

# How **Weather** Conditions Impact **Bike-Share** Usage Patterns in Central Chicago

## A Data-Driven Analysis

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*Project Objective & Research Question*

**Understand the effect of weather on bike-share usage and predict patterns**

"How do weather conditions impact bike-share usage patterns, including ride volume, duration, and station activity between Members and Casual Users in Central Chicago, and can current and forecasted weather data be used to predict usage?"



# Supporting Questions

- 1** How Does the Weather (Type, Temp, Humidity, etc.) Impact Ride Volume?
- 2** What Temporal Trends Emerge Across Weather Conditions?
- 3** How Do Different User Types Respond to Weather?
- 4** How Do Weather Variables Correlate with Overall Ridership?

# Data Collection, Integration, and Limitations

# Data Collection

**Monthly Usage Data from Divvy  
Bike Share Chicago x 2020-2023  
(Kaggle)**

**Historical Bulk Weather Data of  
the City of Chicago from  
OpenWeatherMap.com**

**Live Weather API**

## HIGHLIGHTS

# Data Cleanup and Integration

Process:

Divvy Bike Share

- A For loop
  - Removing Irrelevant and Bad Data Columns
  - Added Metrics
  - Merging Monthly Data

Incorporating Weather Data

- Inner Merge datasets by timestamp

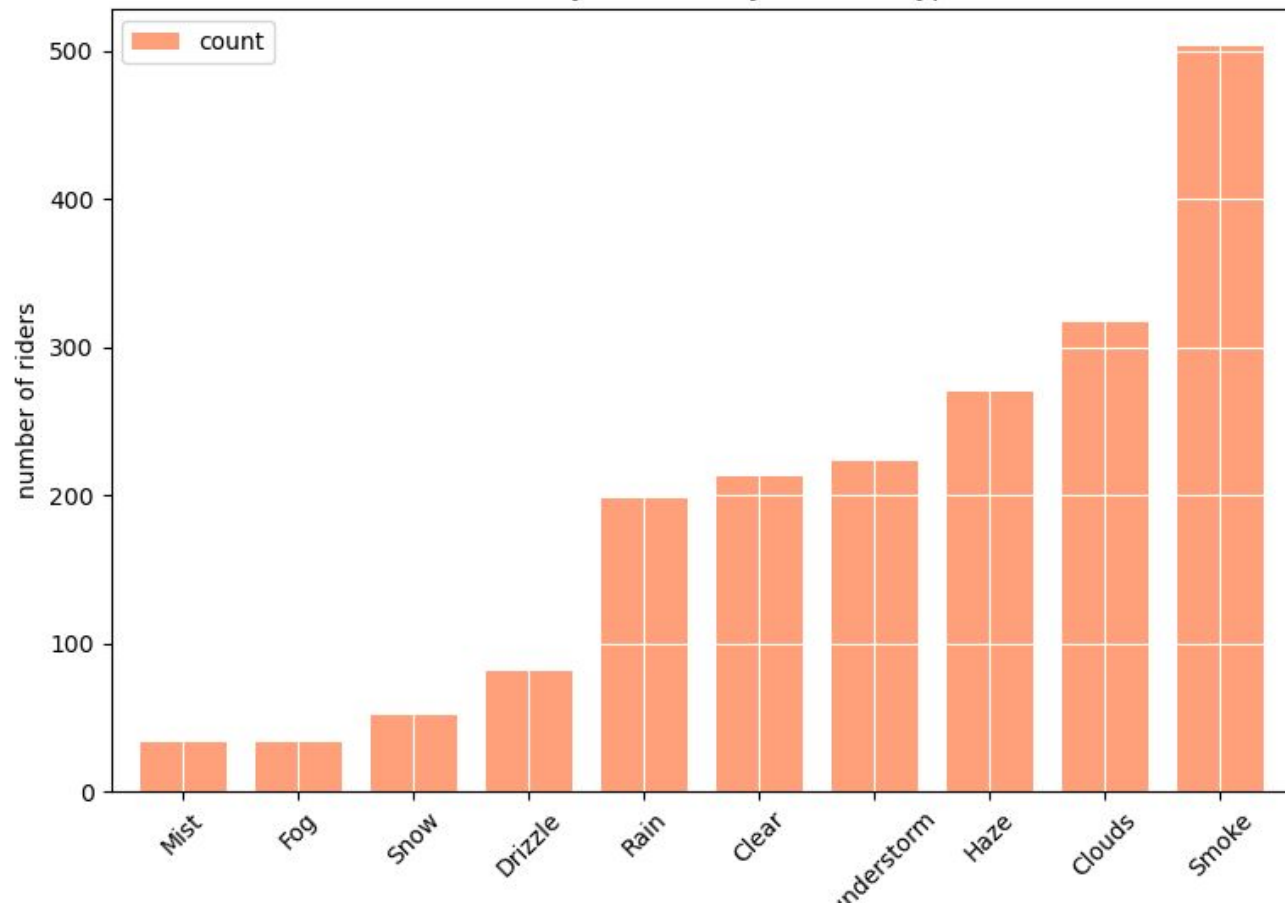
Known Limitations

Bike Share Data	ride_id		start_day	start_hour	start_year	trip_length	
	0	782CEA3C6968D2A6	2020-04-01	0	2020	0 days 00:00	
	1	07F785C9DDA3404C	2020-04-01	0	2020	0 days 00:00	
	2	1FD159E93F7BAFA1	2020-04-01	0	2020	0 days 00:00	
	3	091D47E4F0FC5022	2020-04-01	0	2020	0 days 00:00	
	4	643593E85E46A45C	2020-04-01	0	2020	0 days 00:00	
	...	...	...	...	...	...	
Weather Data	9813892	6D855DB843848DB3	2023-11-30	23	2023	0 days 00:00	
	9813893	447027EB102601BE	2023-11-30	23	2023	0 days 00:00	
	9813894	993257B9E439A2DD	2023-11-30	23	2023	0 days 00:00	
	9813895	9B518D5122FD7D72	2023-11-30	23	2023	0 days 00:00	
	9813896	C4C352D0A2C1A450	2023-11-30	23	2023	0 days 00:00	
			temp	dew_point	feels_like	temp_min	temp_max
	0	2020-01-01	0	-2.08	-5.63	-9.08	-2.31
Resulting Data	1	2020-01-01	1	-1.99	-5.23	-8.99	-2.23
	2	2020-01-01	2	-1.87	-4.96	-8.87	-2.23
	3	2020-01-01	3	-1.90	-4.55	-8.90	-2.79
	4	2020-01-01	4	-2.18	-4.67	-9.18	-2.78
	...	...	...	...	...	...	...
	37232	2023-12-31	19	0.72	-1.19	-5.23	0.00
	37234	2023-12-31	20	0.63	-1.70	-5.17	0.00
37236	2023-12-31	21	0.88	-1.19	-4.85	0.53	
37238	2023-12-31	22	0.77	-1.15	-4.38	-0.03	
37241	2023-12-31	23	0.43	-1.17	-4.81	-0.03	
Resulting Data	ride_id		start_day	start_hour	start_year	trip_length	
	0	782CEA3C6968D2A6	2020-04-01	0	2020	0 days 00:00	
	1	07F785C9DDA3404C	2020-04-01	0	2020	0 days 00:00	
	2	1FD159E93F7BAFA1	2020-04-01	0	2020	0 days 00:00	
	3	091D47E4F0FC5022	2020-04-01	0	2020	0 days 00:00	
	4	643593E85E46A45C	2020-04-01	0	2020	0 days 00:00	
	...	...	...	...	...	...	
	9813892	6D855DB843848DB3	2023-11-30	23	2023	0 days 00:00	
	9813893	447027EB102601BE	2023-11-30	23	2023	0 days 00:00	
	9813894	993257B9E439A2DD	2023-11-30	23	2023	0 days 00:00	
9813895	9B518D5122FD7D72	2023-11-30	23	2023	0 days 00:00		
9813896	C4C352D0A2C1A450	2023-11-30	23	2023	0 days 00:00		

