CAPSTONE PROJECT - SHINE ROSHAN

# TSA Throughput Prediction

2022

# Question

Using historic  hourly data starting at the beginning of 2019, can we predict the number of passengers going through airport security for a given hour?

# Motivation

## Recovery

Predict if and when the travel industry may recover fully from  Covid 19

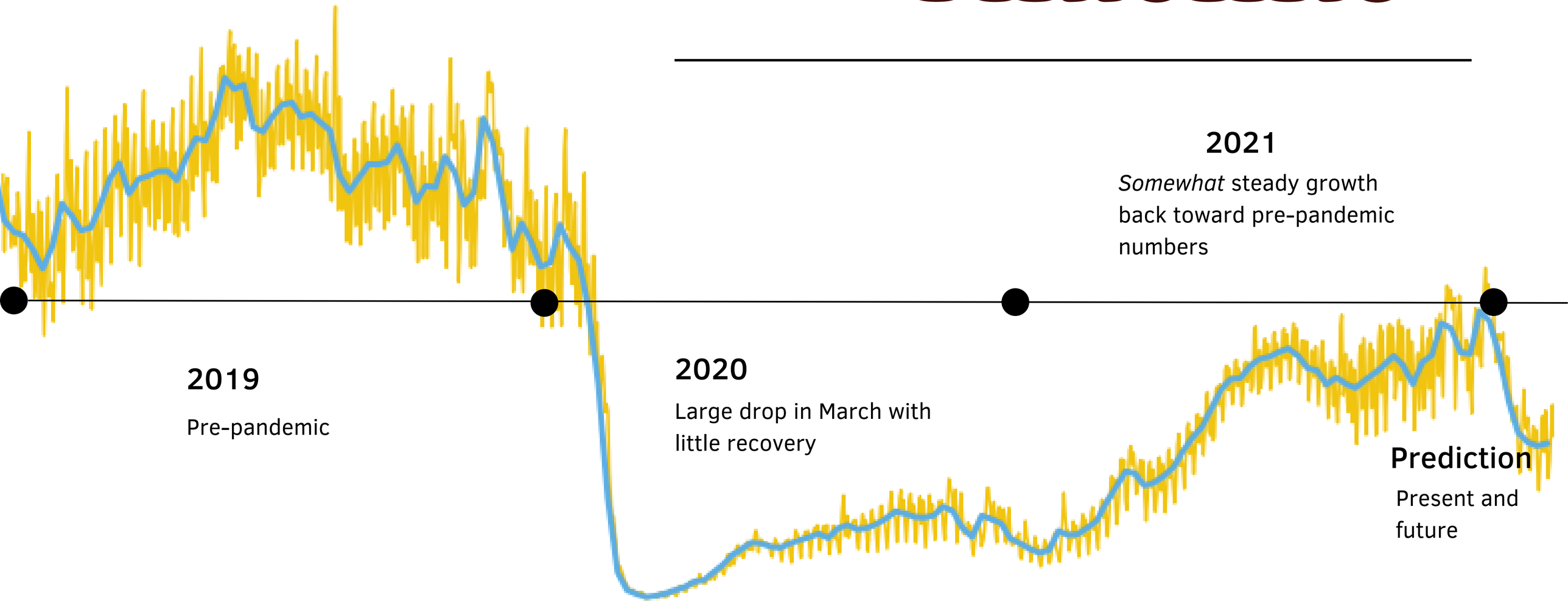
## Efficiency

Proper staff and resource allocations

## Customer Service

Better customer service will create loyal customers

# Timeline



## 2019

Pre-pandemic

## 2020

Large drop in March with little recovery

## 2021

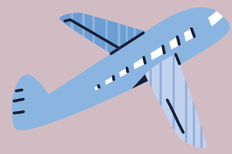
*Somewhat* steady growth back toward pre-pandemic numbers

## Prediction

Present and future

# Stakeholders

Hotels nearby



Airlines

Airport businesses

Airports

Shuttles and Taxis

# Potential Challenges

## Global events


## Pandemics

## Weather

# Data Collection

01

## Source - Repository

- Github repository (updated regularly)
- csv files for each airport
- Gate level counts

02

## Dataframe - individual time seires

- Aggregate throughput for each airport
- Column - Single airport
- Datetime index (time series analysis)

