

# Multi-Agent Data Analysis Report

Generated on 2025-11-24 21:25:18

## Executive Summary

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## Insights

### ***Key Findings***

- This analysis reveals key drivers of sales performance, highlighting the importance of profit and customer acquisition. While customer satisfaction is a factor, its impact is less pronounced. The findings suggest a need for strategies focused on optimizing profit margins, growing the customer base, and further investigating the drivers of customer satisfaction.
- Top Key Findings
  - \* Profit is the most important driver of sales (56.3% feature importance).
  - \* Customer numbers are the second most important factor (22.5% feature importance).
  - \* Customer satisfaction is generally high but has a smaller impact on sales (8.8% feature importance).
- 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, with potential outliers indicating high-performing periods.
- \* Some transactions result in losses, indicated by negative profit values.
- Actionable Recommendations
  - 1. Prioritize Profit Optimization: Analyze profit drivers, optimize pricing, and reduce costs.
  - 2. Focus on Customer Growth and Retention: Invest in effective marketing and loyalty programs.
- 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	8.592
EDA Agent	SUCCESS	4.610
Anomaly Detection Agent	SUCCESS	0.014
ML Agent	SUCCESS	6.324

### 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.

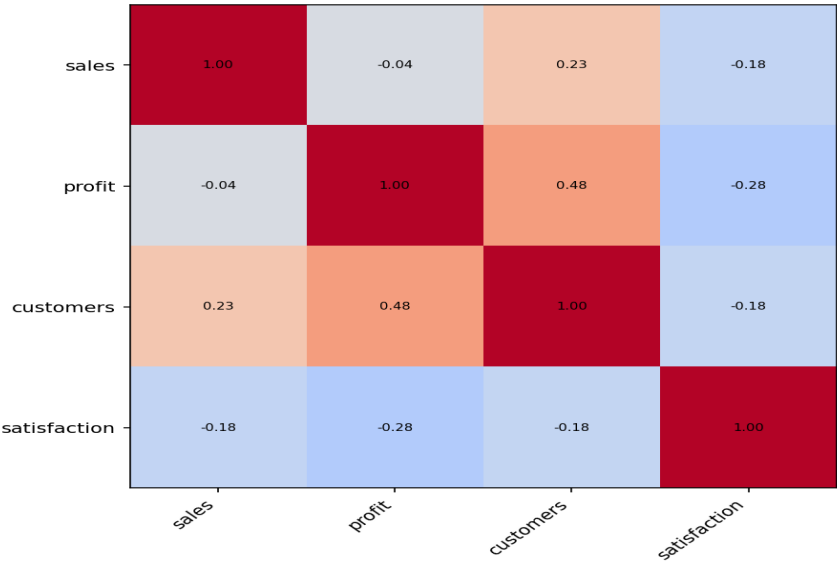
## Data Cleaning Agent - Results

This agent focuses on data preparation and quality assurance within the pipeline. It performs crucial tasks such as handling missing values, resolving inconsistent formats, removing duplicates, and standardizing data types. Its purpose is to provide a clean, reliable dataset, thereby ensuring the accuracy and validity of subsequent analyses. Ultimately, this agent minimizes errors and improves the overall efficiency of the data analysis process.

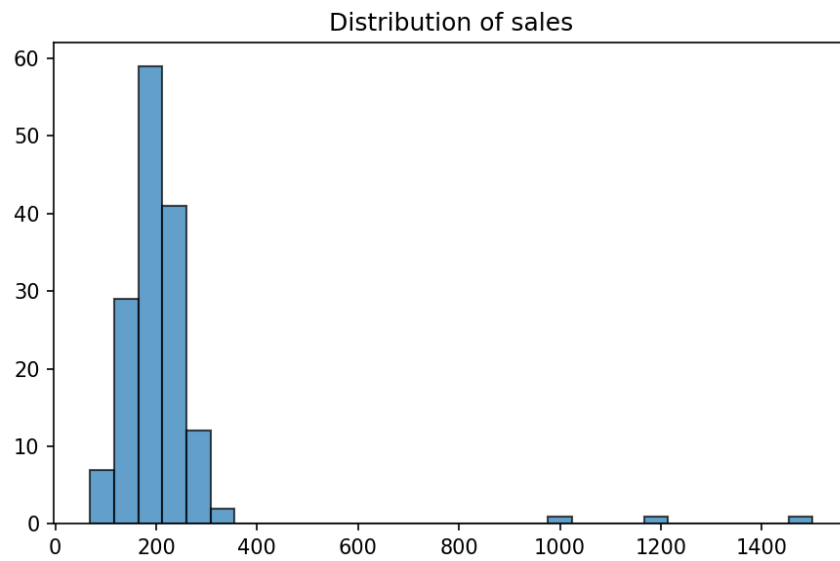
## EDA Agent - Results

This agent performs exploratory data analysis and pattern discovery within the pipeline. Its purpose is to generate statistical summaries and visualizations, revealing key trends, correlations, and distributions present in the data. By identifying data structure, relationships, and quality issues, it provides critical insights that inform subsequent analysis and modeling stages.

