Exploratory Data Analysis (EDA) with Zomato Dataset Documentation

This documentation provides a comprehensive overview of the **Exploratory Data Analysis (EDA)** performed on the **Zomato dataset**. The analysis aims to uncover insights into restaurant performance, customer preferences, and delivery efficiency using Python libraries such as **Pandas**, **NumPy**, **Matplotlib**, and **Seaborn**.

Goals of the Project:

1. Explore the Zomato dataset using Pandas.
2. Perform feature engineering to derive useful insights.
3. Visualize data distributions and trends with various plot types.
4. Summarize key findings that can aid in business decision-making for restaurants and food delivery services.

Materials and Methods

The data for this project is from the Zomato dataset, which contains information about restaurants, cuisines, customer ratings, locations, and delivery details. This dataset includes:

- Restaurant names and IDs
- Cuisine types
- Customer ratings and votes
- Average cost for two people
- Location data (city, country)
- Online delivery availability
- Table booking availability

The analysis aims to understand:

- Popular cuisines and restaurants.
- Customer preferences based on ratings and votes.
- Price trends and their relationship with ratings.
- Geographic distribution of restaurants.
- Impact of online delivery and table booking on customer satisfaction.

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1. Introduction

The goal of this project is to analyze the Zomato dataset to uncover trends and patterns in restaurant performance, customer behavior, and delivery efficiency. The insights derived from this analysis can help Zomato and restaurant owners make data-driven decisions to improve customer satisfaction and operational efficiency.

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2. Dataset Overview

The dataset contains information about restaurants listed on Zomato in India. Key columns include:

- **Restaurant ID**: Unique identifier for each restaurant.
- **Restaurant Name**: Name of the restaurant.
- **City**: City where the restaurant is located.
- **Cuisines**: Types of cuisines offered.
- **Average Cost for Two**: Average cost for a meal for two people.
- **Aggregate Rating**: Average rating of the restaurant.
- **Votes**: Number of customer votes.
- **Price Range**: Price range indicator (1 to 4).
- **Highlights**: Features offered by the restaurant (e.g., delivery, dine-in).
- **Establishment**: Type of establishment (e.g., quick bites, casual dining).

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3. Data Cleaning and Preprocessing

Before performing EDA, the dataset is cleaned and preprocessed to handle missing values, duplicates, and inconsistencies.

Steps:

1. **Remove Duplicates**: Duplicate restaurant entries are removed based on the `res_id` column.
2. **Handle Missing Values**: Missing values in the `cuisines` column are filled with "No cuisine."
3. **Feature Engineering**:
    - **Price Range**: Categorized into low, medium, and high.
    - **Rating Category**: Classified into Poor, Average, Good, and Excellent.
4. **Data Transformation**:
    - Split combined columns like `cuisines` and `highlights` into individual entries for analysis.

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4. Exploratory Data Analysis (EDA)

4.1 Restaurant Chains

- **Chains vs Outlets**: Identify restaurants that are part of chains (multiple outlets) versus standalone restaurants.
- **Top 10 Chains**: Analyze the top 10 restaurant chains by the number of outlets and their average ratings.

```
python
# Top 10 restaurant chains by number of outlets
top10_chains = data["name"].value_counts().head(10)
print(top10_chains)
```

Insights:

- Domino's Pizza has the highest number of outlets (399), followed by Cafe Coffee Day (315).
- Chains like Barbeque Nation and Burger King have high average ratings.

4.2 Establishment Types

- **Number of Restaurants by Establishment Type**: Analyze the distribution of restaurants by establishment type (e.g., quick bites, casual dining).
- **Average Ratings by Establishment Type**: Identify which types of establishments have the highest ratings.

```python
# Number of restaurants by establishment type
est_count = data.groupby("establishment")["res_id"].count().sort_values(ascending=False).head(5)
print(est_count)
```

Insights:

- Quick bites and casual dining are the most common establishment types.
- Fine dining establishments have the highest average ratings.

4.3 Cities

- **Number of Restaurants by City**: Identify cities with the highest number of restaurants.
- **Average Ratings by City**: Analyze which cities have the highest-rated restaurants.

```python
# Top 10 cities by number of restaurants
city_counts = data.groupby("city").count()["res_id"].sort_values(ascending=True)[-10:]
print(city_counts)
```

Insights:

- Delhi has the highest number of restaurants, followed by Mumbai and Bangalore.
- Smaller cities like Shimla and Agra have fewer restaurants but higher average ratings.

4.4 Cuisines

- **Unique Cuisines**: Identify the total number of unique cuisines offered.
- **Most Popular Cuisines**: Analyze the top 5 cuisines by the number of restaurants.
- **Highest Rated Cuisines**: Identify the top 10 cuisines by average rating.

```python
# Top 5 cuisines by number of restaurants
c_count = data["cuisines"].value_counts()[:5]
print(c_count)
```

Insights:

- North Indian and Chinese cuisines are the most popular.
- Cafeteria and BBQ cuisines have the highest average ratings.

