Yulu Bike Sharing Demand Analysis

1. Problem Statement

Yulu, a micro-mobility company, provides bike-sharing services in Indian metropolitan cities. The business challenge was to understand:

- How **seasonal factors** (spring, summer, fall, winter) and

- **Weather conditions** (clear, cloudy, mist, rain/snow)

affect **bike rental demand** across weekdays and weekends.

The goal was to derive **data-driven strategies** for fleet allocation, operational scaling, and revenue optimization.

◆ 2. Dataset

- **Size:** 10,000+ rental records

- **Features:**

    - Date, Season, Weather, Temperature, Humidity, Windspeed

    - Count of rentals (target variable)

    - Day type: weekday/weekend

◆ 3. Methodology

Step 1: Data Cleaning & Preprocessing

- Handled missing values using median imputation.

- Removed outliers in rental counts using IQR method.

- Standardized numerical features (temperature, humidity, windspeed).

Step 2: Exploratory Data Analysis (EDA)

- **Descriptive Statistics:** Average rentals across weekdays vs weekends.

- **Visualization:**

  - Line plots to track rental demand trends.

  - Boxplots to compare demand across seasons.

  - Bar charts for weather-wise demand.

- **Key Observation:** Clear weather & summer/fall seasons showed peak rentals.

Step 3: Hypothesis Testing

- **ANOVA:** Tested whether mean rentals differ across seasons.

  - ✅ Result: Significant difference → season impacts rentals.

- **Chi-Square Test:** Association between weather and rental demand category (high/low).

  - ✅ Result: Significant → weather strongly influences demand.

- **Shapiro-Wilk & Levene's Test:** Validated assumptions of normality & equal variance before applying ANOVA.

Step 4: Insights & Business Strategy

- **Weekdays vs Weekends:** Demand is nearly equal → Both need fleet allocation priority.

- **Weather Impact:** Rentals drop drastically in adverse weather (rain, mist, snow).

- **Seasonal Impact:**

  - Summer/Fall → High demand → **Scale up operations**

    ○ Winter/Bad weather → Low demand → **Scale down operations**

◆ 4. Results

- Statistical evidence confirms **season & weather significantly affect rentals**.

- Clear patterns allow **predictable fleet allocation**.

- Data-driven strategy to dynamically adjust operations can potentially:

  ○ Increase fleet utilization rate by **15–20%**

  ○ Reduce operational losses during low-demand periods

  ○ Enhance customer satisfaction with bike availability during peaks

---

◆ 5. Tools & Technologies

- **Python Libraries:** Pandas, NumPy, Matplotlib, Seaborn, Statsmodels, SciPy

- **Statistical Tests:** ANOVA, Chi-Square, Shapiro-Wilk, Levene's Test

- **Visualization Tools:** Seaborn, Matplotlib

◆ 6. Business Impact

- **Operational Efficiency:** Right-sizing the fleet reduces idle bikes.

- **Revenue Growth:** Optimized demand-based supply increases trip completion rates.

- **Scalability:** Framework can be extended to other cities with similar data.

◆ 7. Conclusion

This analysis provided Yulu with **data-driven fleet allocation strategies**, ensuring balanced supply across weekdays and weekends while considering seasonality and weather conditions.

Key Recommendations:

- Prioritize both weekdays and weekends equally.

- Scale down fleet in winters or adverse weather.

- Upscale operations in summer and fall seasons with clear weather.