# Data Structure

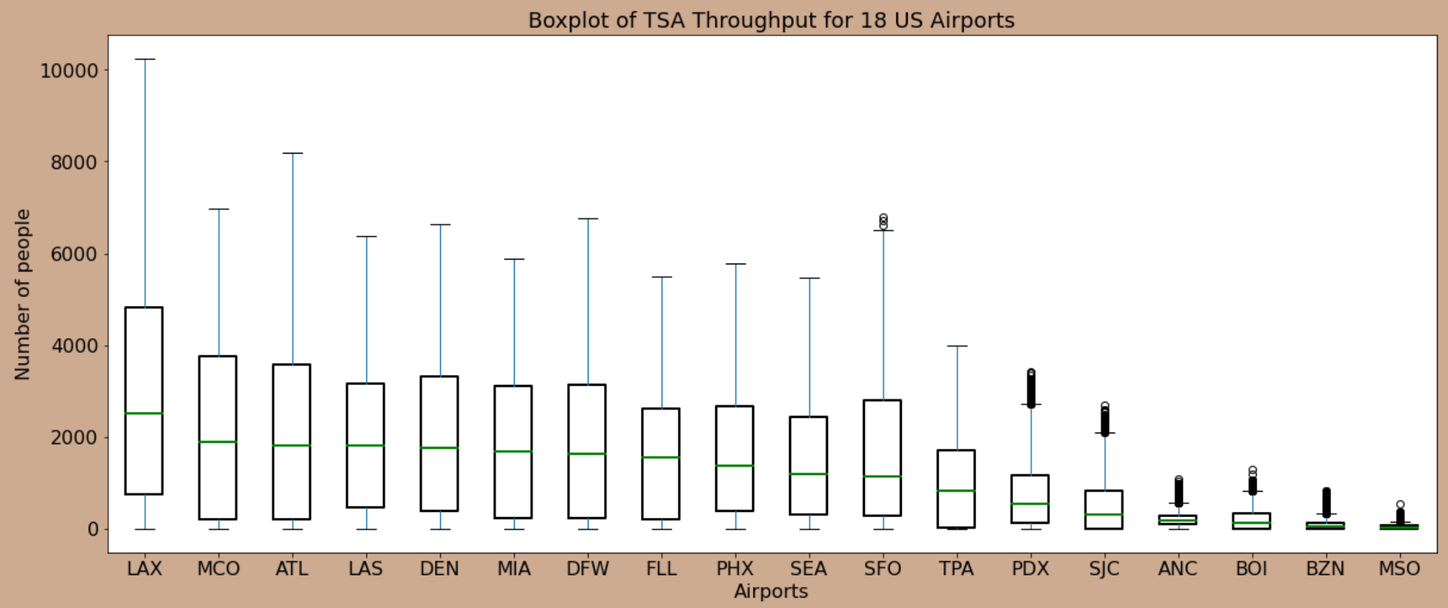
**HOURLY DATA**

**Over 3 years**

**Start - Dec 31, 2018**
**End - Feb 5, 2022**

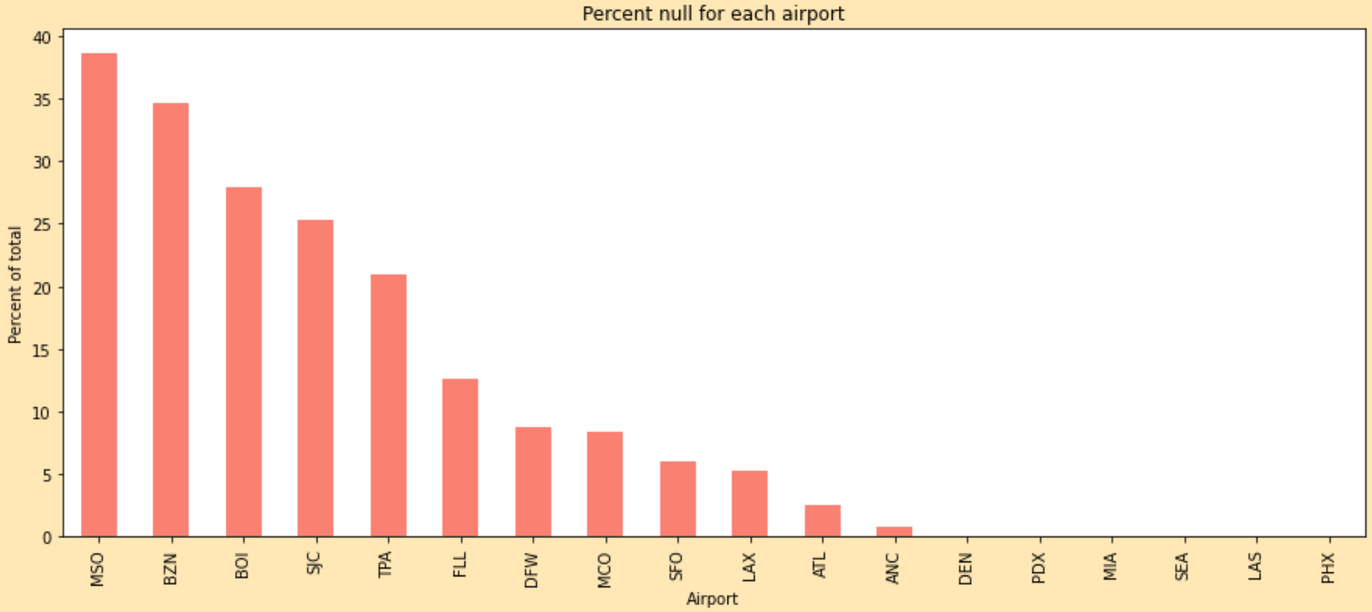
## 18 Columns

A I R P O R T S



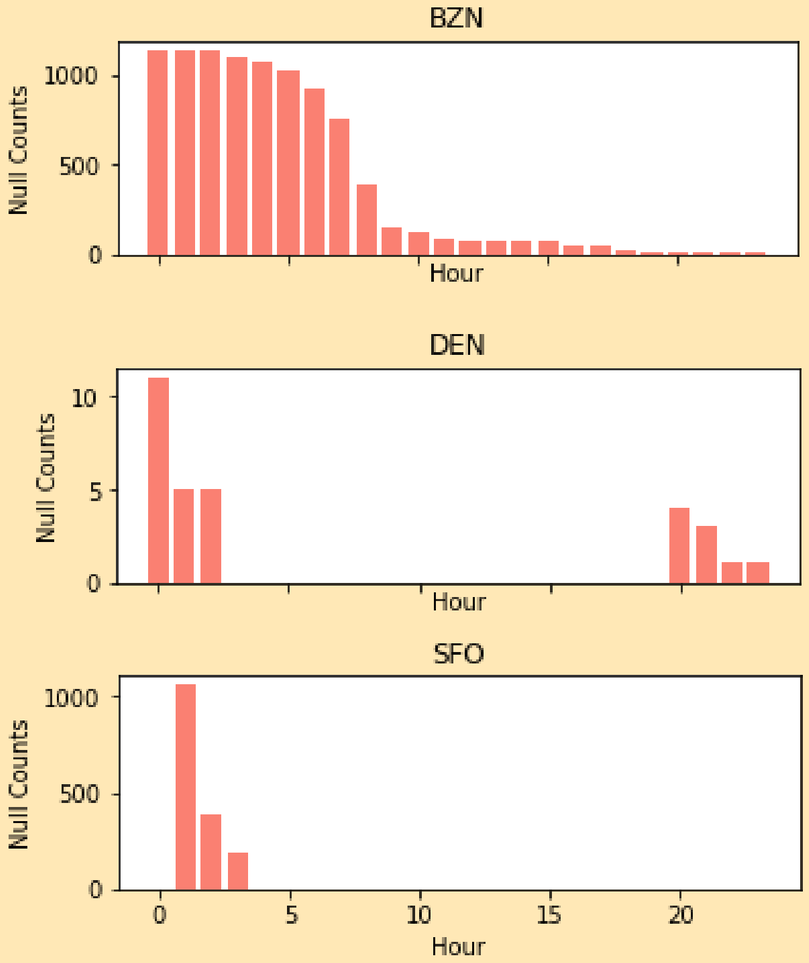
