# Introduction to Data Analysis with Python

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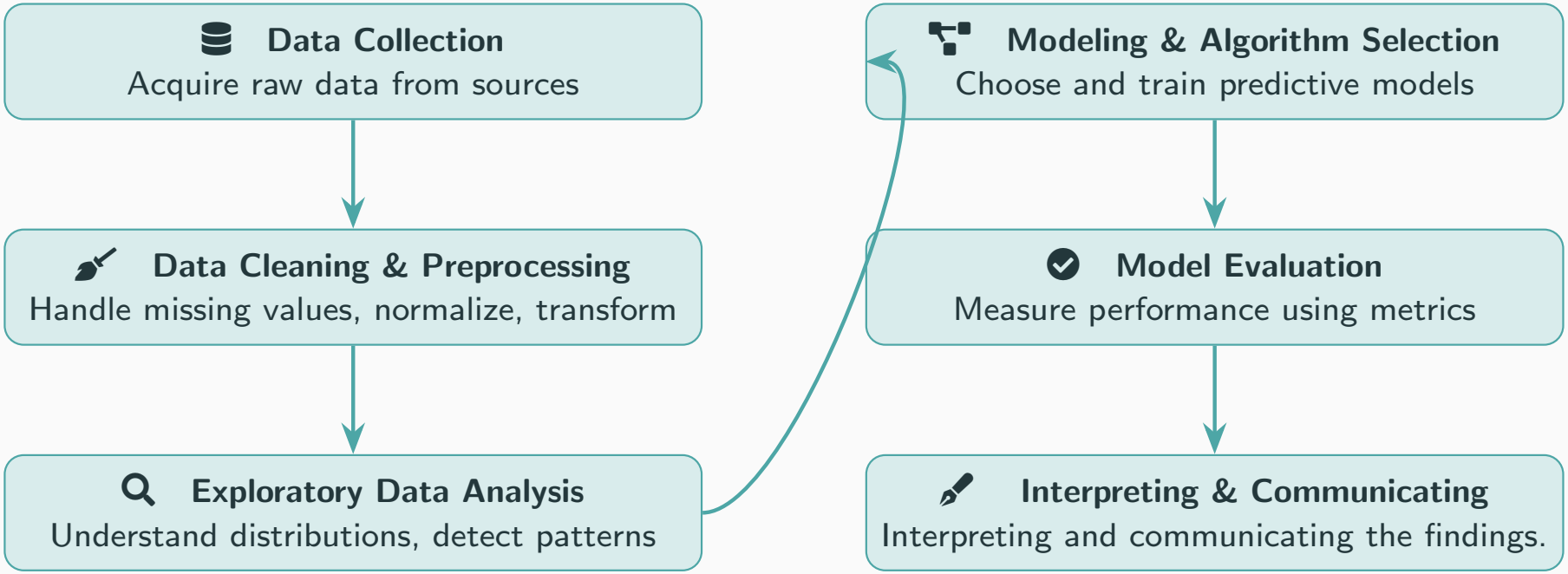
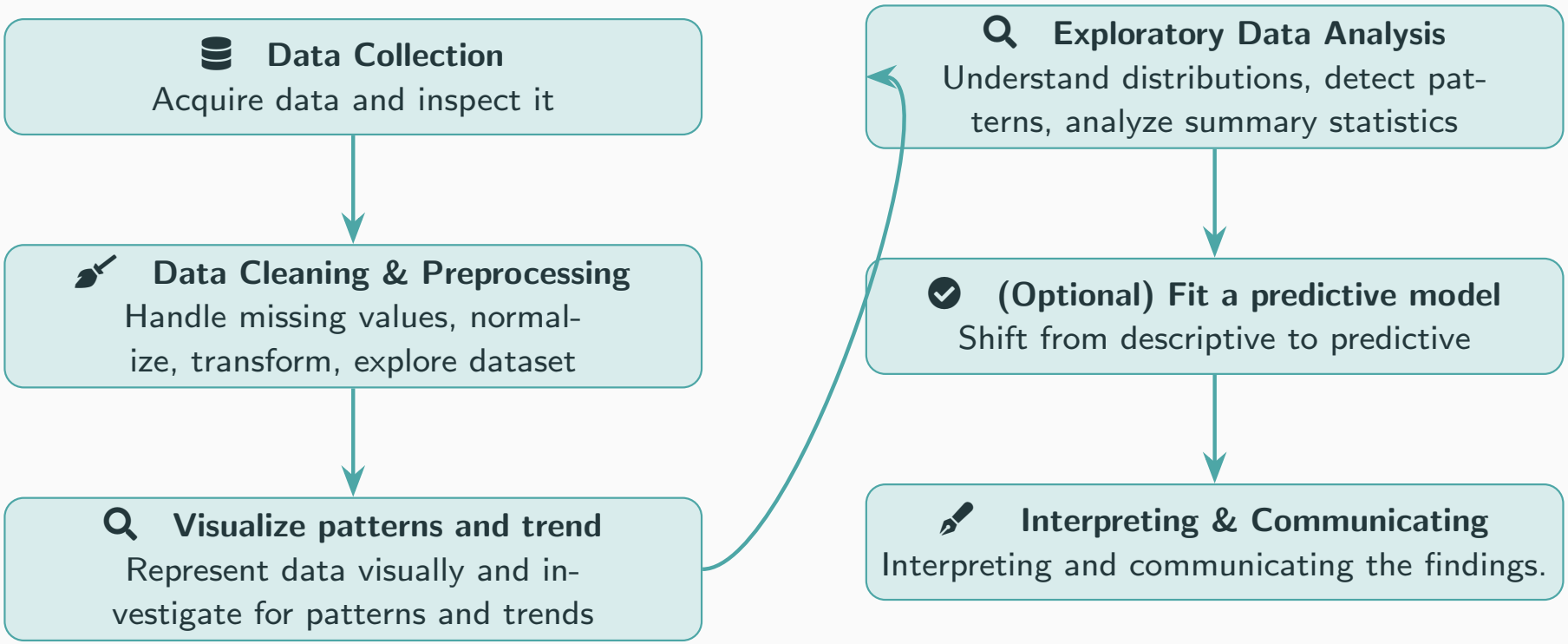
# Homework Correction