# Usage Trends by Weather Type

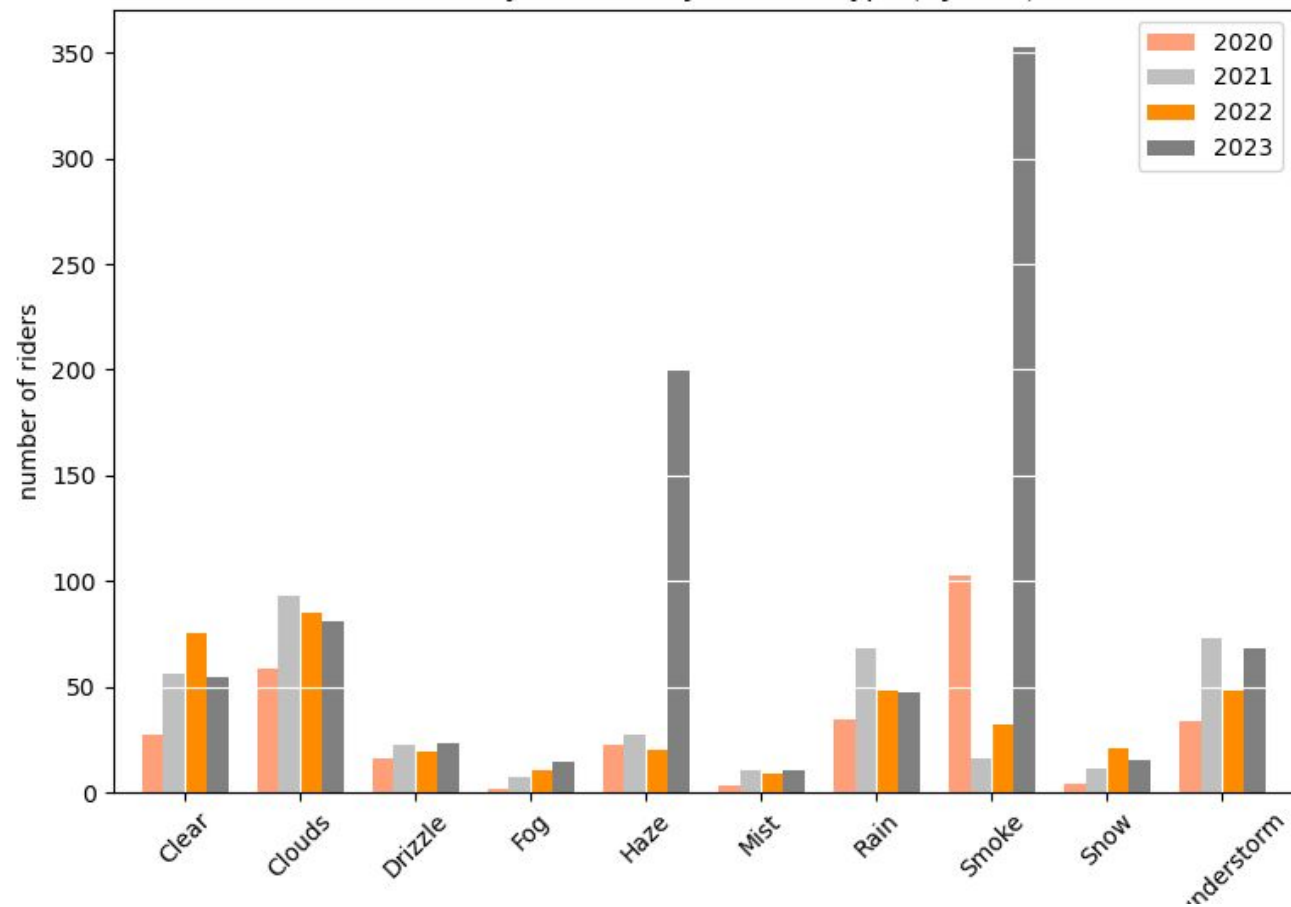


Probability of Riders by Weather Type

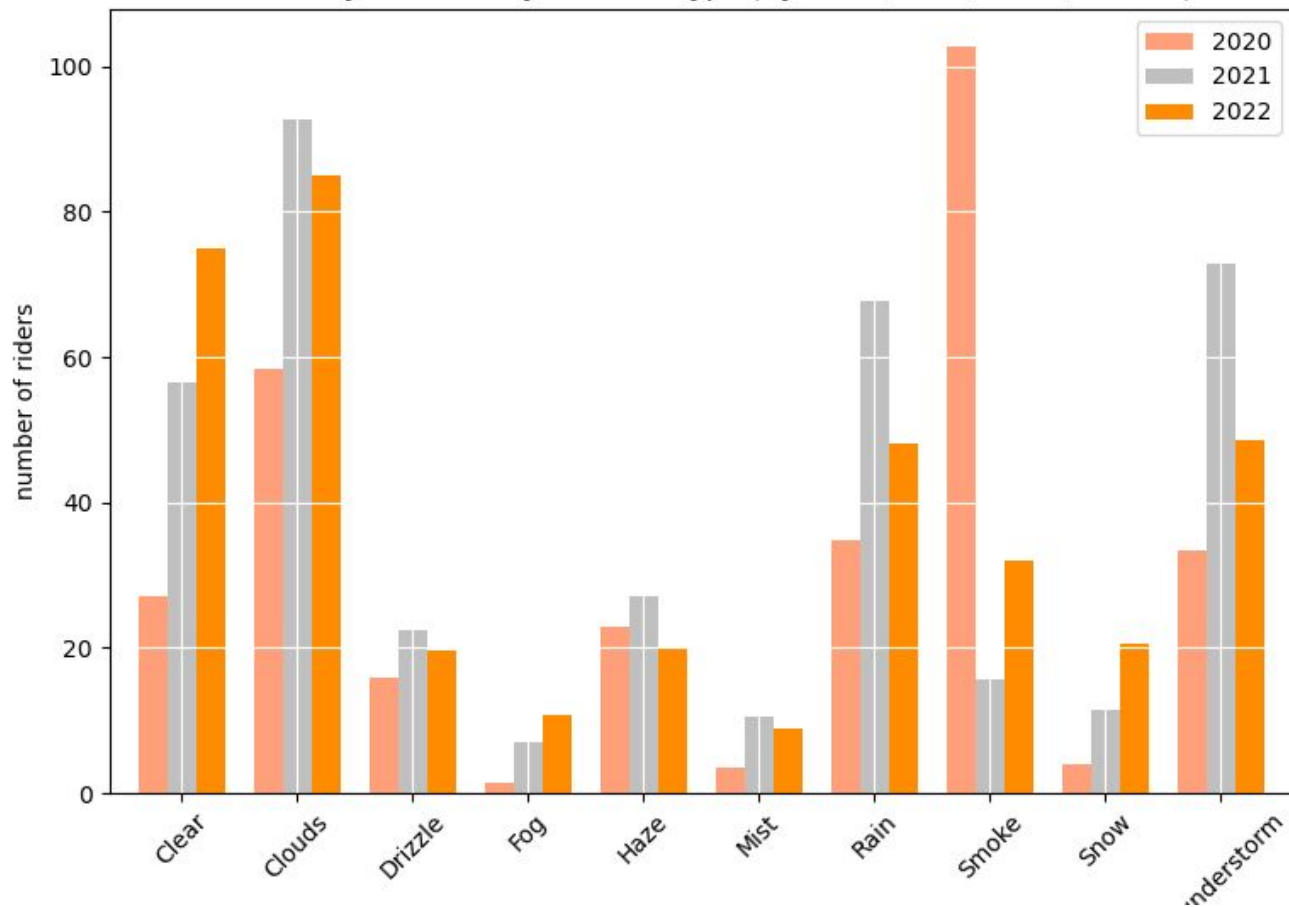




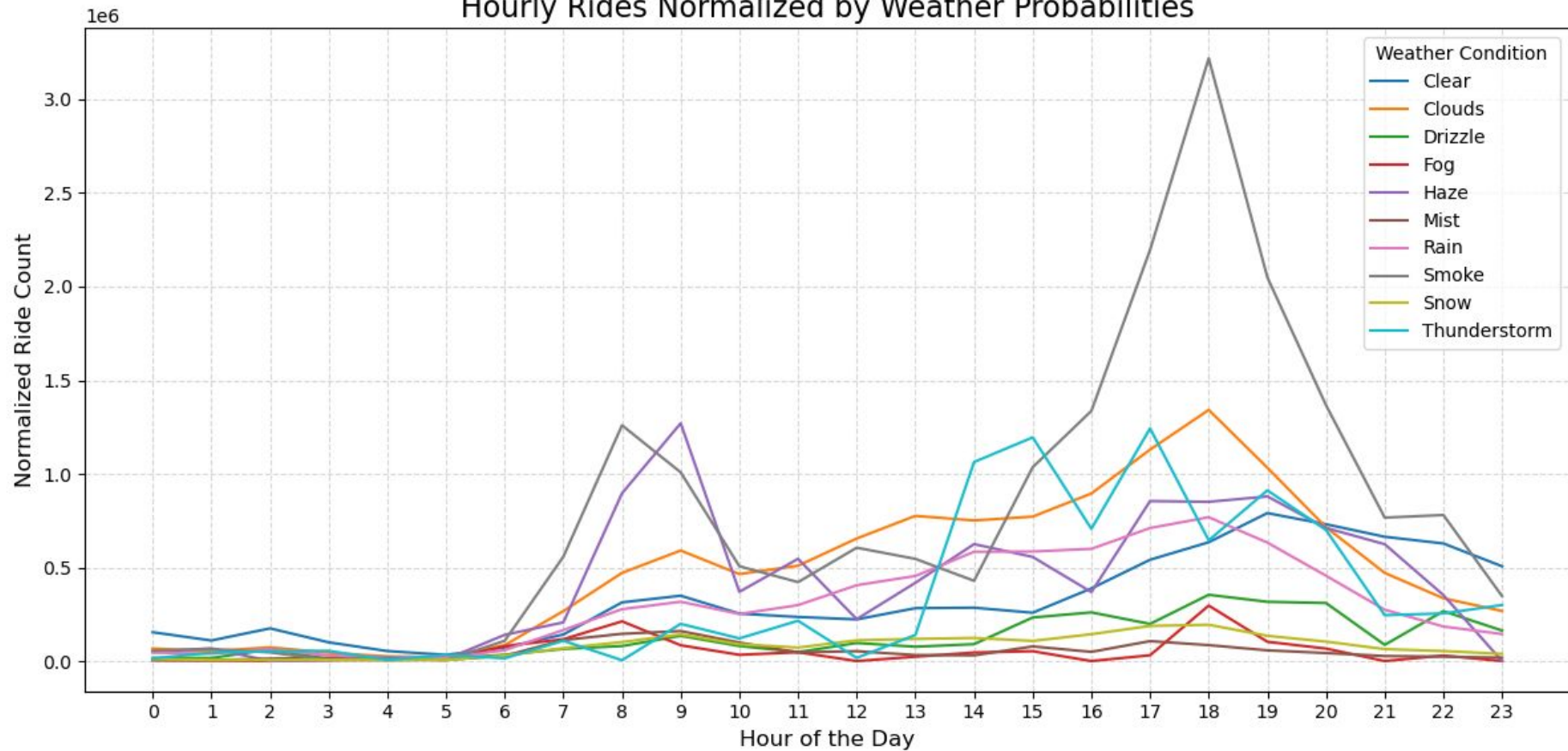