# Null Values

**Small Airports have higher null values**

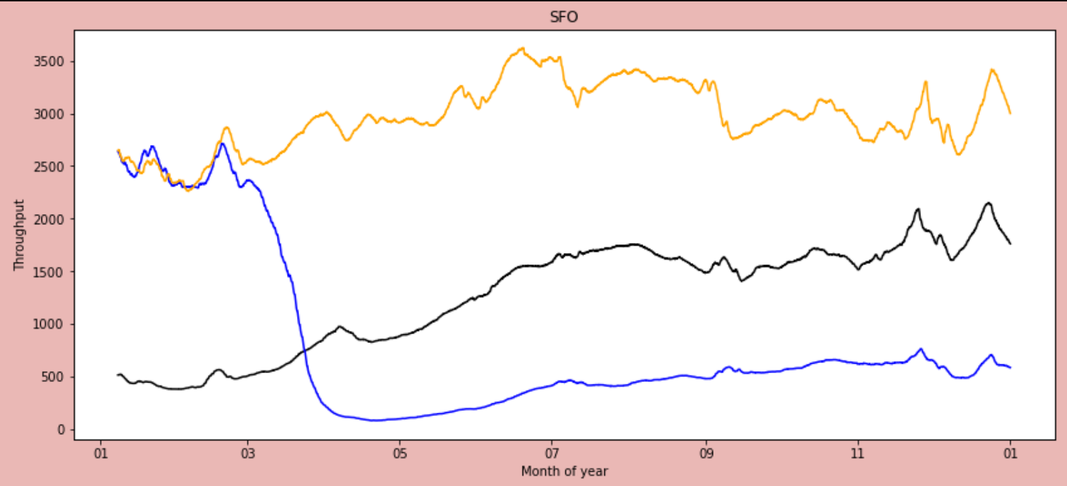


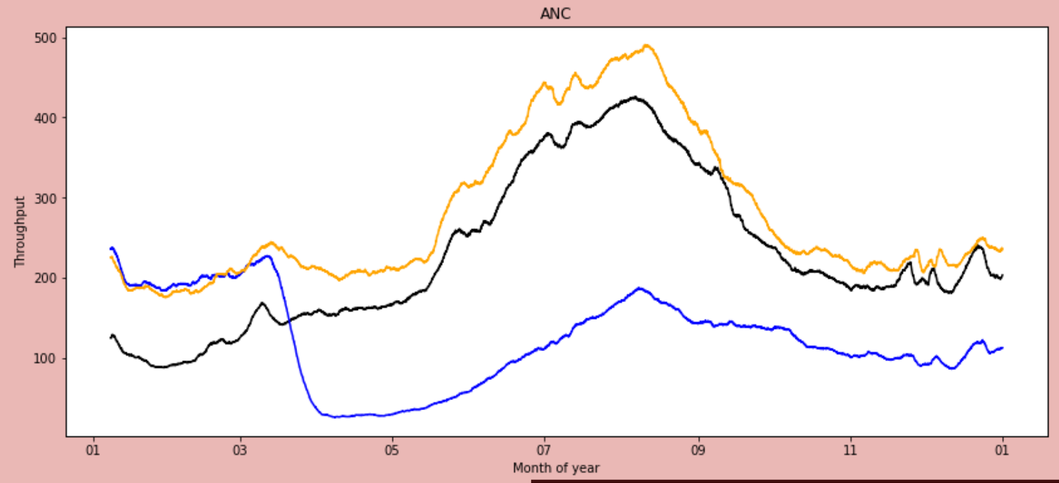

**Impute null with ZERO**

**Fewer Flights in the Middle of the night**



# Yearly Trends




2019

2020