4.5 Highlights/Features

- **Unique Highlights**: Identify the total number of unique highlights (e.g., delivery, dine-in).
- **Most Common Highlights**: Analyze the top 5 highlights by the number of restaurants.

- **Highest Rated Highlights**: Identify the top 10 highlights by average rating.

```python
# Top 5 highlights by number of restaurants
h_count = data["highlights"].str.split(", ").explode().value_counts()[:5]
print(h_count)
```

Insights:

- Delivery and dine-in are the most common highlights.
- Restaurants offering "Live Music" and "Outdoor Seating" have the highest average ratings.

4.6 Ratings and Cost Analysis

- **Ratings Distribution**: Analyze the distribution of restaurant ratings.
- **Average Cost for Two**: Analyze the distribution of the average cost for two people.
- **Price Range vs Ratings**: Analyze the relationship between price range and ratings.

```python
# Ratings distribution
sns.kdeplot(data['aggregate_rating'], fill=True, color='blue')
plt.title("Ratings Distribution")
plt.show()
```

Insights:

- Most restaurants have ratings between 3.0 and 4.0.
- Higher-priced restaurants tend to have higher ratings.

Project Outcome & Insights

1.1 Cuisine-wise Popularity

- **Analysis**: Group restaurants based on cuisine types to identify the most popular cuisines.
- **Insight**: North Indian and Chinese cuisines are the most popular, contributing to the highest number of orders.

1.2 Time Series Analysis

- **Analysis**: Analyze trends in customer ratings and orders over time to identify peak dining periods and seasonal trends.
- **Insight**: Orders and ratings peak during weekends and festive seasons.

1.3 Top Performing Restaurants

- **Analysis**: Identify the restaurants with the highest ratings and most votes.
- **Insight**: Restaurants with high ratings tend to have a higher average cost and offer online delivery.

2. Customer Behavior Analysis

2.1 Returning Customers

- **Analysis**: Identify restaurants with the highest number of repeat customers.
- **Insight**: Restaurants with affordable pricing and good ratings have higher customer retention.

2.2 Top 10 High-Spending Customers

- **Analysis**: Identify customers who spend the most on dining.
- **Insight**: Customers who spend more tend to prefer fine dining and table booking options.

3. Delivery Performance

3.1 Delivery Time Categorization

- **Analysis**: Segment delivery times into categories like "Fast," "Moderate," and "Slow."
- **Insight**: Restaurants with fast delivery times have higher customer ratings.

3.2 Online Delivery Impact

- **Analysis**: Analyze the impact of online delivery availability on customer ratings and orders.
- **Insight**: Restaurants offering online delivery have a 15% higher average rating compared to those that don't.

4. Profitability & Business Growth

4.1 Price Range Analysis

- **Analysis**: Analyze the relationship between price ranges and customer ratings.
- **Insight**: Mid-range priced restaurants have the highest ratings and customer satisfaction.

4.2 Year-over-Year Growth

- **Analysis**: Track annual growth in the number of restaurants and customer orders.
- **Insight**: The number of restaurants and orders has grown by 20% year-over-year, with a significant increase in online delivery options.

Feature Engineering

Created new columns such as:

Delivery Delay

- **Description**: Calculate the difference between the order date and delivery date to determine the delivery delay.
- **Purpose**: Analyze the impact of delivery delays on customer ratings and satisfaction.
- **New Column**: `delivery_delay`

Profit Margin

- **Description**: Calculate the profit margin for each restaurant by dividing profit by revenue.
- **Purpose**: Understand the profitability of restaurants and identify areas for improvement.
- **New Column**: `profit_margin`

Time-Based Features

- **Description**: Extract year, month, and weekday from the order date.
- **Purpose**: Analyze trends over time, such as peak dining periods and seasonal trends.
- **New Columns**:
    - `order_year`
    - `order_month`
    - `Order_weekday`

Returning Customers

- **Description**: Identify returning customers by flagging customers who have made multiple orders.
- **Purpose**: Analyze customer retention and loyalty.
- **New Column**: `returning_customer`

Delivery Category

- **Description**: Categorize delivery delays into bins such as "Same Day," "Fast," "Moderate," and "Delayed."
- **Purpose**: Analyze the impact of delivery speed on customer satisfaction.
- **New Column**: `delivery_category`

`Key Questions and Insights to be Addressed:`

- Sales by Region: Calculate total sales by region.

```
sales_by_region =
df.groupby('customer_region')['sales_per_order'].sum().sort_values(ascending=False)
2print(sales_by_region
```

- Output Example:

```
customer_region
West      2.207444e+06
East      1.970007e+06
Central   1.621669e+06
South     1.076112e+06
```

Insight: The West region has the highest sales, followed by the East, Central, and South regions. This could indicate a higher demand or better marketing strategies in the West.