Probability of Riders by Weather Type (By Year)

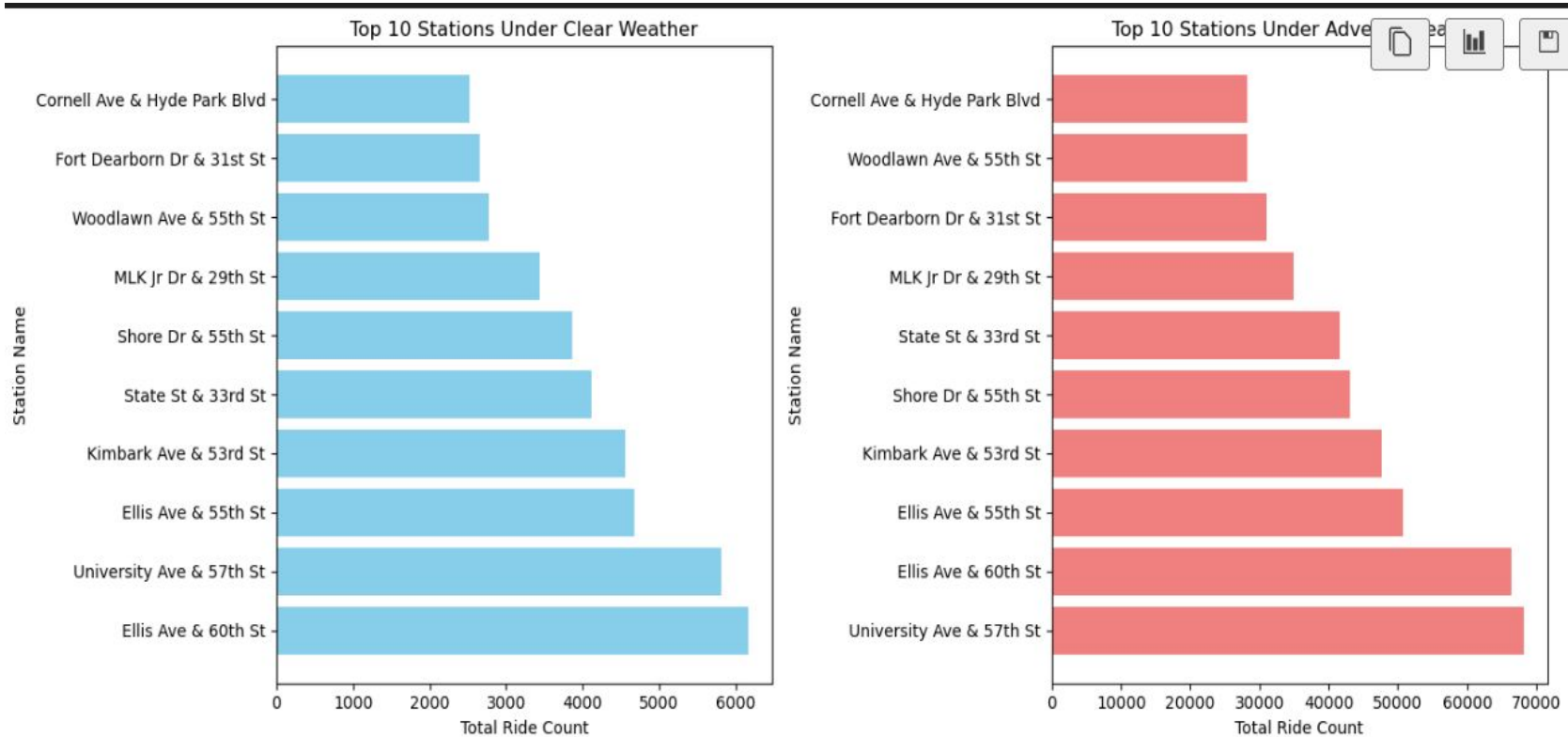


Probability of Riders by Weather Type (By Years; 2020, 2021, & 2022)