# Recap: Data Analysis Pipeline



- **Advanced data analysis** shifts from descriptive to predictive
- This introductory class is mostly focused on steps 1-3

# Possible pipeline for the group project



# Course Overview

- Up to now: gaining necessary Python skills
- Next lessons: Basic statistics for data analytics, including some theory

# Data Visualization

# Scatterplot

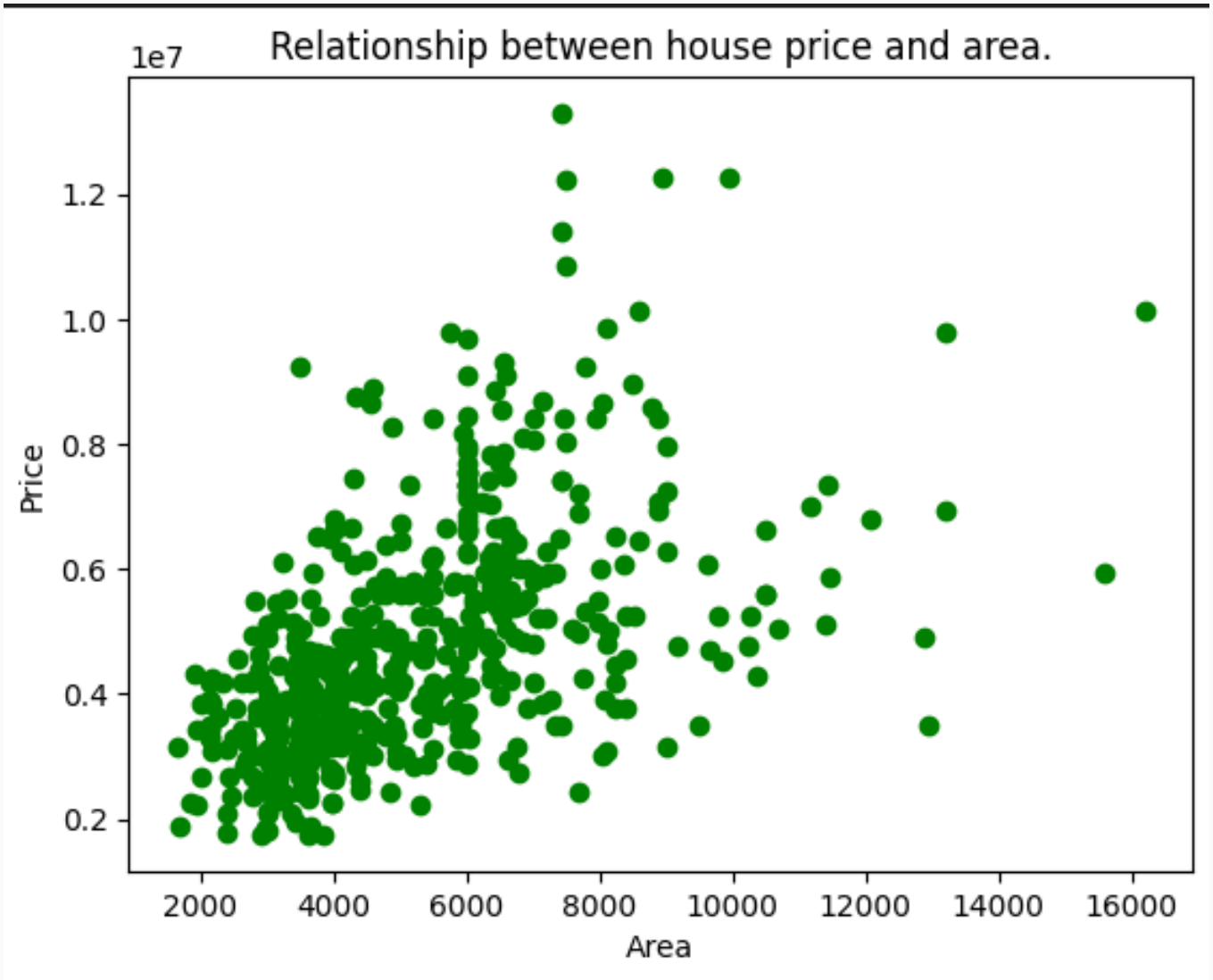



**Figure 1:** Scatterplot representing the relation between house prices and area.

- Displays the relationship between two numerical variables using dots.
- Each point represents an observation's values on the x- and y-axes.
- Useful for identifying correlations, patterns, or outliers.

# Bar Plot


**Figure 2:** Bar plot representing price value per number of bedrooms.

- Displays categories on one axis, values on the other
- Can be horizontal or vertical
- Useful for comparing **discrete values**