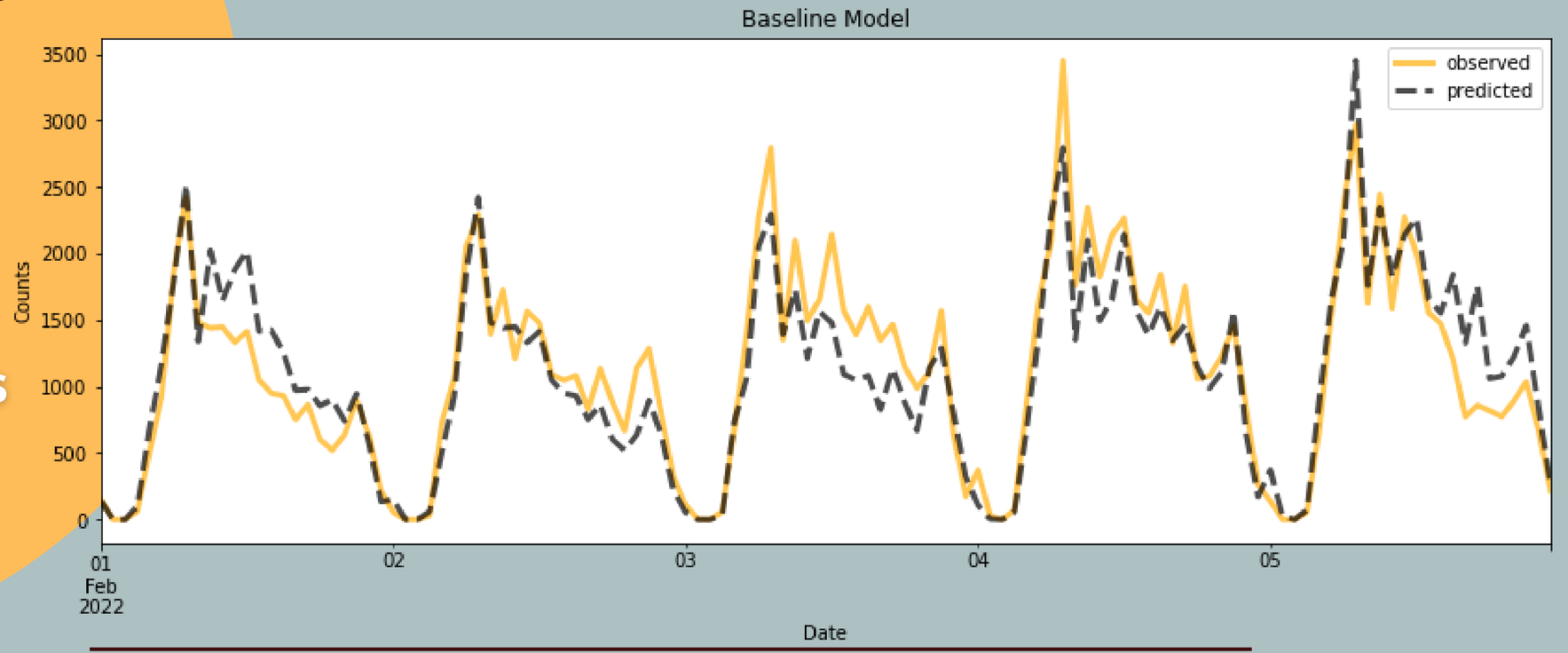
2021

# Baseline Model

## 276 passengers

**Average Error**

**Uses yesterday's values**



# Seasonal ARIMA Model

- AR - Auto-regressive: q
- MA - Moving Average: p
- I - Differencing: d
- Seasonal parameters: P, D, Q, S