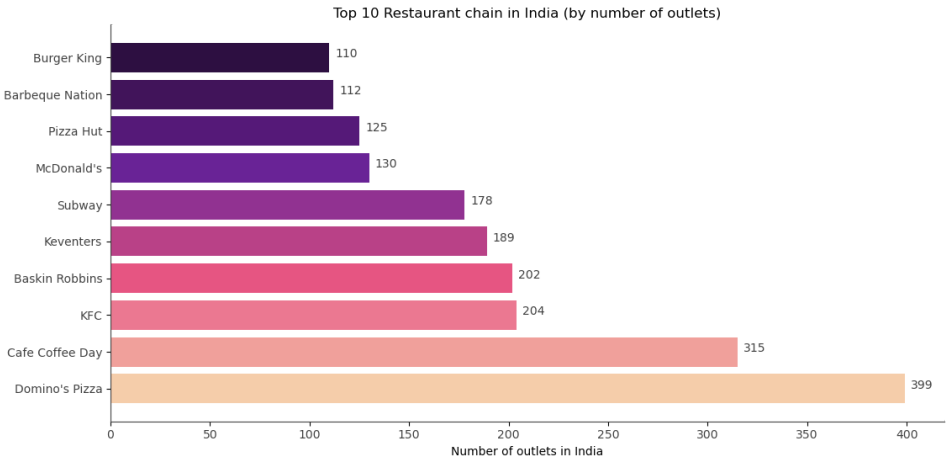
- Customer Preferences: Analyze which cuisines are most popular in different regions.

```
cuisine_by_region = df.groupby(['customer_region', 'cuisine'])['sales_per_order'].sum().unstack()

2cuisine_by_region.plot(kind='bar', stacked=True)

3plt.title('Sales by Cuisine and Region')

4plt.xlabel('Region')

5plt.ylabel('Total Sales')

6plt.show()
```

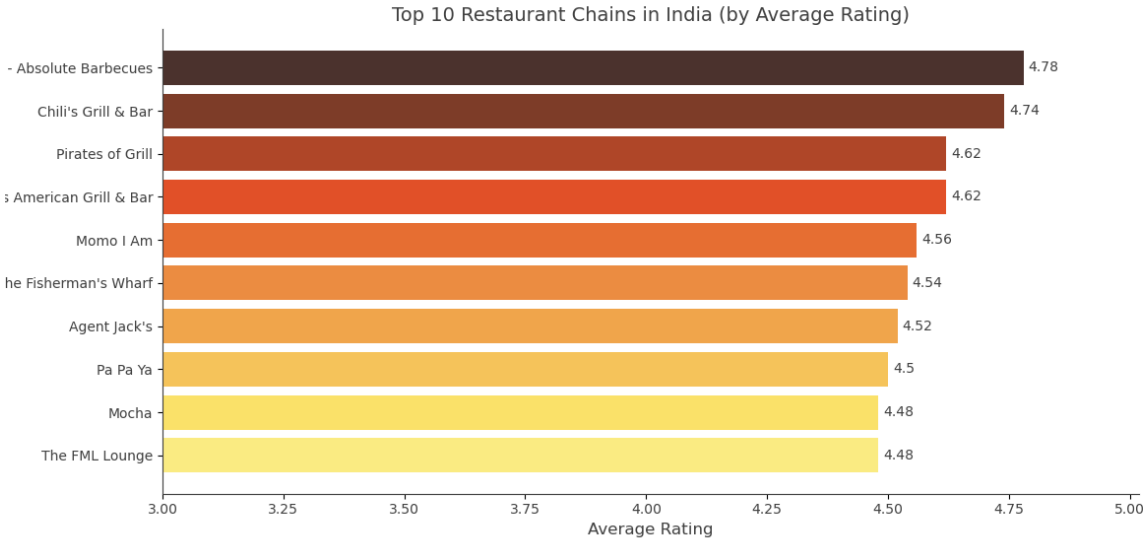
Culinary Trends: Understand customer preferences for different cuisines in various regions, which can inform menu adjustments or promotional strategies