# Histogram

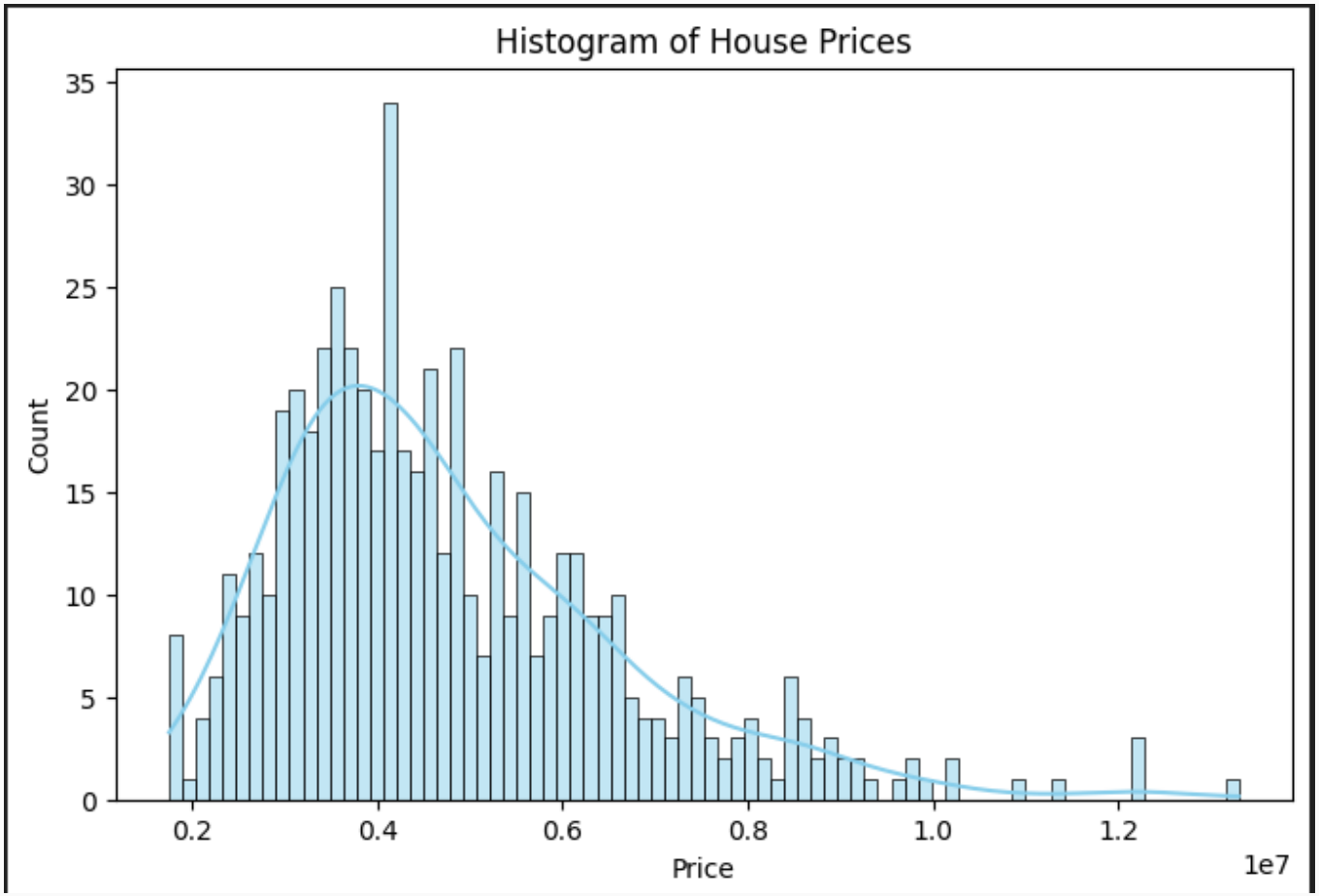



**Figure 3:** Histogram representing the continuous variable price.

# Bar Plot vs Histogram

- Histogram represents a **continuous value**, bar plot represents **frequency amounts for each value**
- Histogram: Divide value into bins, and plot those bins
- Bar plot: plot real number of each value
- Purpose of bar plot: frequency count
- Purpose of histogram: checking data evolution

# Advanced Visualizations

# Summary

- Heatmaps
- Pairplots
- Boxplots
- Violin Plots
- Facet Grids
- Grouped Bar Plots
- Regression
- Time-Series (optionally: with Rolling Averages)