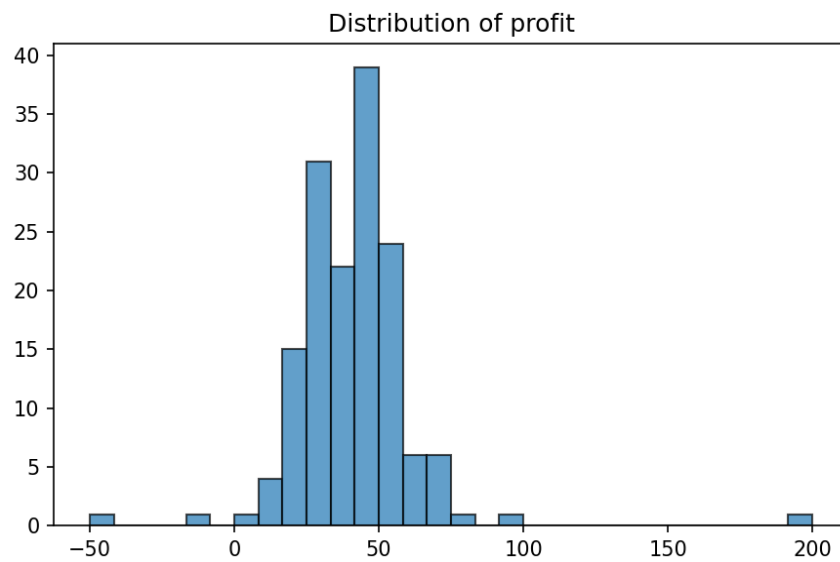
### *correlation\_heatmap*



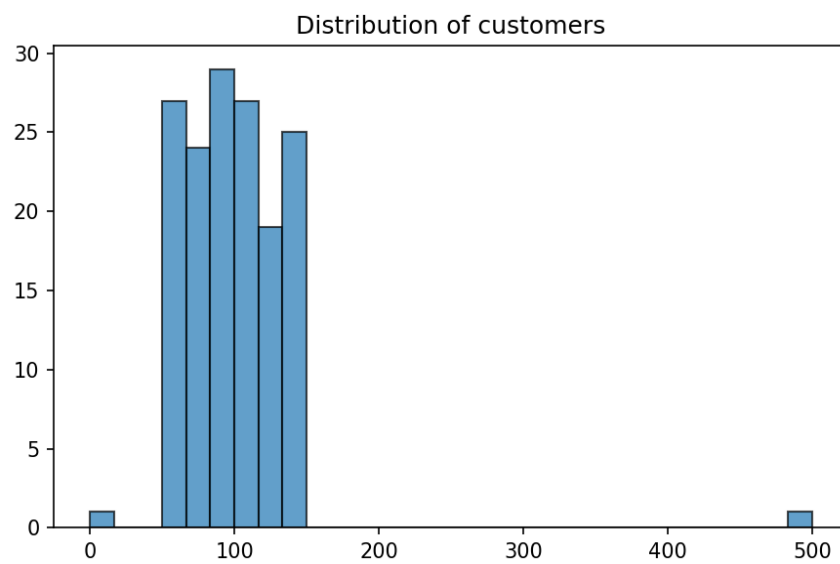
### *distribution\_sales*



***distribution\_profit***



***distribution\_customers***



## Anomaly Detection Agent - Results

This agent focuses on outlier detection and data quality monitoring within the pipeline. It performs anomaly detection using IQR-based statistical methods, flagging potentially erroneous data points or significant events. Its primary purpose is to identify unusual patterns that could impact analysis results. The agent outputs a summary of detected anomalies, including affected features and their respective counts, enabling targeted investigation and data correction.

### ***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 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 underlying drivers of the target outcome. The agent outputs a ranked list of features, enabling data scientists to prioritize variables with the greatest impact.

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

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