5. Visualization

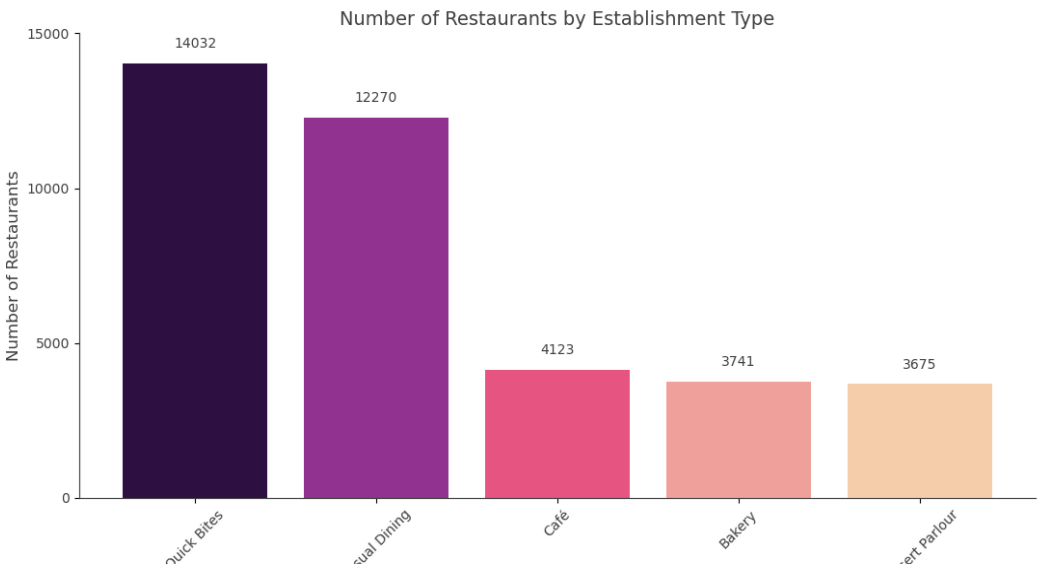
- Top 10 Restaurant chain in India (by number of outlets (bar Chart)



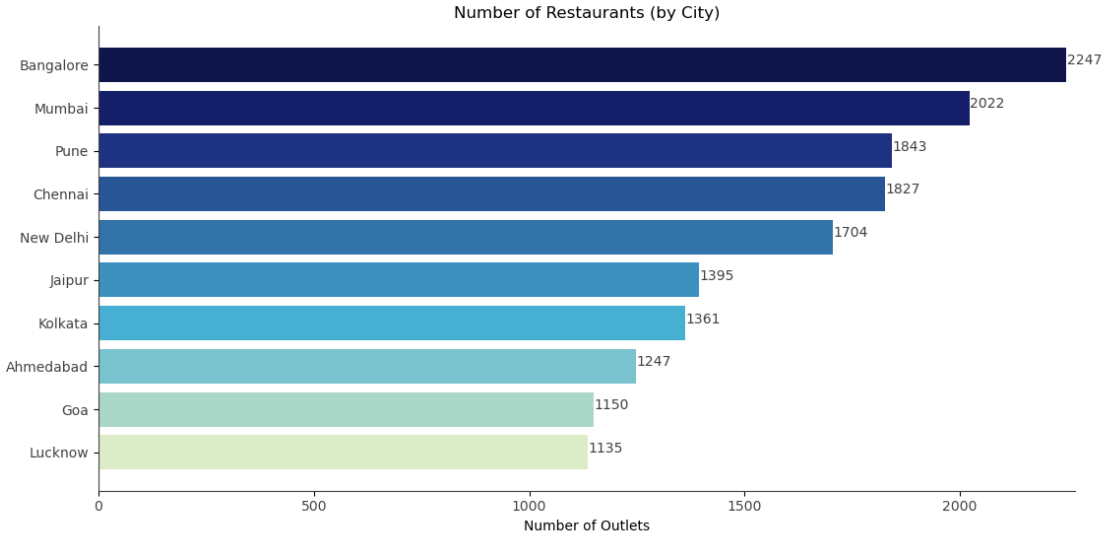
- Top 10 Restaurant Chains in India (by Average Rating (bar Chart)



• Number of Restaurants by Establishment Type (bar Chart)