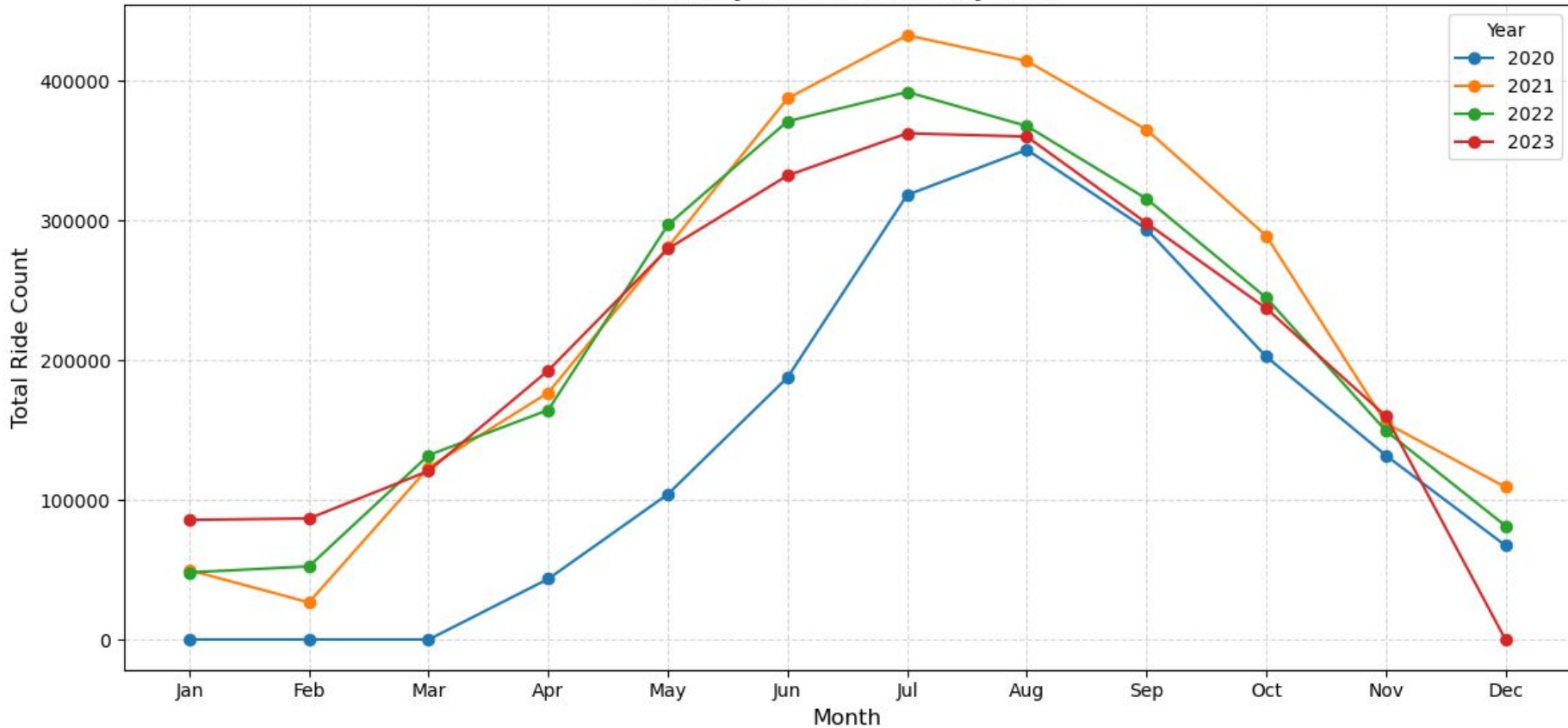
# Hourly Rides Normalized by Weather Probabilities



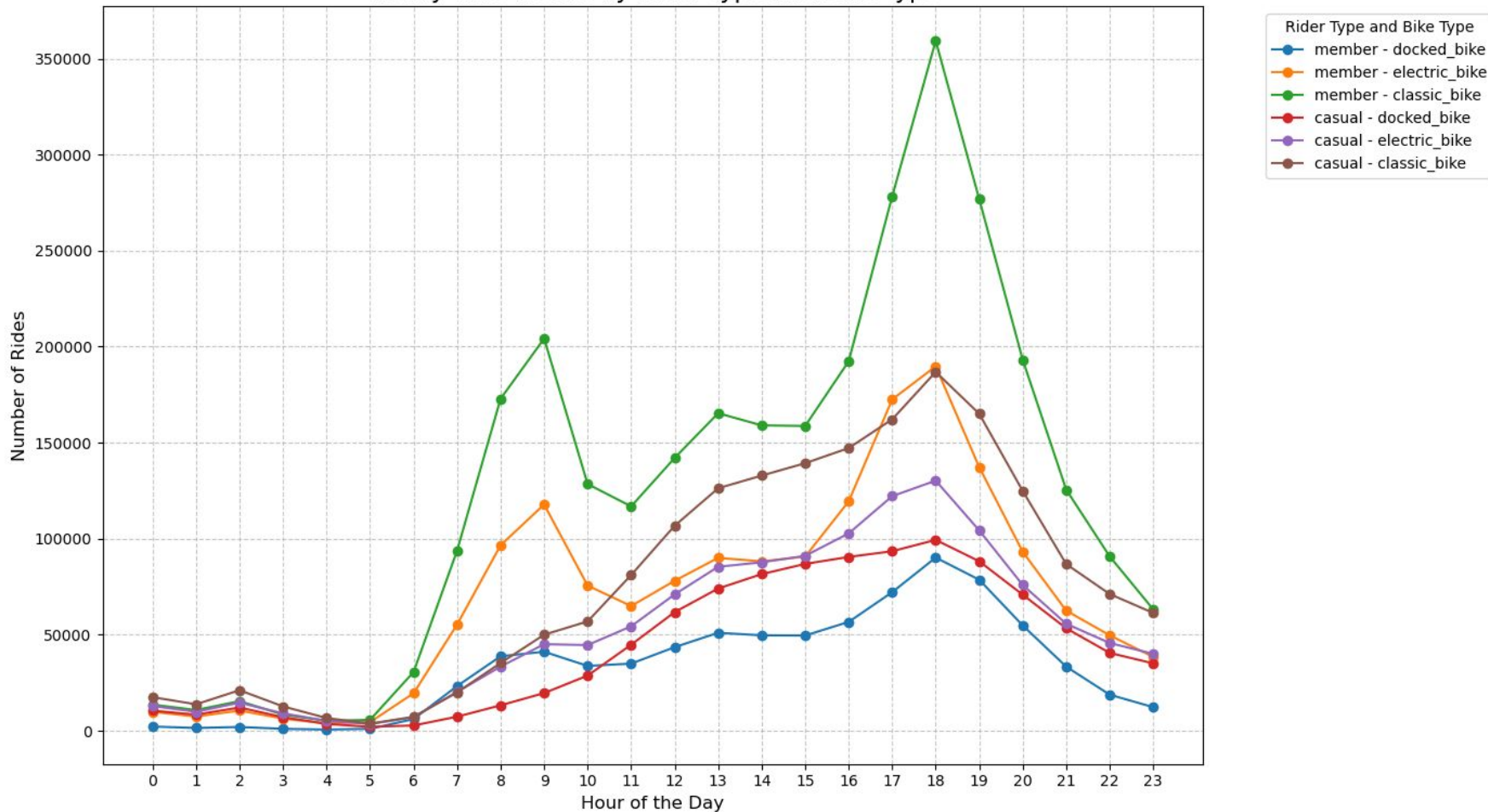


# Usage Trends by Time

# Monthly Ride Volume by Year



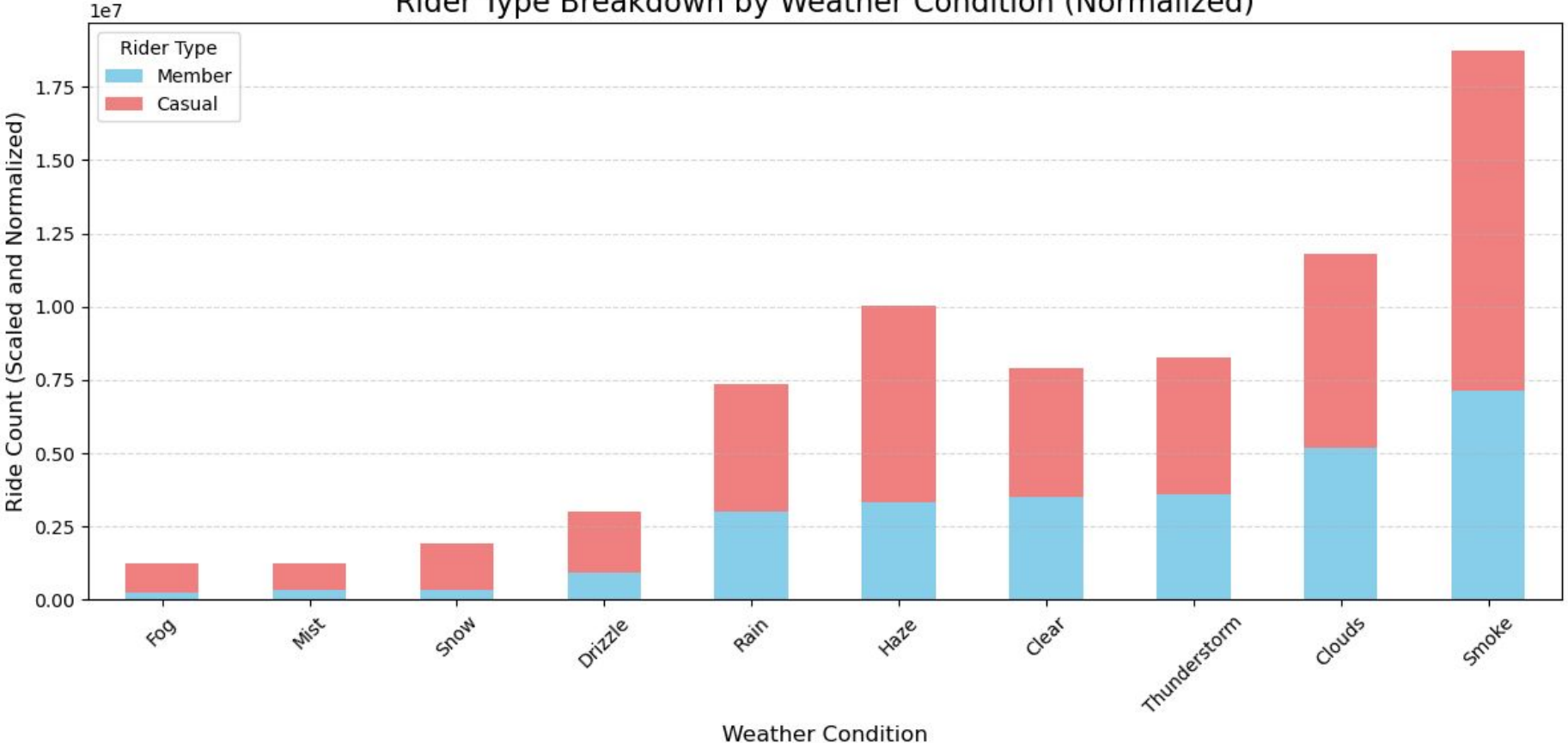
# Hourly Ride Trends by Rider Type and Bike Type



