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## Air Canada Cargo Contact Centre Staffing Forecasting

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# Agenda:

- Problem Statement
- Data Description
- Methodology
- Results
- Conclusion

# The Problem

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Air Canada Cargo Customer Service creates a **one-year staffing schedule** based on historical data for **emails and calls**.

Currently, Air Canada Cargo Customer Service **uses an Excel spreadsheet** to calculate the required number of staff to achieve desired service levels in both **English and French**.

With new channels of communication, we need a solution to estimate the number of staff required to service our customers.



# Problem Statement:

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## Goals

Create a model for **estimating required staffing** based on contact volumes, considering service level requirements, language needs, and current staffing levels.

### Goals:

- Consider service level requirements
- Account for language requirements (English/French)
- Incorporate current staffing levels

### Subproblems:

- Forecasting number of required staffing
- Optimisation of the schedule based on the Forecast

# Datasets Description

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We have four main datasets:

- **CASES / all cases** : Voice calls + E-mails
- **VoiceCallComplete** : More detail about voice calls
- **AWSConnectData** : Performance of agents
- **AWB** : Airway bills

Data preprocessing steps taken (cleaning, merging datasets, etc.)





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# Methodology

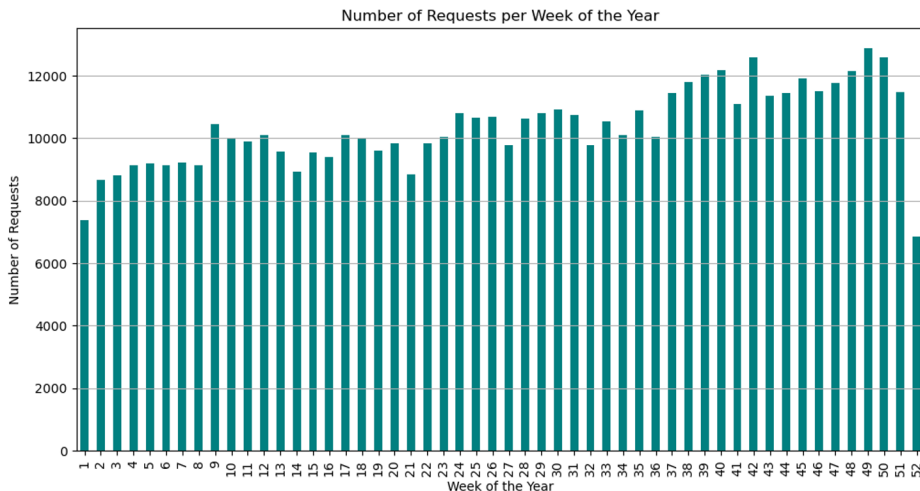
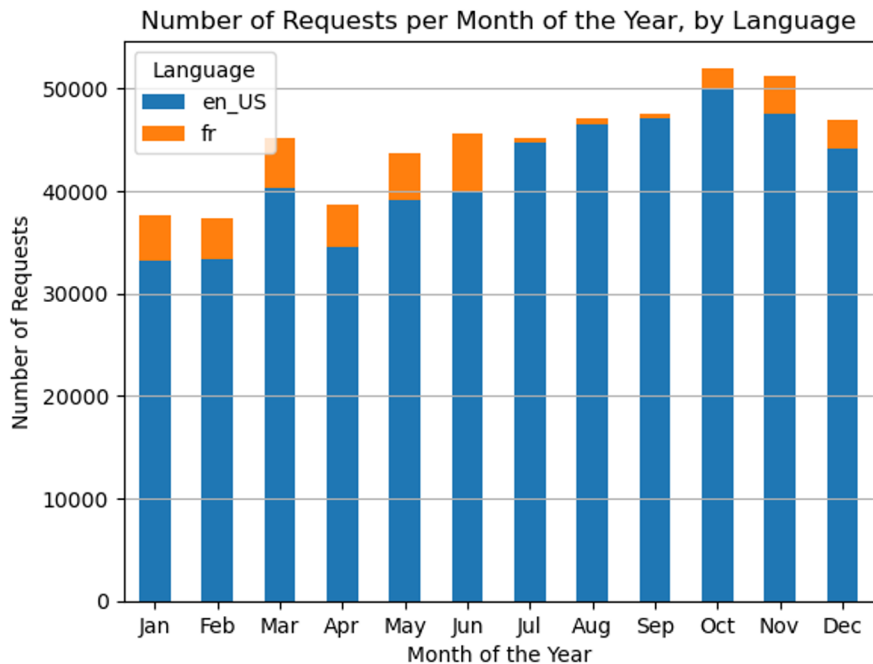
- Descriptive Analysis
- Forecasting
- Optimisation