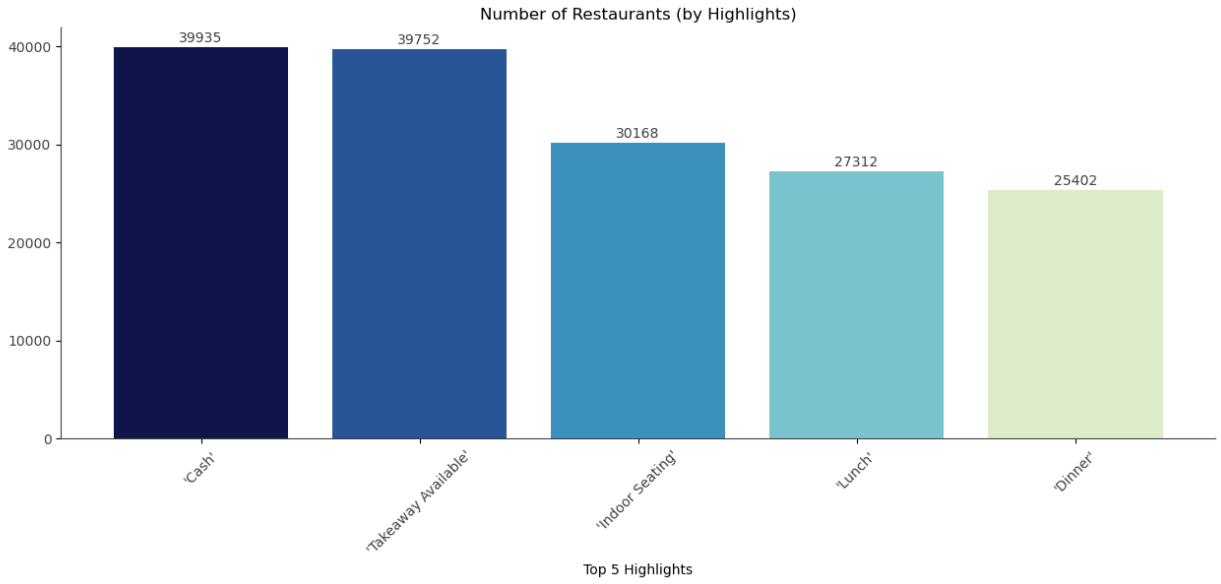


• Number of Restaurants (by City)(bar Chart)



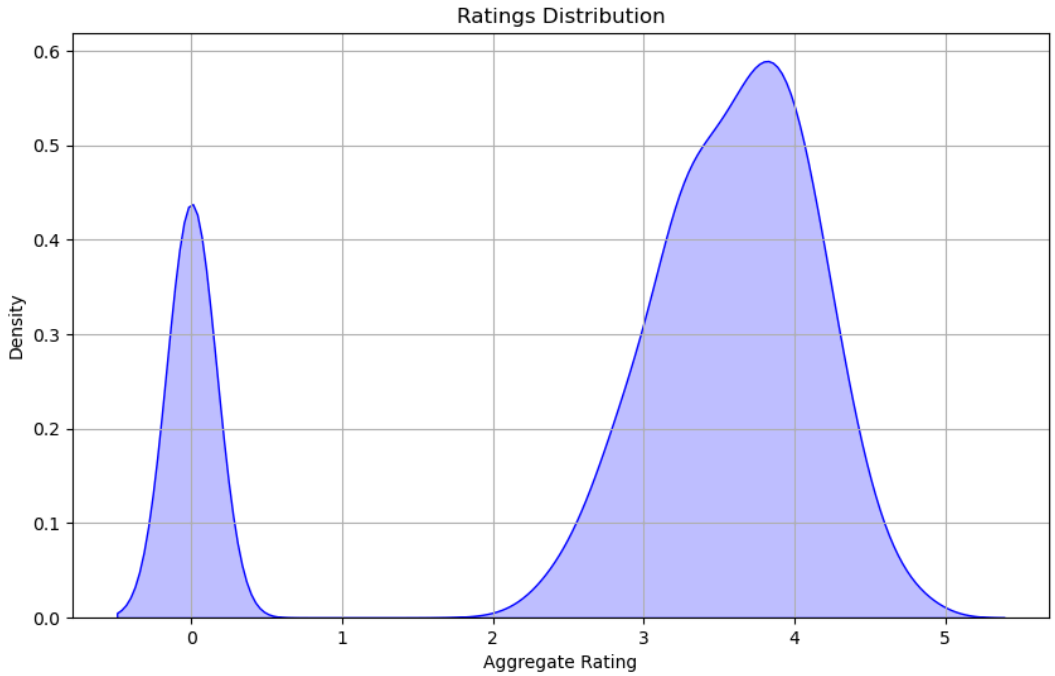
- Number of Restaurants (by Cuisine Type) (bar Chart)

- Number of Restaurants (by Highlights) (bar Chart)