# Heatmap

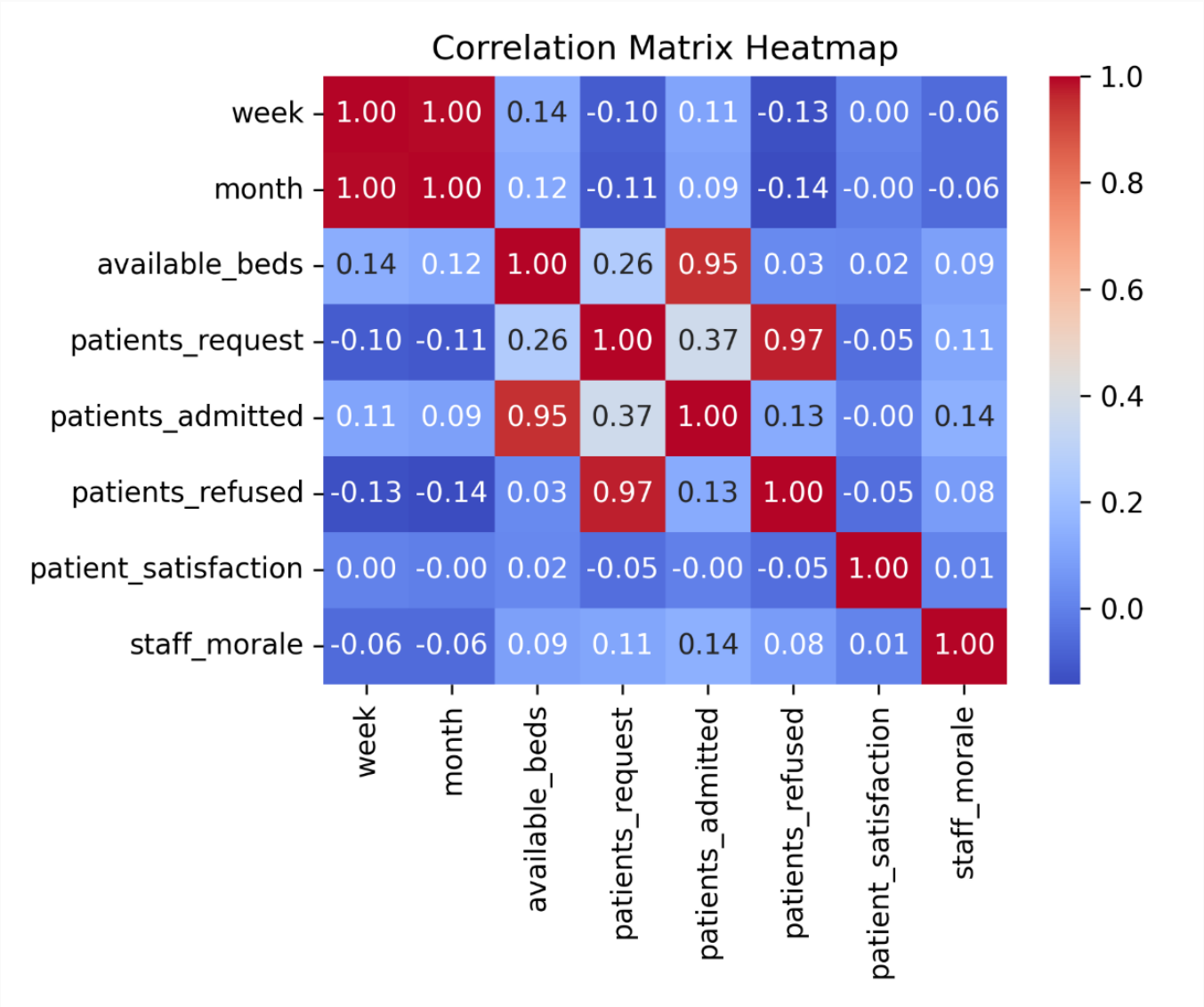



**Figure 4:** Correlation matrix heatmap of numerical features

- Plots the values one against the other in a matrix format
- The number you see is the **pairwise correlation coefficient**
- Quantifies linear relationship between the variables
  - 1: perfect linear correlation
  - 0: no linear correlation
  - -1: perfect negative linear correlation
- Useful to spot correlations among the variables
- More info about correlation to come in the EDA lecture

# Pairplot / Scatter Matrix

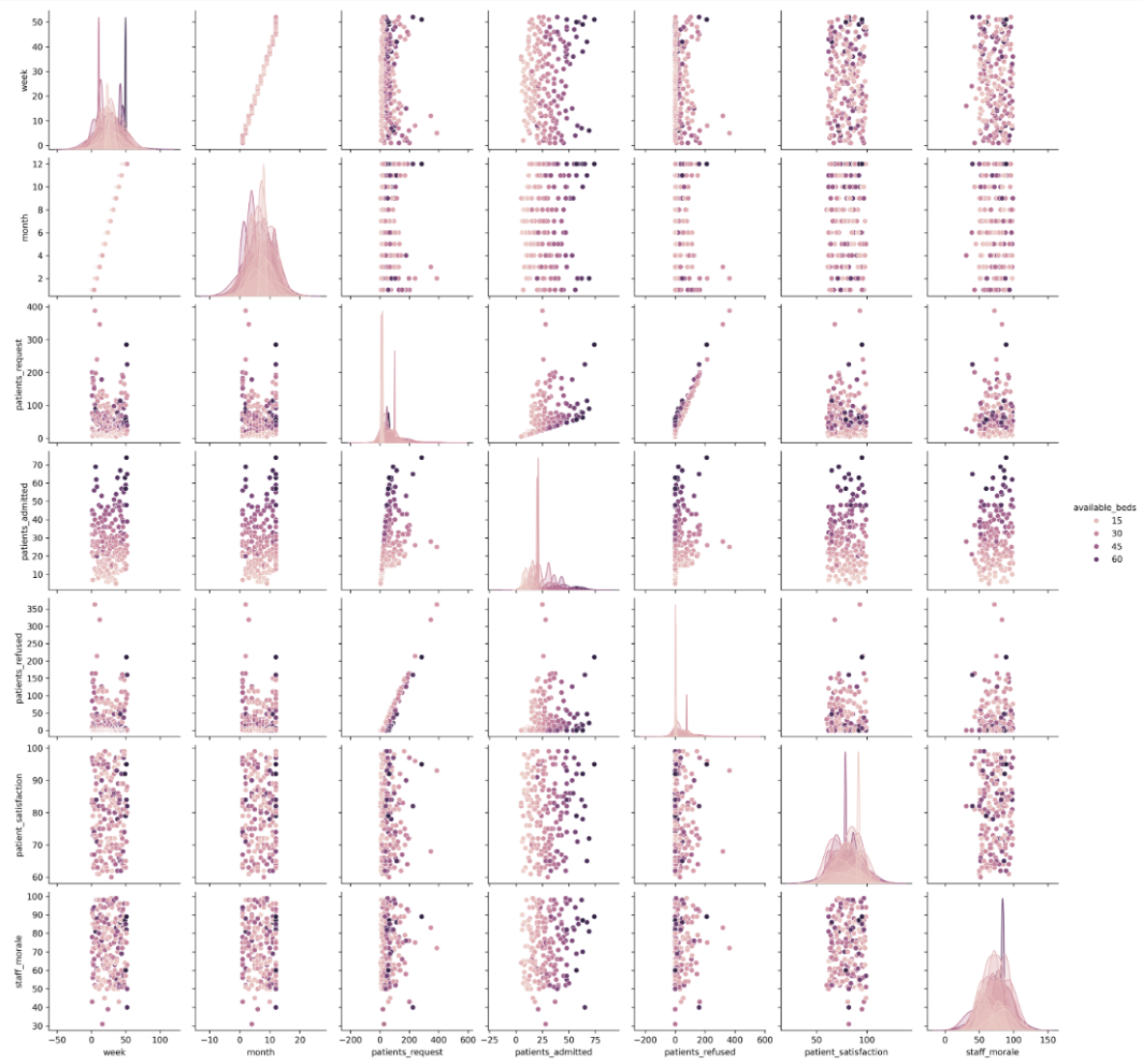



**Figure 5:** Pairwise relationships between variables

- Similarly to heatmap, plots correlation between variables
- In form of a plot and not a number