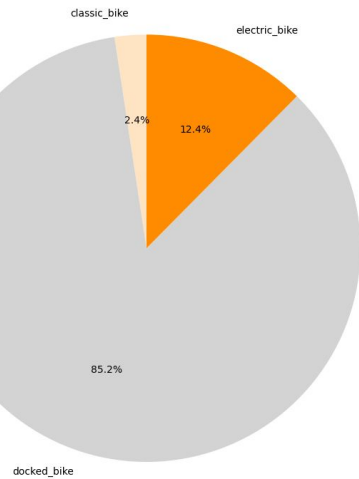


# Rider Type Preferences

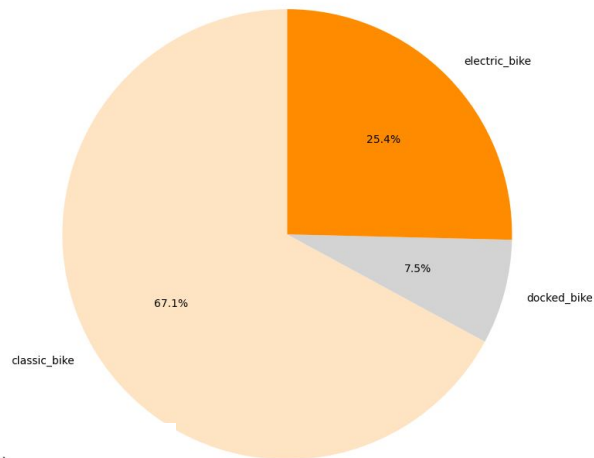
Rider Type Breakdown by Weather Condition (Normalized)



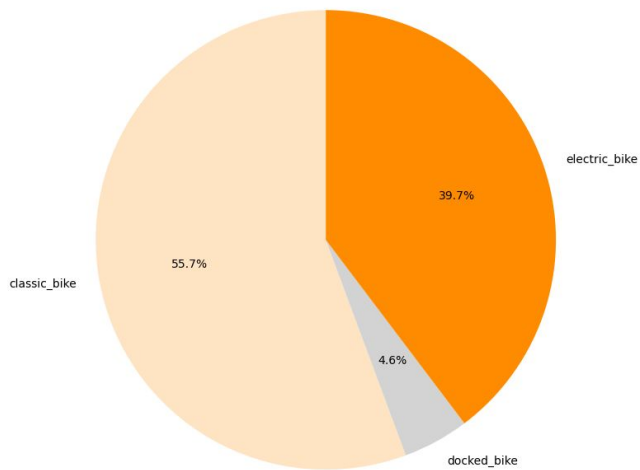
Rideable Type Distribution in 2020 (Complete)



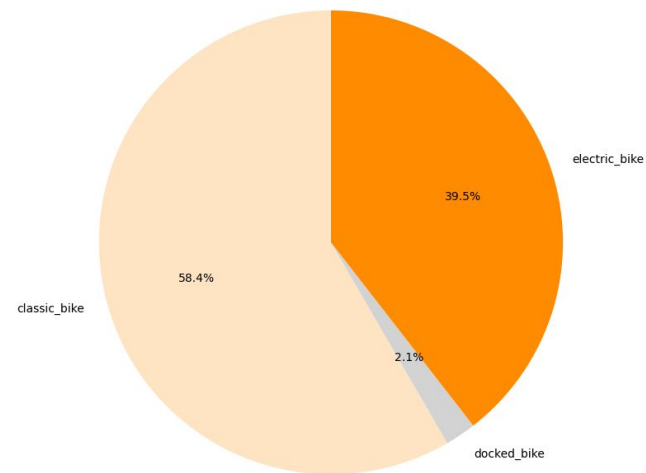
Rideable Type Distribution in 2021 (Complete)



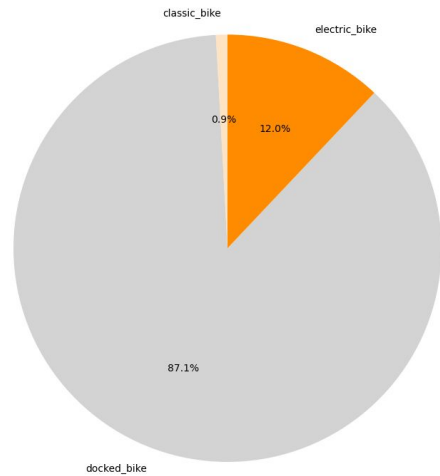
Rideable Type Distribution in 2022 (Complete)



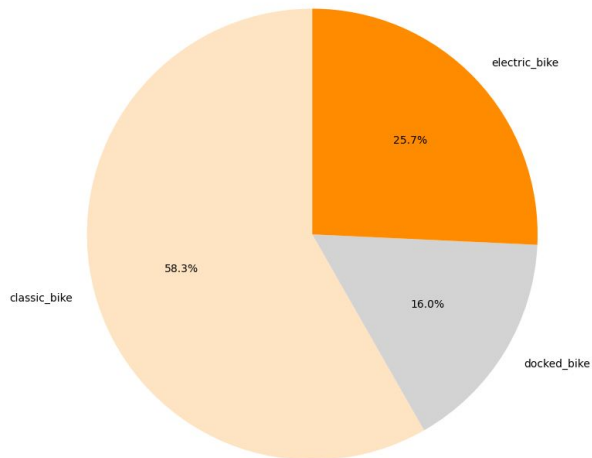
Rideable Type Distribution in 2023 (Complete)



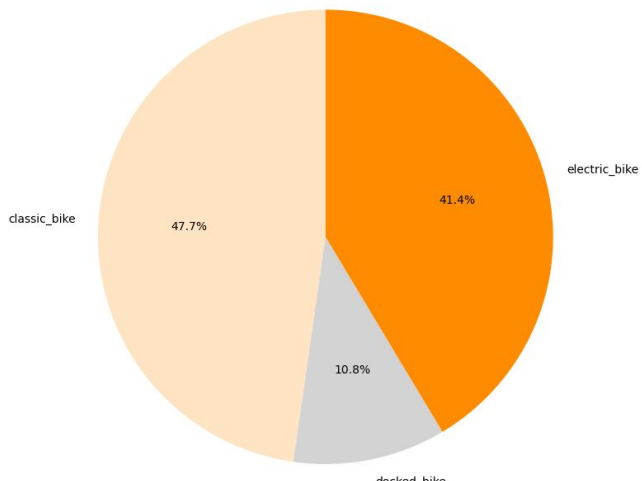
Rideable Type Distribution in 2020 (Casual)