**(p, d, q) X (P, D, Q, S)**

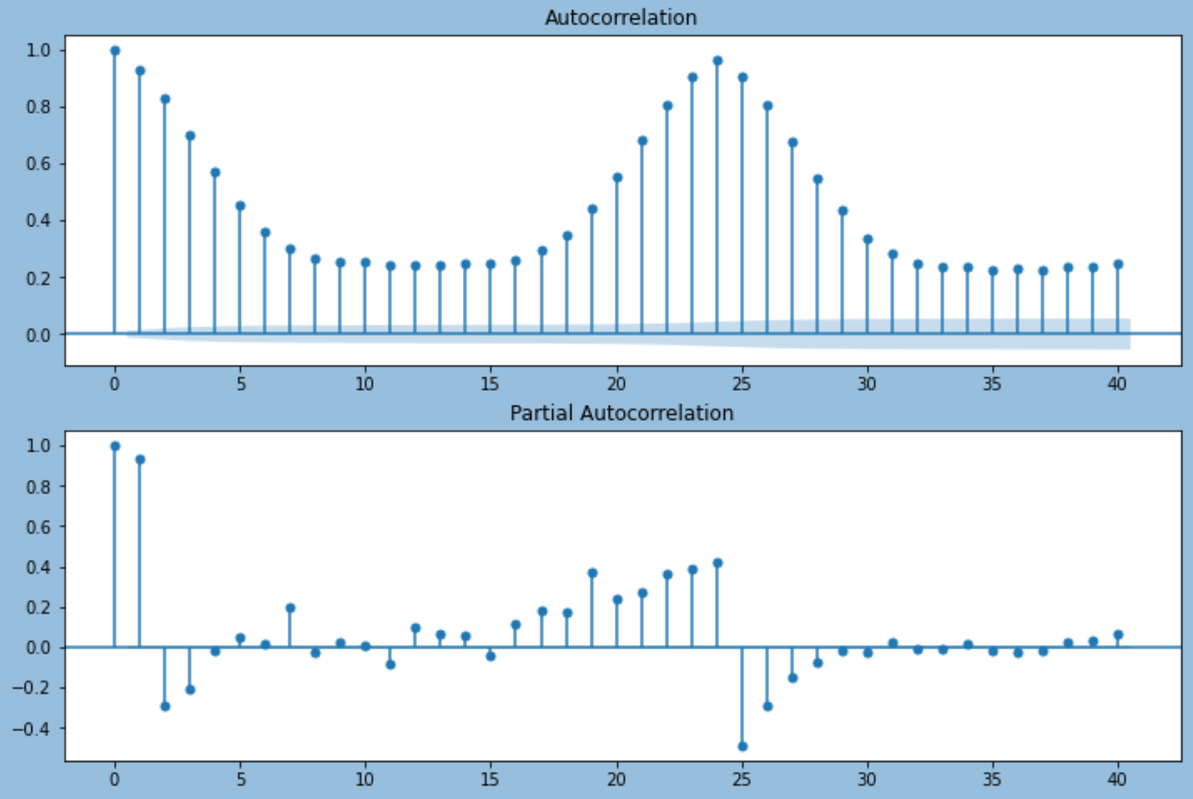
# Seasonality/Stationarity

**Seasonal**:

- Period (S) = 24
- D = 1 (max values)

**Non-stationary**:

- d+D ≤ 2
- d = 0 or 1



# Best Parameters

1. **Seasonality:** D=1, S=24
2. **Stationarity:** d = 0, 1
3. **Autoregressive:** p, q = 0, 1, 2