# Boxplots

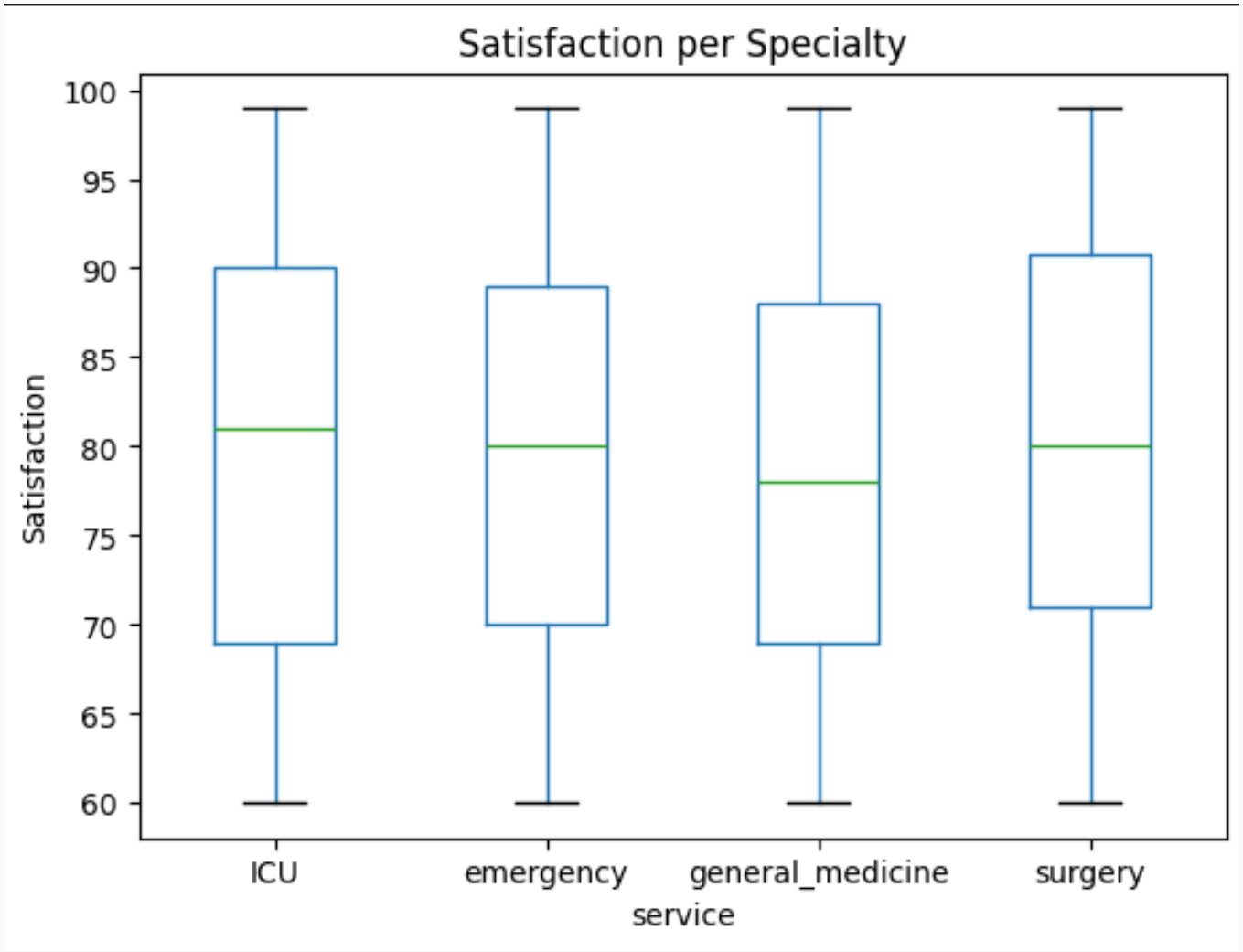



**Figure 6:** Boxplot representing patient satisfaction per category.

- Box: Interquartile range (values between 25% and 75%)
- Line: Median
- Upper and lower whisker, eventually outliers