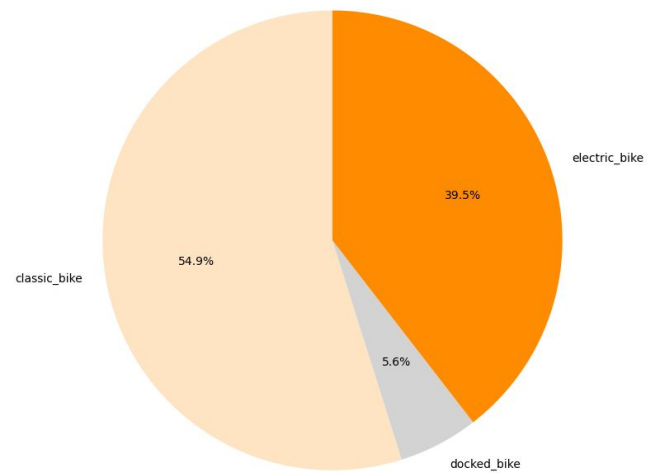
Rideable Type Distribution in 2021 (Casual)



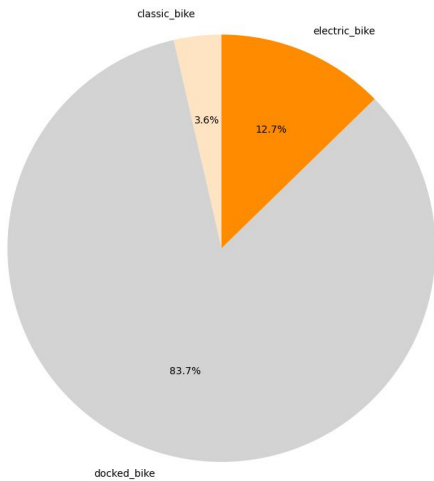
Rideable Type Distribution in 2022 (Casual)



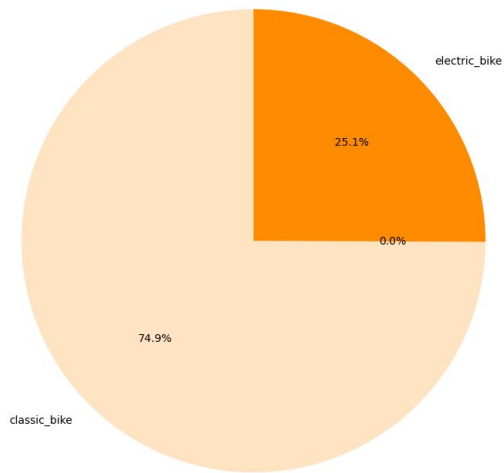
Rideable Type Distribution in 2023 (Casual)



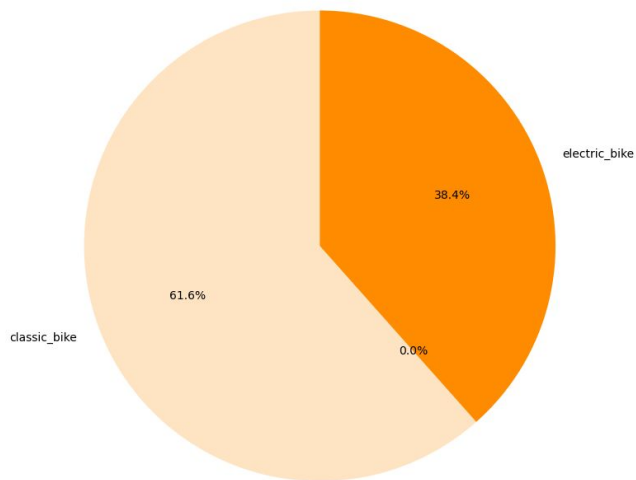
Rideable Type Distribution in 2020 (Member)



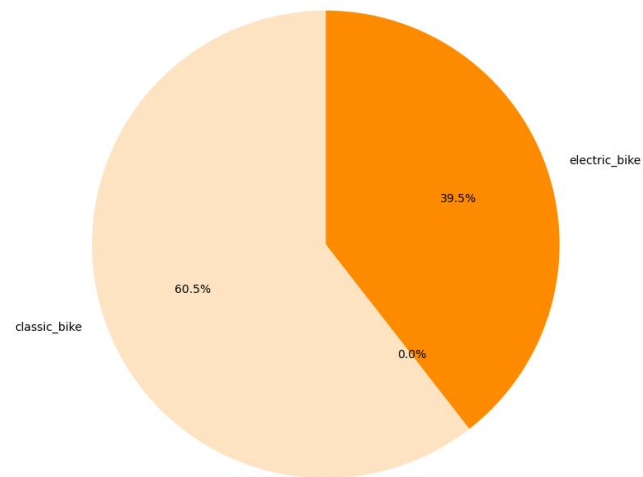
Rideable Type Distribution in 2021 (Member)



Rideable Type Distribution in 2022 (Member)

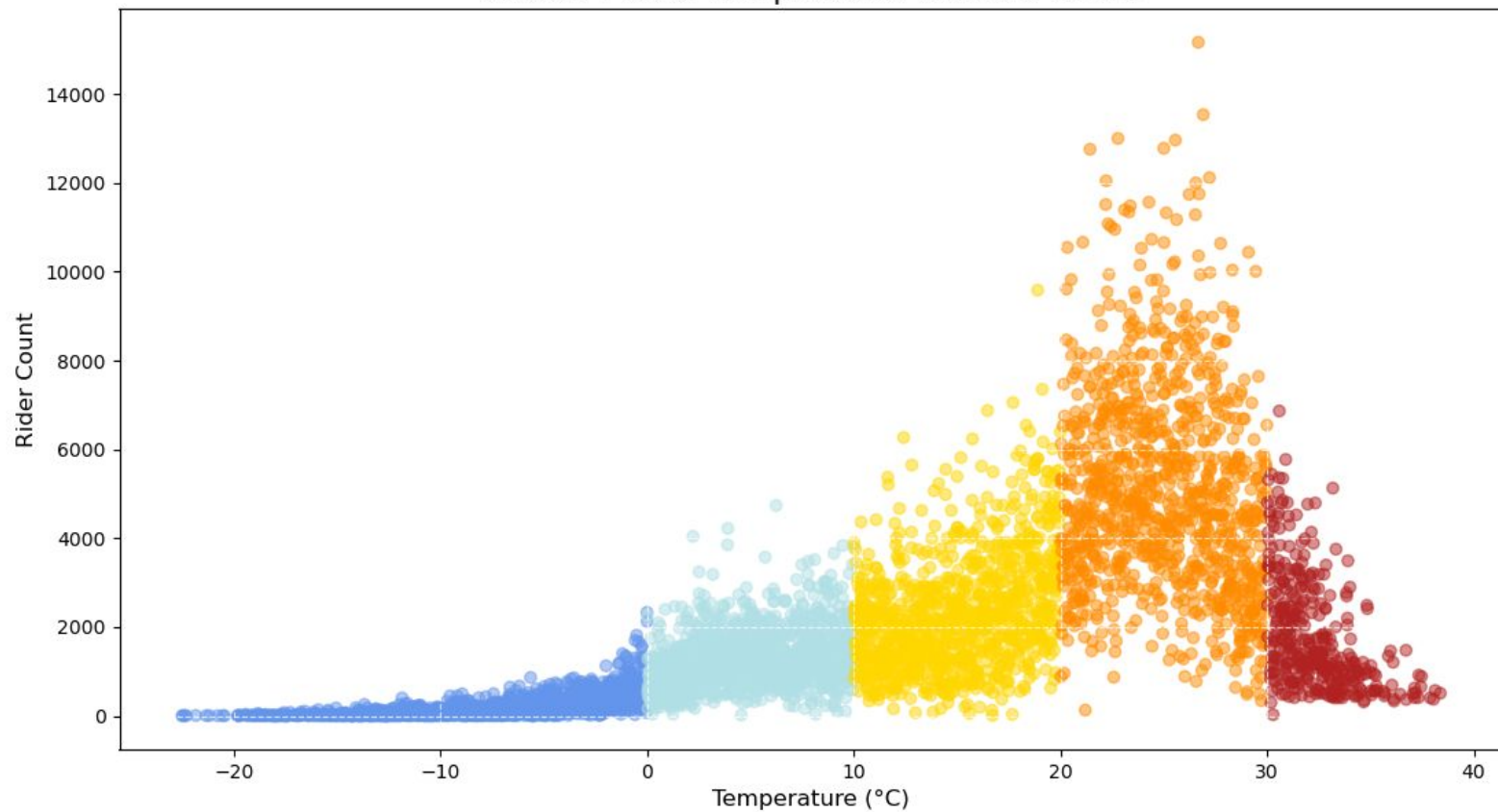


Rideable Type Distribution in 2023 (Member)