4. **Moving Average:** P, Q = 0, 1, 2, 3

**GRID SEARCH:**
**p, d, q, P, Q**

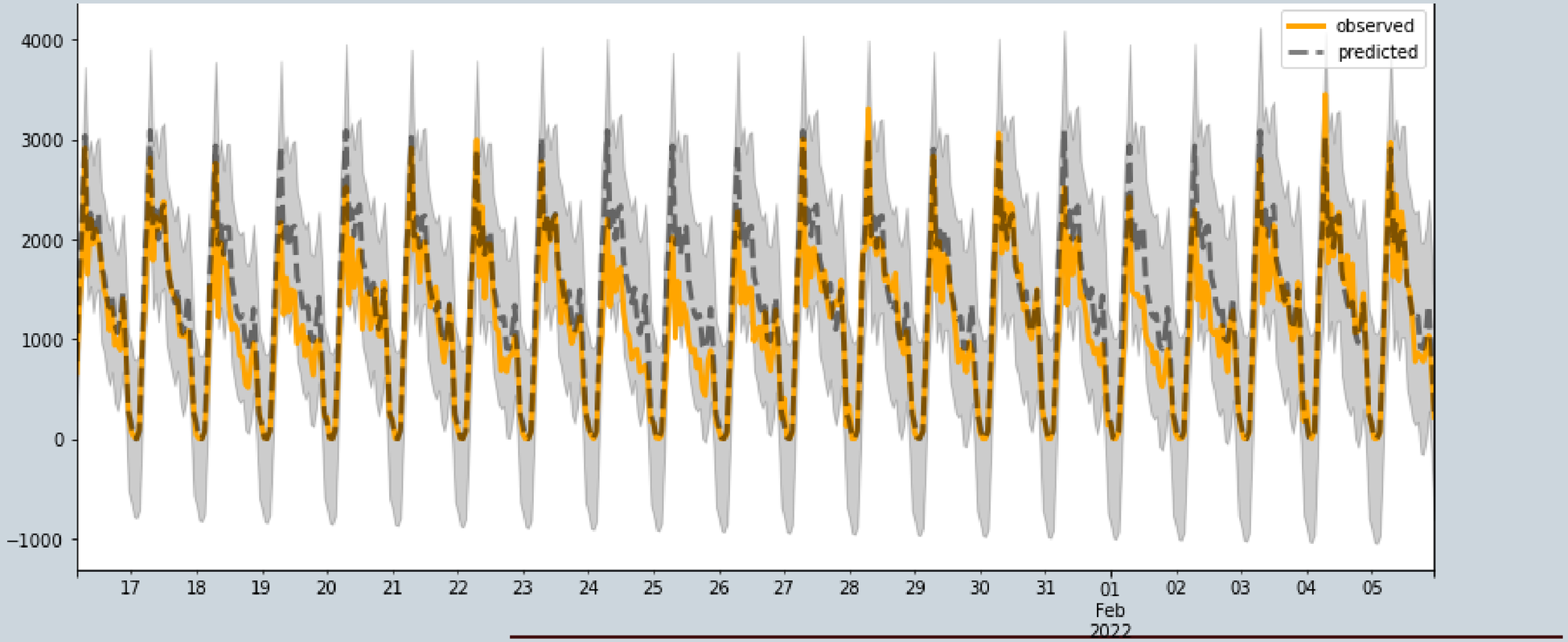
# Training

- Tain/Test split: test against last 500 values
- Cross-validation for best parameters
- Metric - Akaike Information Criteria (AIC) - Best predictive model

