

INFO 511 FUNDAMENTALS OF DATA SCIENCE FLIGHT MATRIX

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MOTIVATION:

- Understand the operational dominance of Brussels Airport relative to other Belgian airports
- Explore seasonal trends and deviations in flight activity
- Investigate patterns in departures, arrivals, and total flights to inform policy and operational planning

Key Questions:

1. How does the total number of monthly flight departures and arrivals at Brussels Airport compare to other major airports in Belgium?
2. What are the seasonal trends and deviations in flight activity?
3. Are there statistically significant differences in flight patterns across airports and months?

DATA OVERVIEW

- **Dataset:** Flights data (2016-2019) from major Belgian airports.
 - Covers both Instrument Flight Rules (IFR) and Visual Flight Rules (VFR) flights.
 - Includes major airports such as Brussels, Antwerp, Charleroi, Liège, and Ostend-Bruges.
 - Comprehensive temporal range ensures insights across different seasonal and annual cycles.
- **Key Columns:**
 - FLT_DATE - Converted to datetime format
 - APT_ICAO & APT_NAME
 - YEAR & MONTH_NUM
 - YEAR_MONTH
 - FLT_DEP_1, FLT_ARR_1, FLT_TOT_1
- **Preprocessing Steps:**
 - Handled missing values in flight metrics by replacing NaN with 0.

Highlights from Exploratory Data Analysis (EDA)

Monthly Comparison:

- Observed significant peaks in summer months and dips during winter

Seasonal Trends:

- Brussels consistently outperforms other airports in flight activity
- Other airports show flatter trends but align with seasonal peaks.

Key Observations:

- Anomaly in March and April 2016, possibly related to external events (e.g., geopolitical)



Seasonal Trends Modeling

Grouped Analysis:

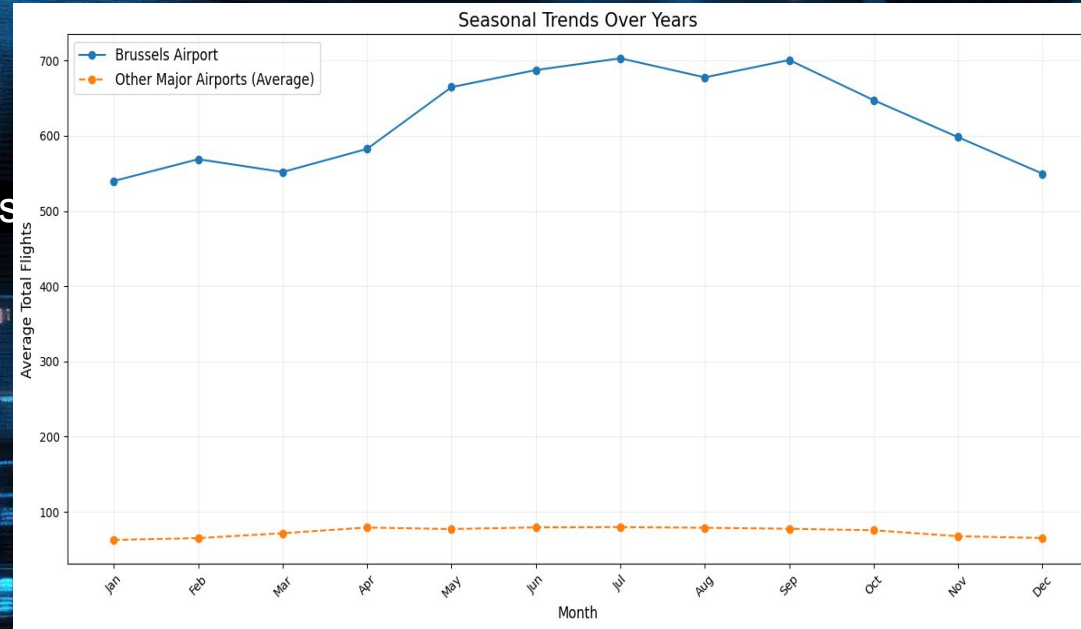
- Monthly averages for flight metrics across Brussels and other airports

Key Findings:

- Brussels exhibits higher seasonality, with summer peaks and winter troughs
- Other airports show relatively steady patterns

Potential External Factors:

- Summer tourism increases flight demand
- Winter reductions align with holiday schedules or weather patterns



Deviation of Observed from Expected Frequencies

Positive Deviations:

- Significant peaks in summer months
- Brussels (July, +0.20) and Ostend-Bruges (March, +0.19).
- Driven by increased tourism and high seasonal demand

Negative Deviations:

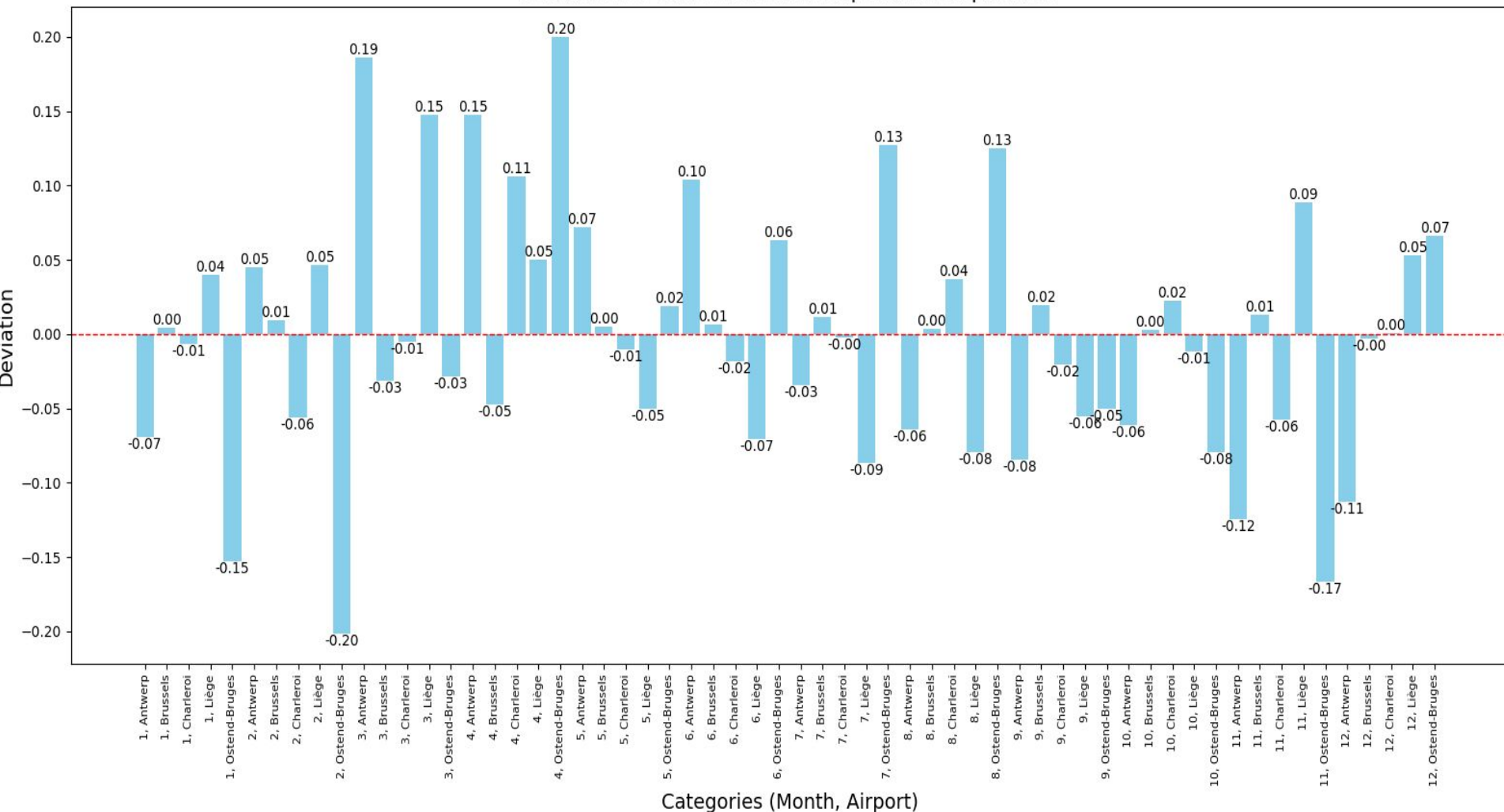
- Largest dips in winter months: Ostend-Bruges (January, -0.20) and Liège (November, -0.17)
- Reflects reduced travel demand during off-peak seasons

General Trends:

- Brussels Airport shows the highest variability, aligning with major seasonal peaks.
- Smaller airports like Ostend-Bruges and Liège experience extreme fluctuations, especially in winter.

Deviation of Observed from Expected Frequencies

Deviation



Conclusions and Future Work

- Brussels Airport dominates flight activity but exhibits higher variability.
- Seasonal trends are consistent, with summer peaks and winter dips.
- Statistically significant differences in flight patterns across months and airports.

Future Work:

- Incorporate additional data (e.g., weather, geopolitical events) to explain anomalies.
- Apply predictive models to forecast future trends.
- Extend analysis to compare Belgium's airports to international hubs.

THANK YOU