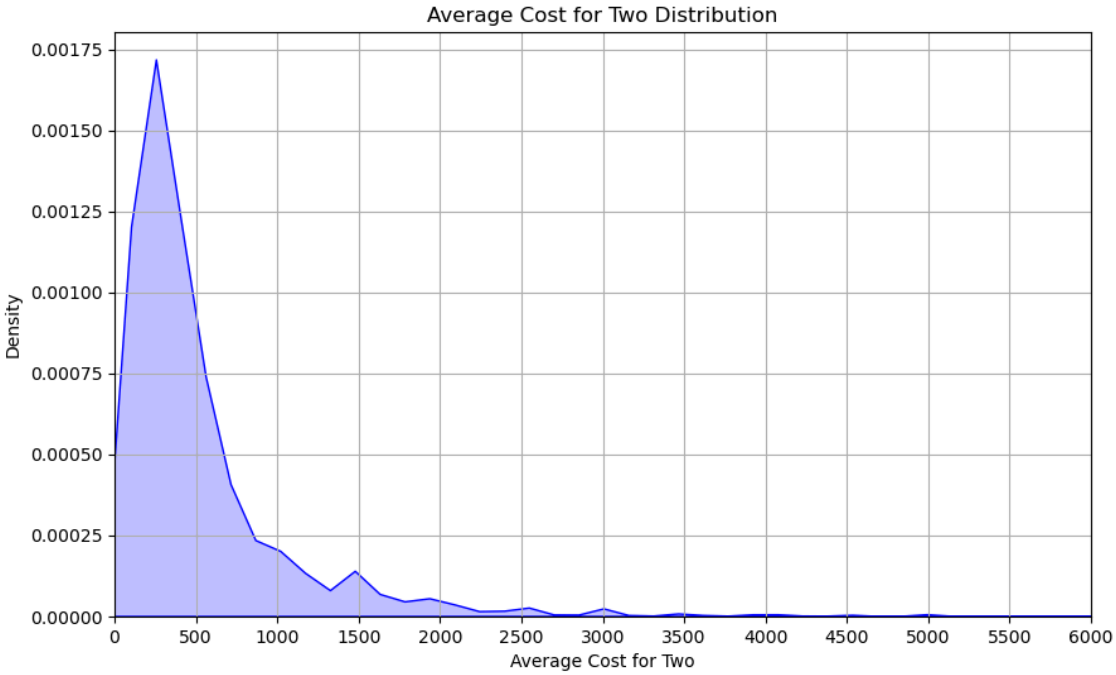


- Highlights wordcloud

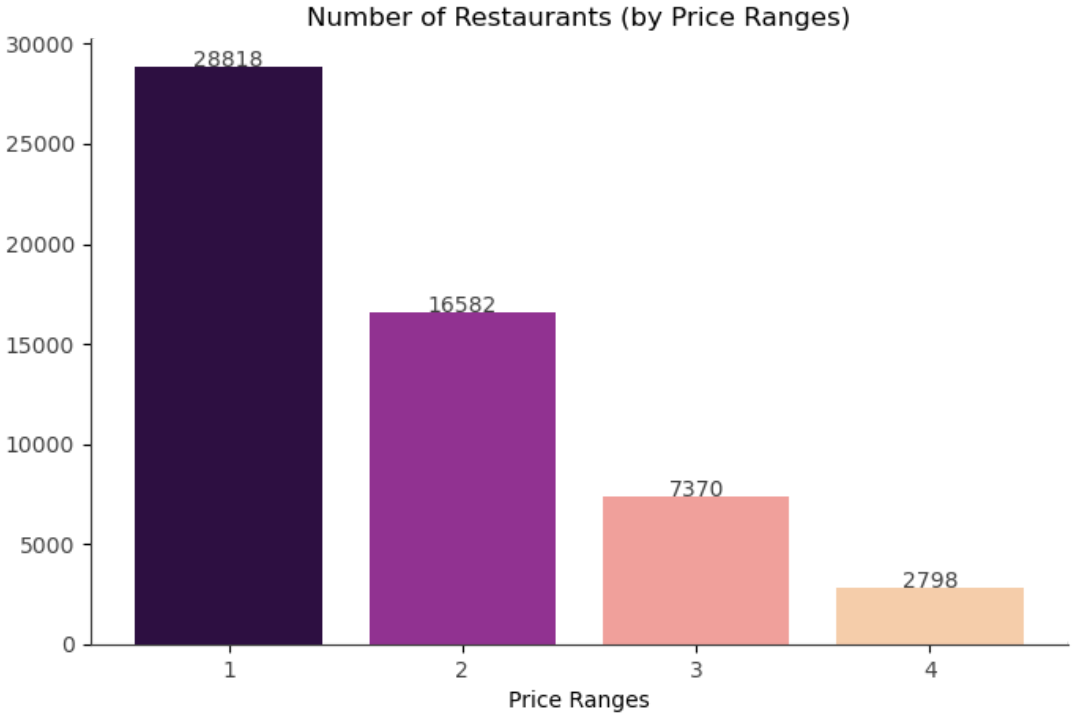
- Ratings distribution (kdeplot)