# Violin Plot

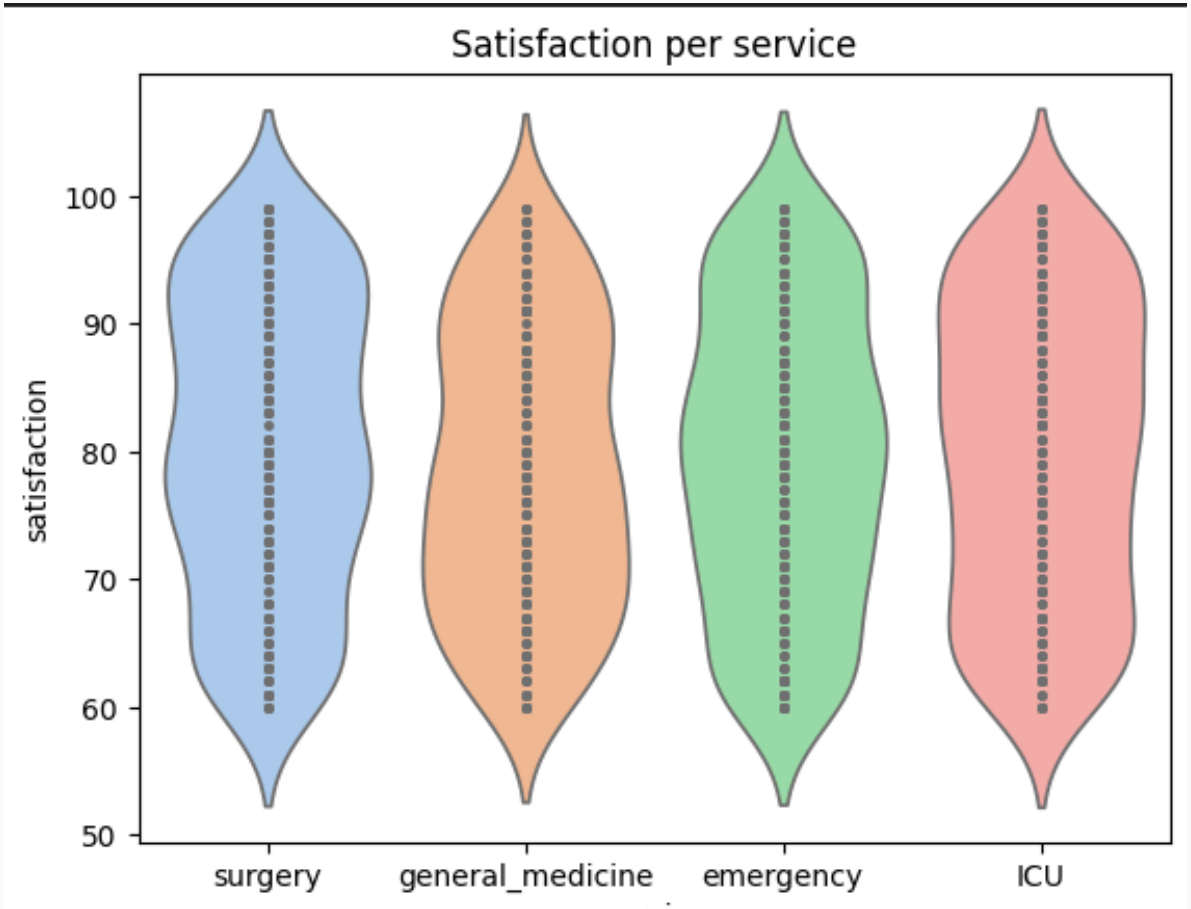



**Figure 7:** Distribution of patient satisfaction

- Wide sections = many points (high density)
- Narrow sections = few points (low density)
- Inside: data points, eventually median and IQ-range

# Facet Grid / Small Multiples

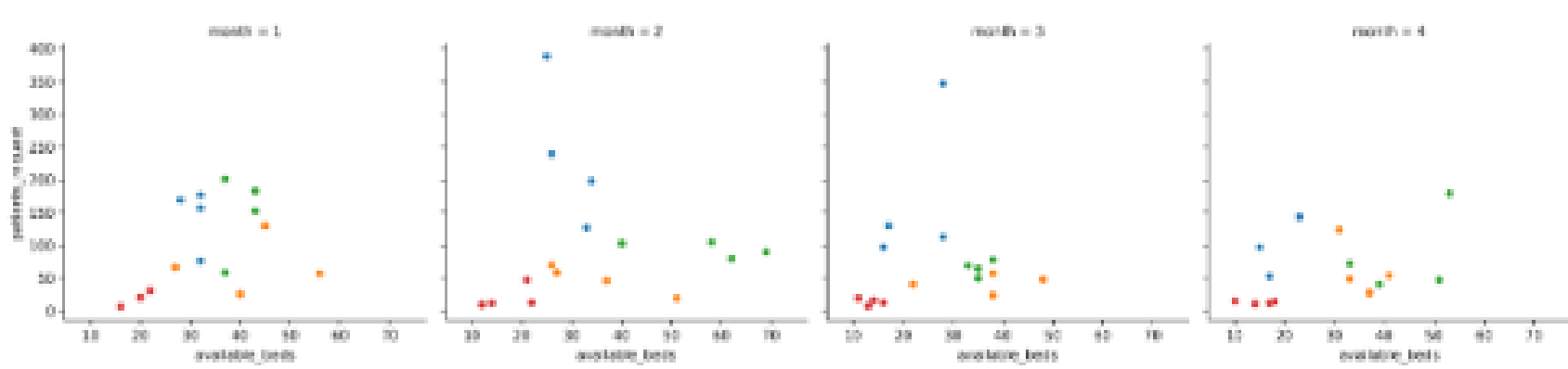


**Figure 8:** Scatter plots of available beds vs patients request per service.

- Same kind of plot (here: scatterplot) across multiple subsets
- Useful to compare patterns across subsets
- Parameters: rows (x-axis), column (y-axis), hue (colour, optional)