# Usage Trends by Temperature

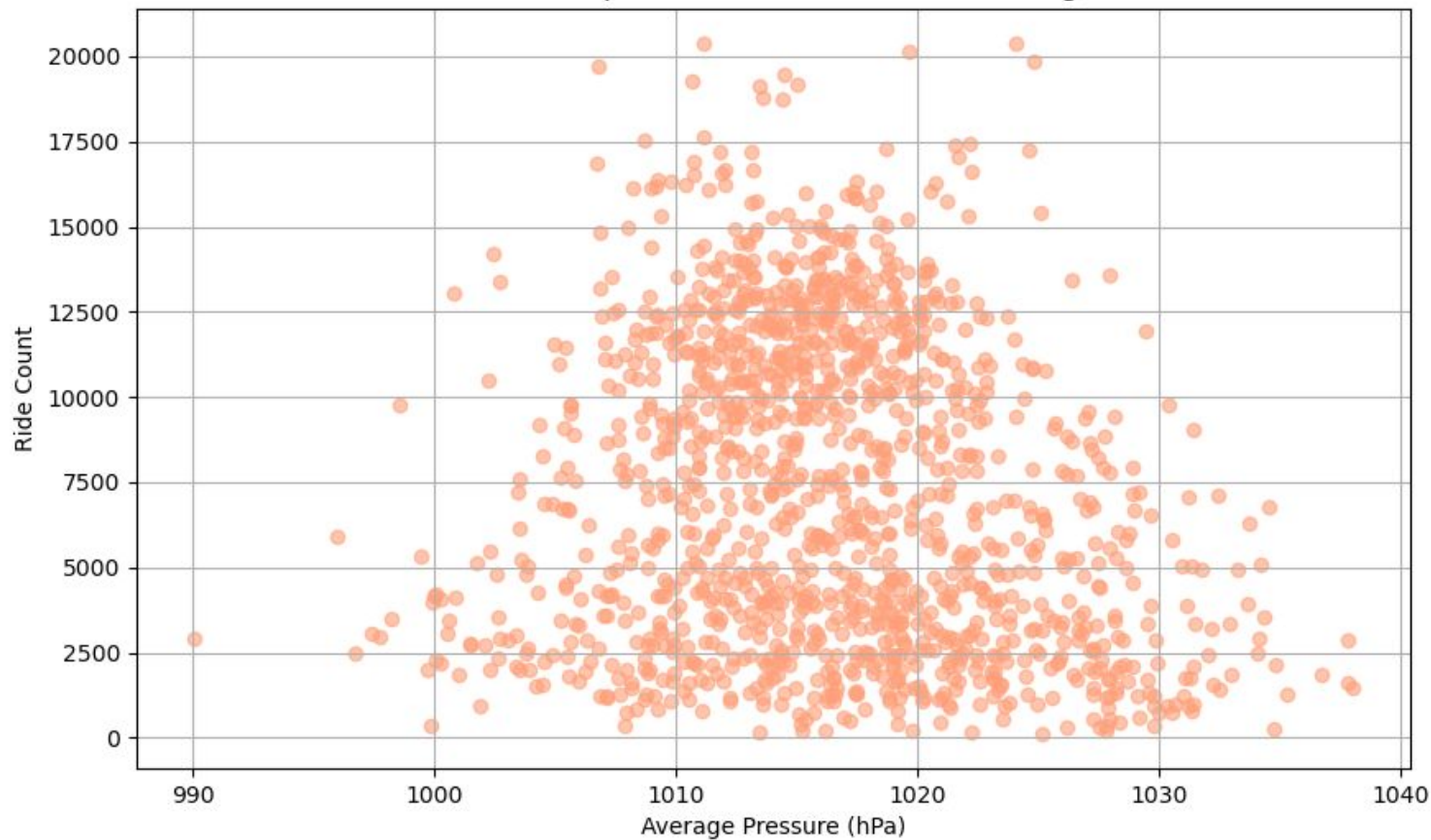
Scatter Plot of Temperature vs Rider Count