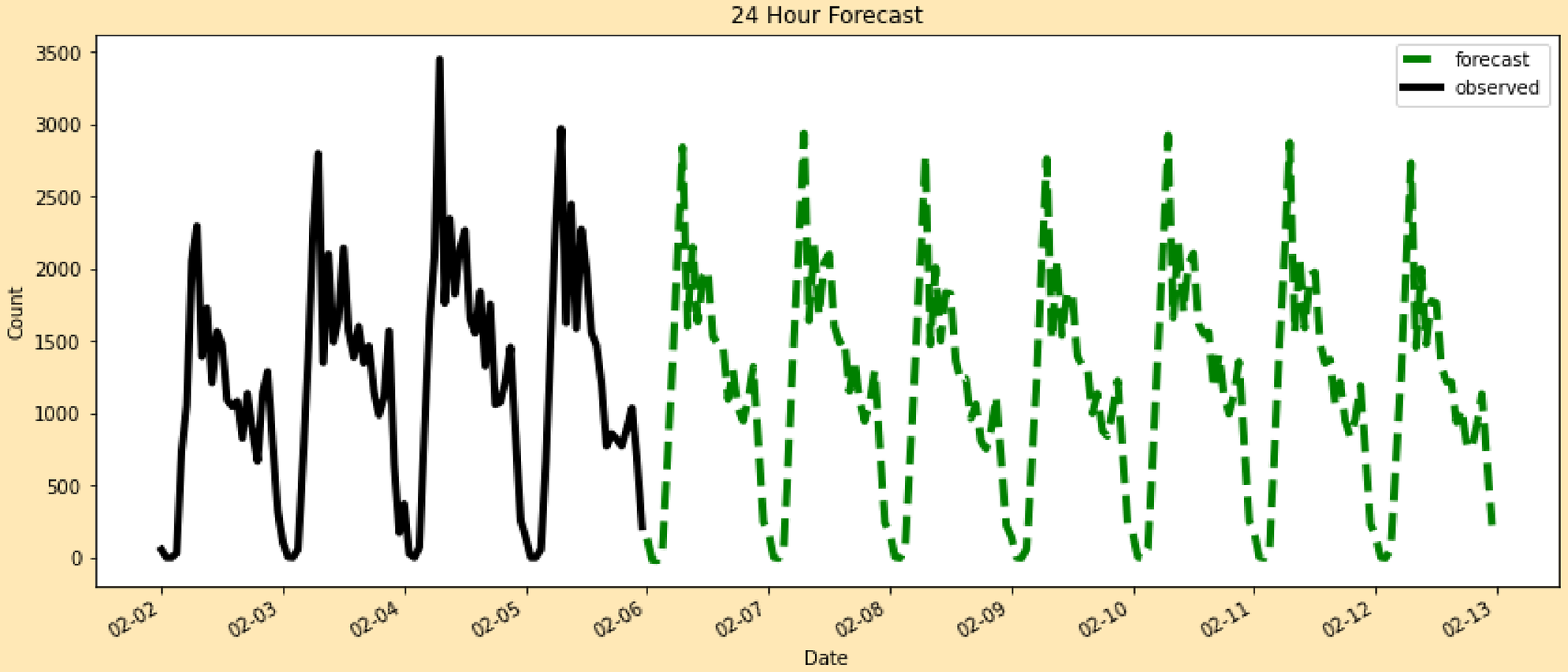
**(1, 0, 1) X (3, 1, 3, 24)**

# Prediction

## Test MAE - 227 people



# Forecast


24 Hour Forecast
forecast
observed
Count
Date
3500
3000
2500
2000
1500
1000
500
0
02-02
02-03
02-04
02-05
02-06
02-07
02-08
02-09
02-10
02-11
02-12
02-13

# Next Steps

Perform time series clustering of all airports

Automate data collection from source repository as it is updated