# Stacked / Grouped Bar Plot

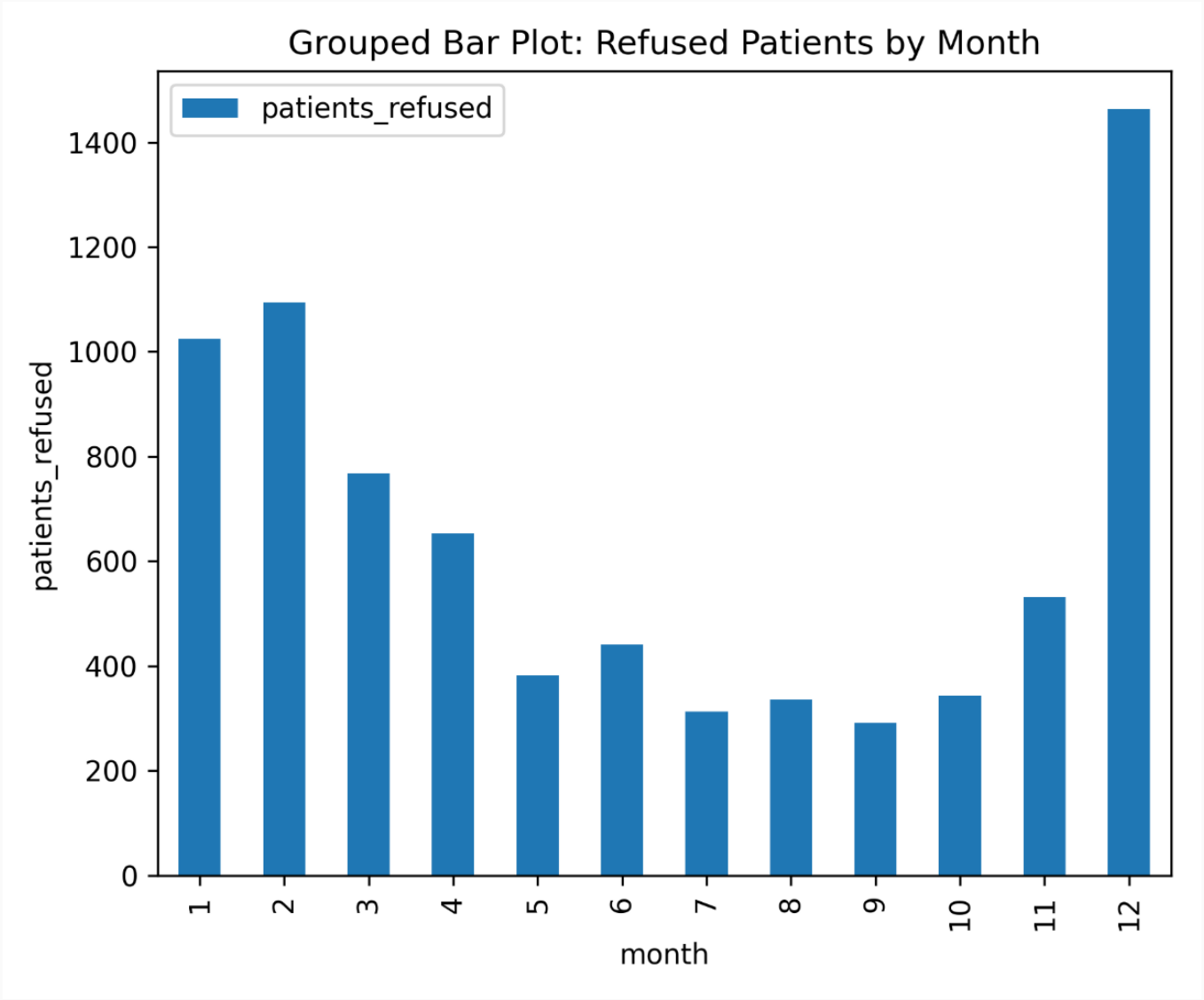



**Figure 9:** Enter Caption

- Same idea as bar plot, but more advanced: grouping several variables
    - Here: refused patients by month **for all categories**