# Usage Trends by Pressure

Relationship between Pressure and Bike Usage

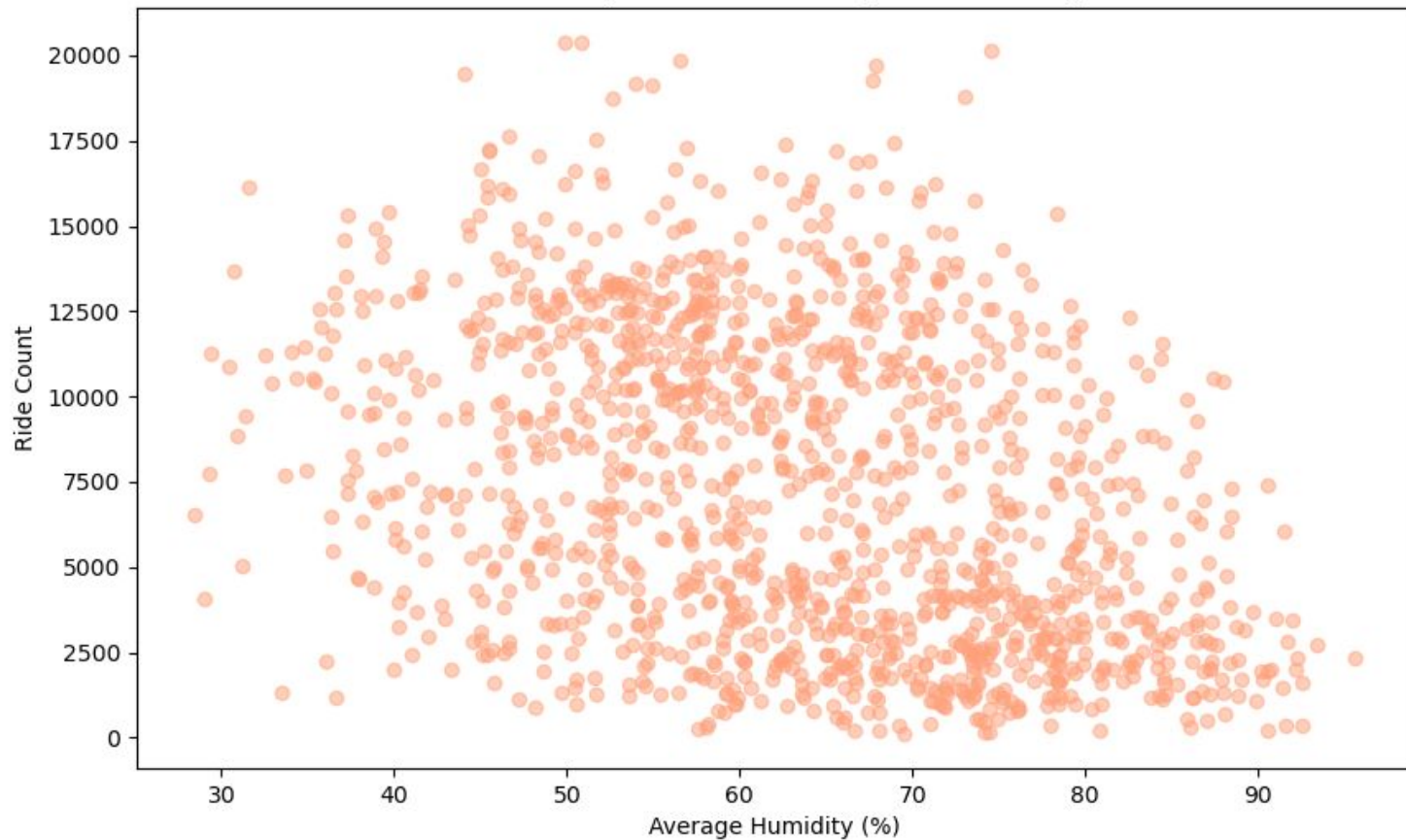


Correlation between pressure and bike usage:  $-0.15982607636106538$

T-statistic: 5.675373785077928, P-value:  $1.695332623938162e-08$

# Usage Trends by Humidity

Relationship between Humidity and Bike Usage



humidity\_level

Low 9491.721311

Medium 8374.440821

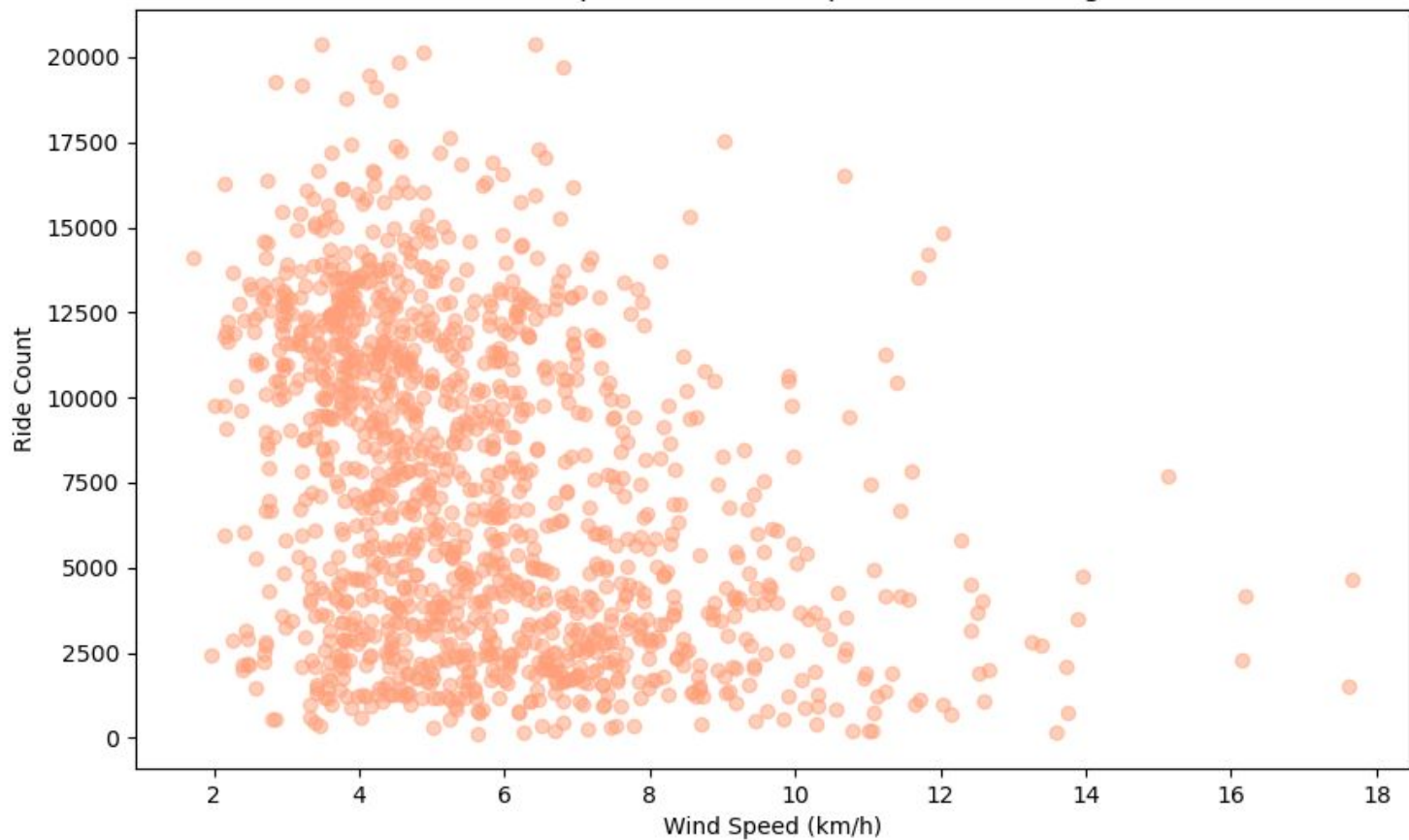
High 5135.859375

Name: total\_rides, dtype: float64

ANOVA F-statistic: 89.9906553200607, P-value: 2.1804968466732907e-37

# Usage Trends by Wind Speed

Relationship between Wind Speed and Bike Usage



Correlation between wind speed and bike usage:  $-0.3446805515371327$

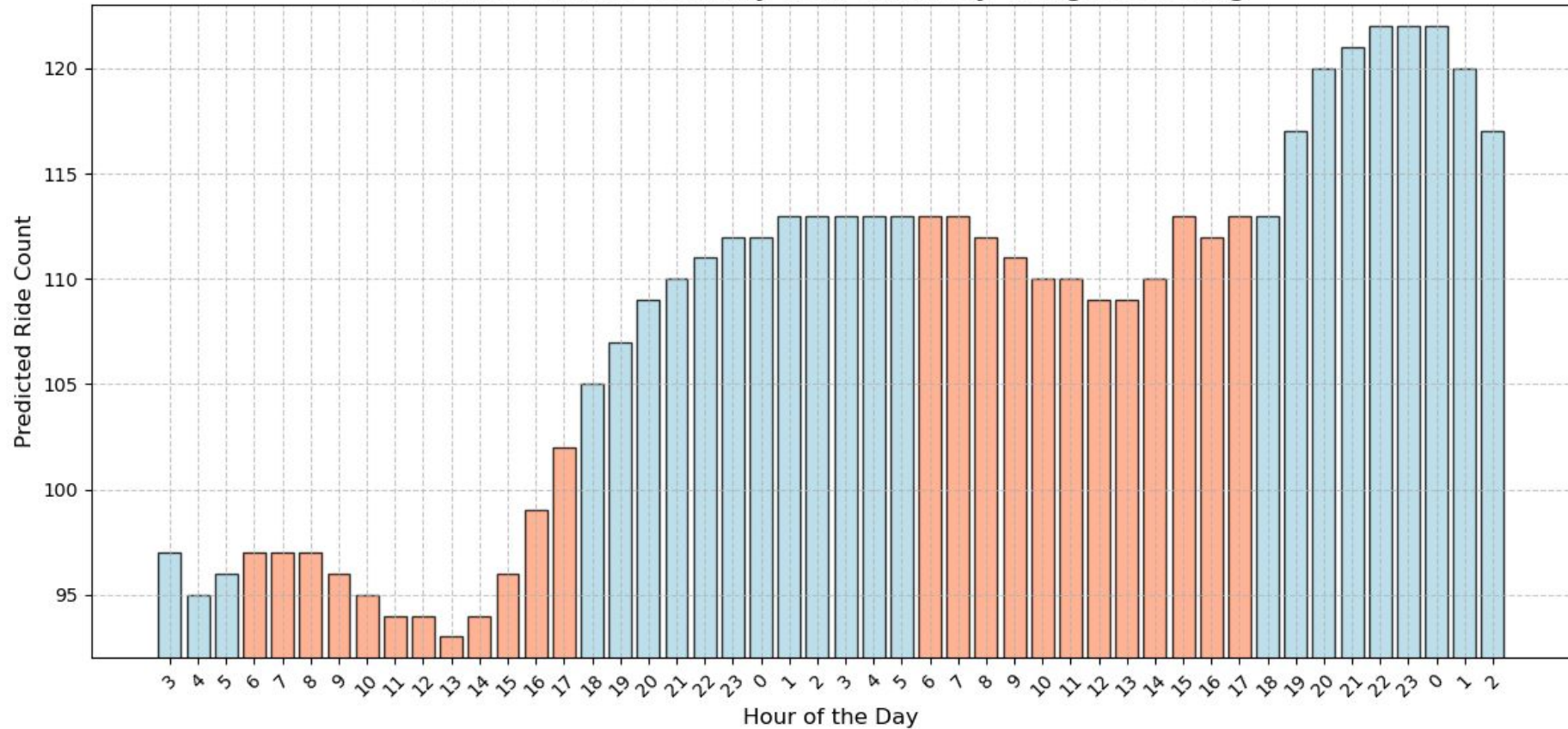
# API Work and Predictions



Metric	Datetime	feels_like_Value	humidity_Value	pressure_Value	temp_Value	temp_max_Value	temp_min_Value
0	2024-12-12 04:00:00	34	157	119	34	103	114
1	2024-12-12 05:00:00	35	167	119	35	103	114
2	2024-12-12 06:00:00	34	174	120	34	103	114
3	2024-12-12 07:00:00	31	184	121	30	103	114
4	2024-12-12 08:00:00	27	191	121	25	103	114

.....

Predicted Ride Count by Hour with Day & Night Coloring



# Conclusion and Recommendations

# Questions?