# Descriptive analysis



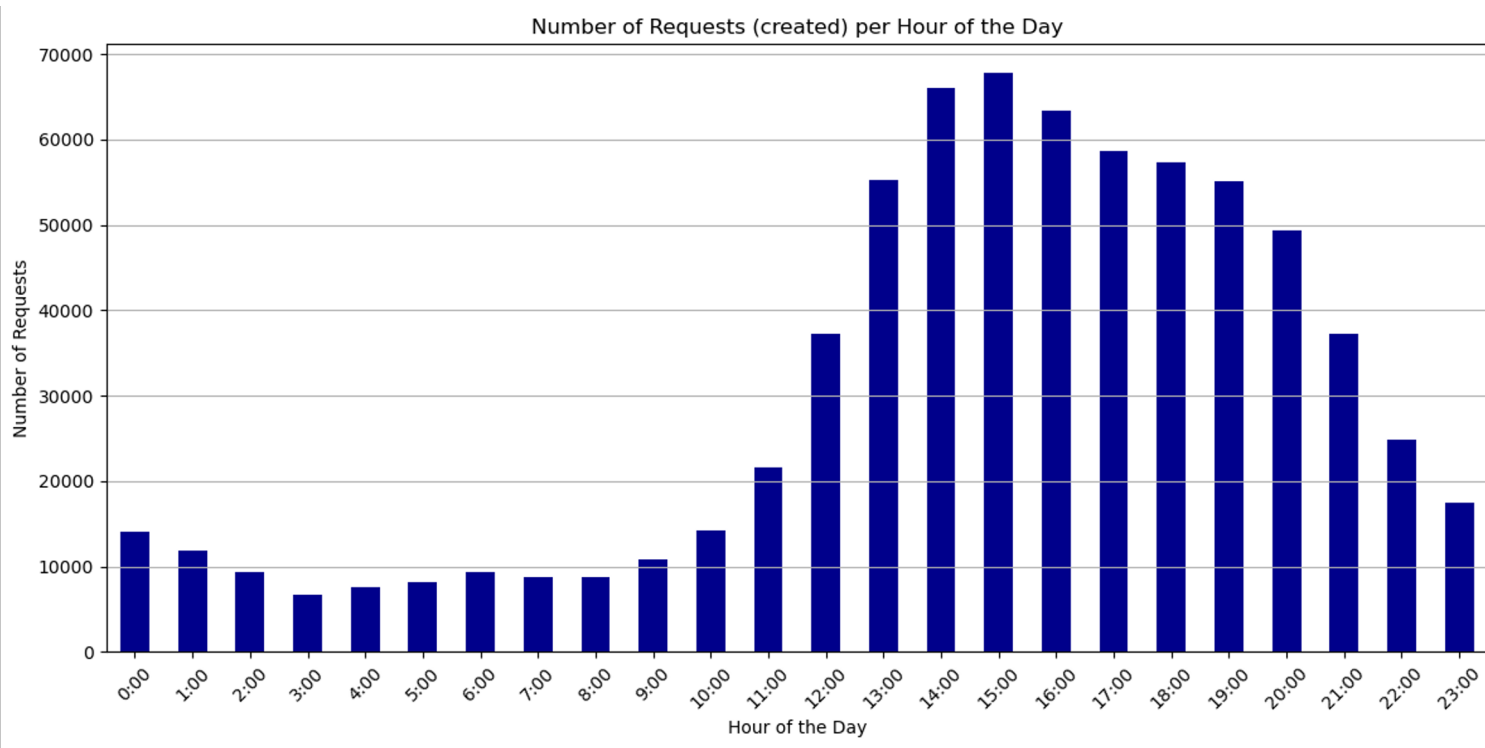
- 15 months of data: January 2023 - April 2024
- Calls and emails
- Languages: English and French
- Also have number of **airway bills** (cargo contracts) per month

