Agent focuses on predictive modeling and feature analysis within the data pipeline. It performs baseline model training and calculates feature importance scores to identify key predictive patterns. Its purpose is to reveal the drivers behind the target outcome. Ultimately, it outputs a ranked list of features, providing valuable insights for informed decision-making.

### ***Top Features:***

- profit: 0.5629
- customers: 0.2253
- satisfaction: 0.0878
- date: 0.0520
- category: 0.0431
- region: 0.0290