# Regression / Trend Lines

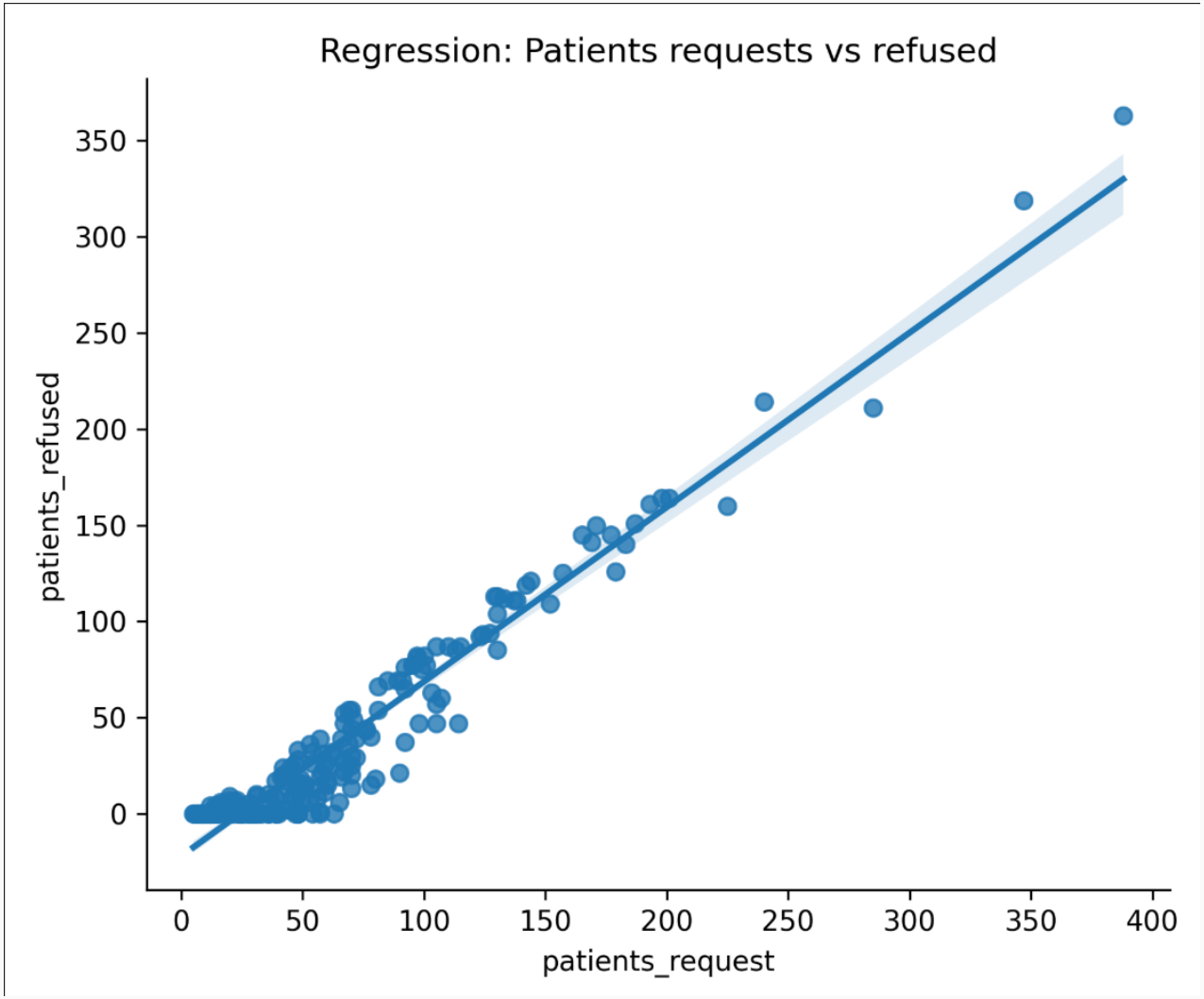



**Figure 10:** Regression lines on a scatter plot.

- Plots linear relation between two variables
- Useful to detect trends
- Eventually, add `hue` parameter

# Time-Series with Rolling Averages

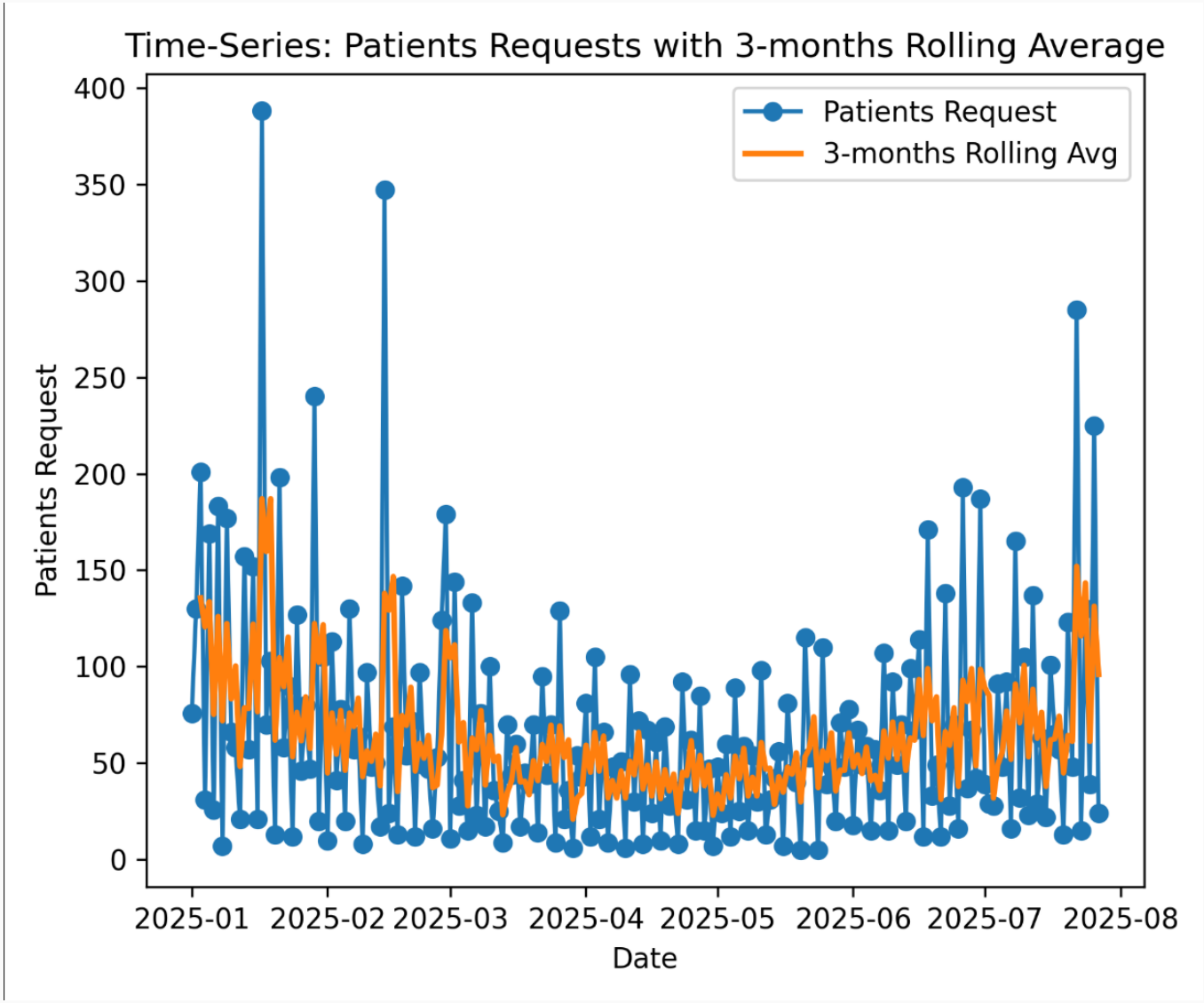



**Figure 11:** Monthly patients admissions with 3-months rolling average

- Data in relation to time (here: months)
- Data taken at **equal points in time**
- Useful to analyze temporal structure and temporal changes of data
- Rolling average: smooth monthly data (here: three months, so average of each months with 2 previous months) to highlight trends without being influenced by possibly unimportant changes

# Summary

- Heatmaps $\rightarrow$ correlations and patterns
- Pairplots $\rightarrow$ multi-variable relationships
- Violin plots $\rightarrow$ distributions with density
- Facet grids $\rightarrow$ subgroup patterns
- Stacked/Grouped bars $\rightarrow$ categorical comparisons
- Regression $\rightarrow$ trends and group differences
- Time-series $\rightarrow$ temporal trends and smoothing