# Requests by week and month

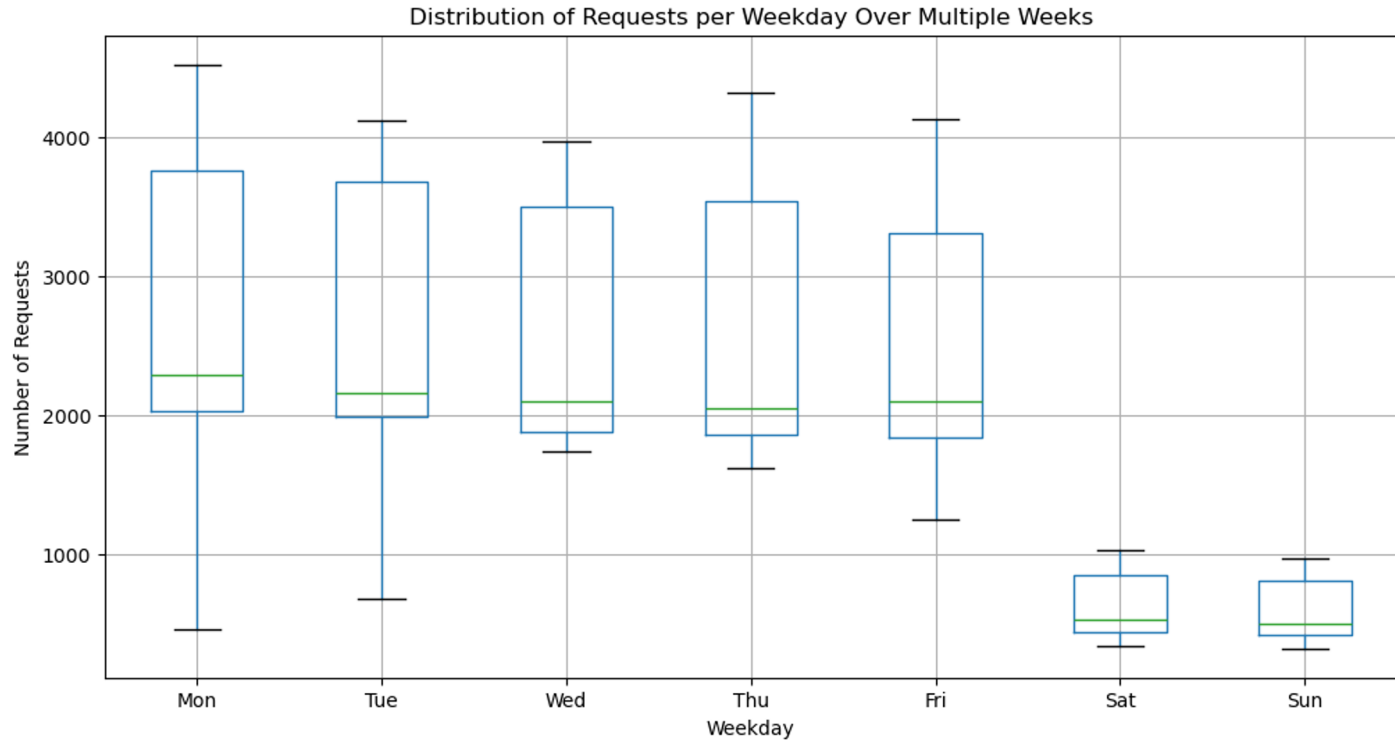




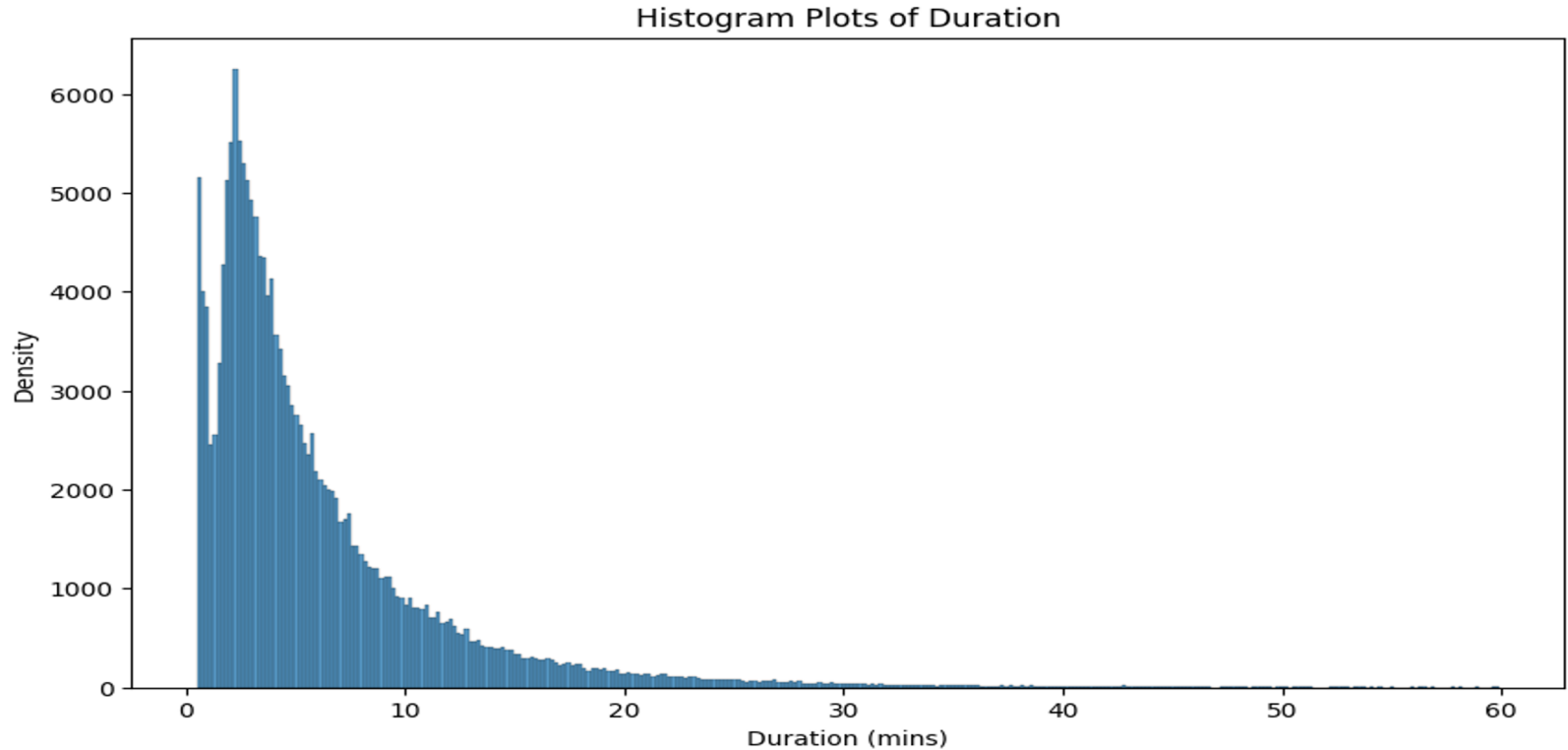