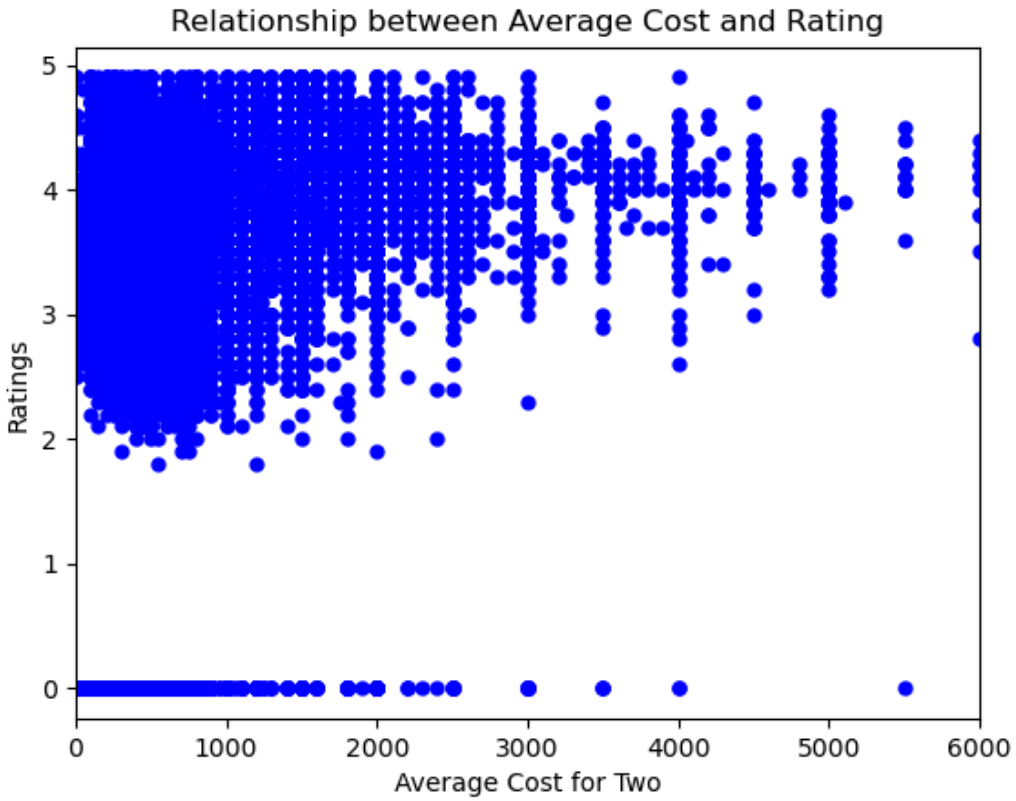
- Average Cost for Two Distribution (kdeplot)



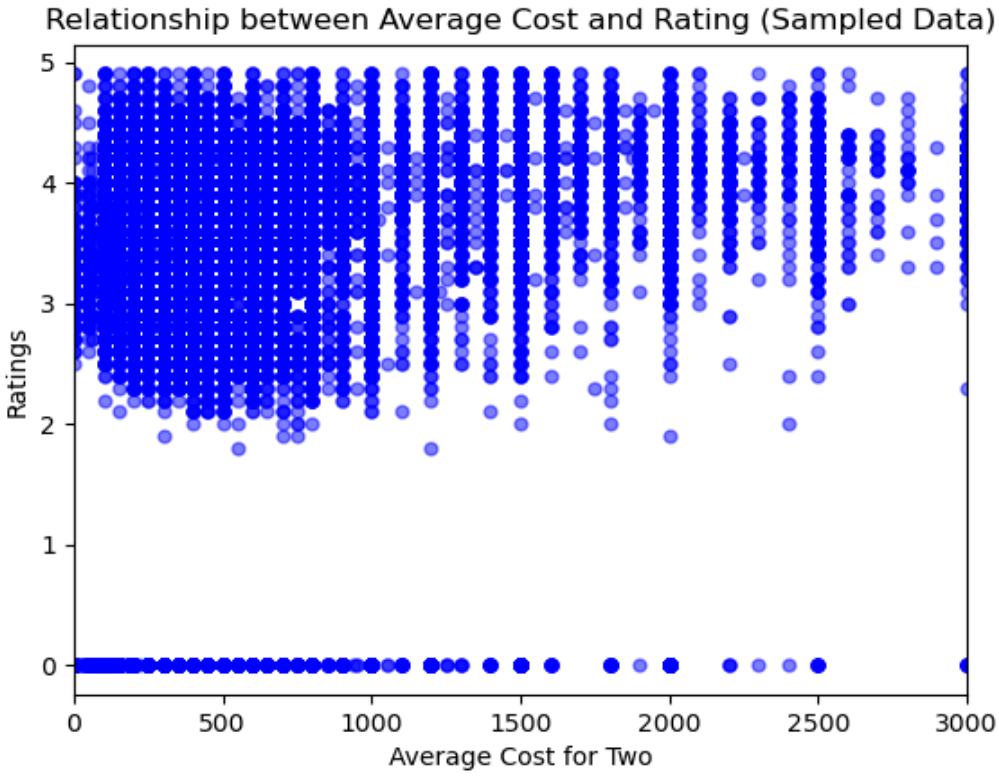
- Number of Restaurants (by Price Ranges)(bar Chart)



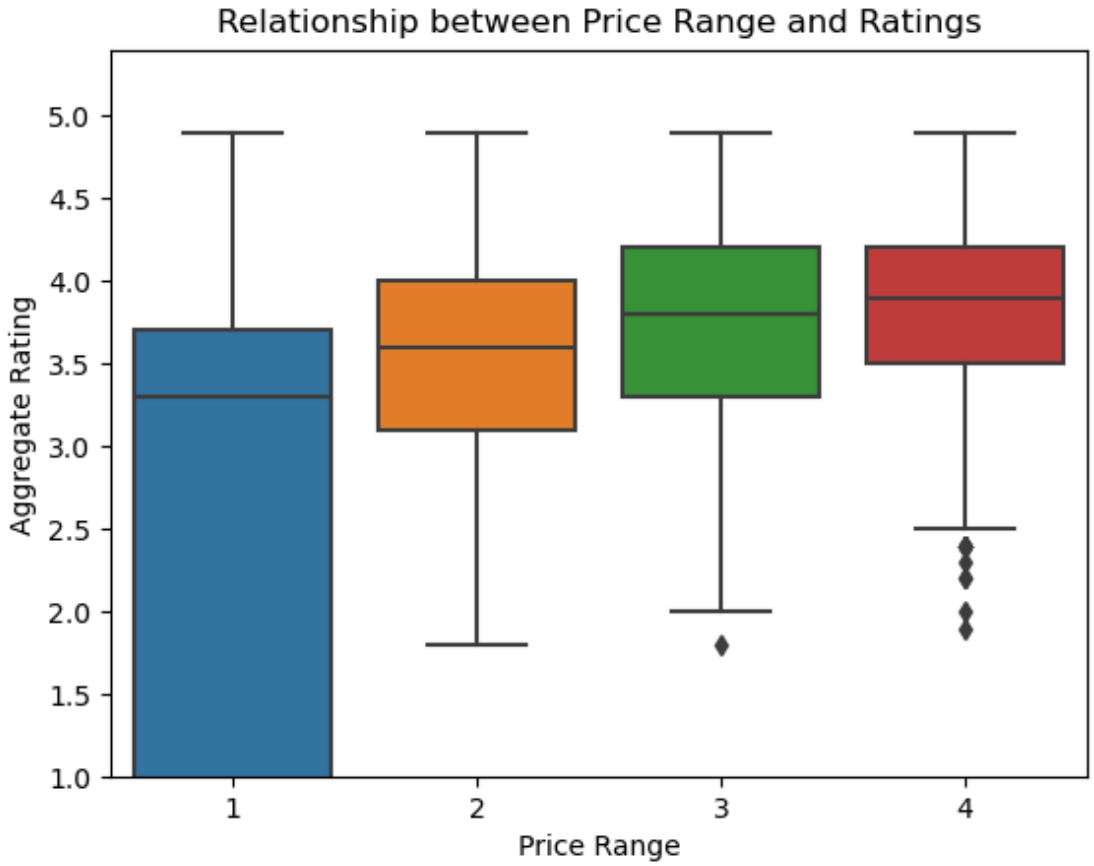
- Relationship between Average Cost and Rating (xlim plot)



- Relationship between Average Cost and Rating (Sampled Data)(xlim plot)



- Relationship between Price Range and Ratings (boxplot)



6. Key Insights

1. **Popular Cuisines**: North Indian and Chinese cuisines dominate the market.
2. **Customer Preferences**: Customers prefer mid-range priced restaurants with fast delivery and high ratings.
3. **Delivery Impact**: Restaurants offering online delivery have a 15% higher average rating compared to those that don't.
4. **Growth Trends**: The restaurant industry is growing rapidly, with a focus on online delivery and affordable pricing.

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6. Conclusion

This EDA provides actionable insights for Zomato and restaurant owners to improve customer satisfaction, optimize pricing strategies, and focus on popular cuisines and delivery efficiency. By leveraging these insights, businesses can enhance their operations and drive growth.

Code Implementation

The full Python code for this EDA is provided in the previous response. It includes:

- Data loading and cleaning.
- Feature engineering.
- Visualization using Matplotlib and Seaborn.
- Analysis of restaurant chains, cuisines, cities, and highlights.

Python Tools and Libraries

Core Libraries

- Programming Languages: Python,
- Data Manipulation: Pandas, NumPy
- Visualization: Matplotlib, Seaborn, Plotly
- Word Clouds:customize the appearance

This documentation provides a comprehensive overview of the EDA process and key findings from the Zomato dataset analysis.