# Requests across the day



# Requests across the week

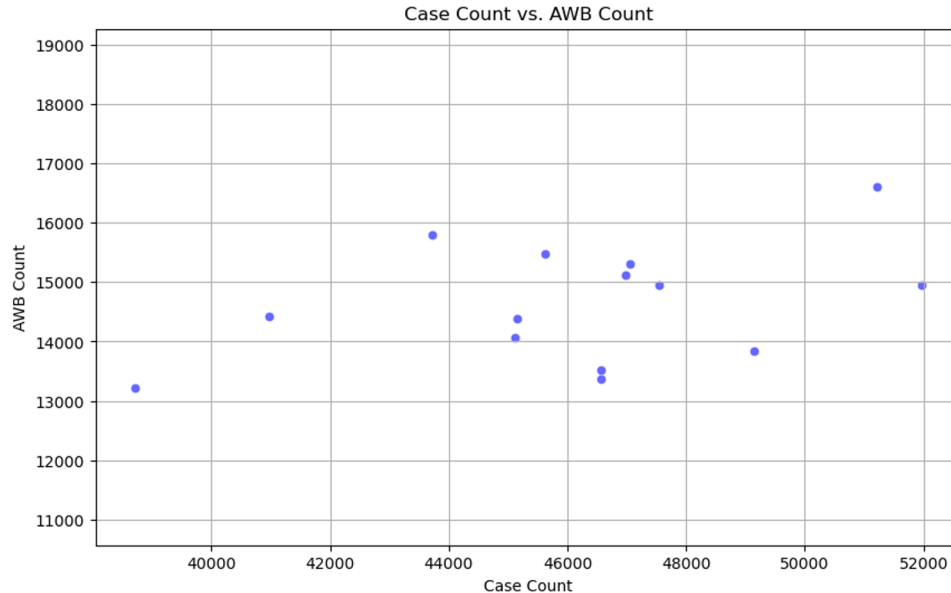


# Work time required per request



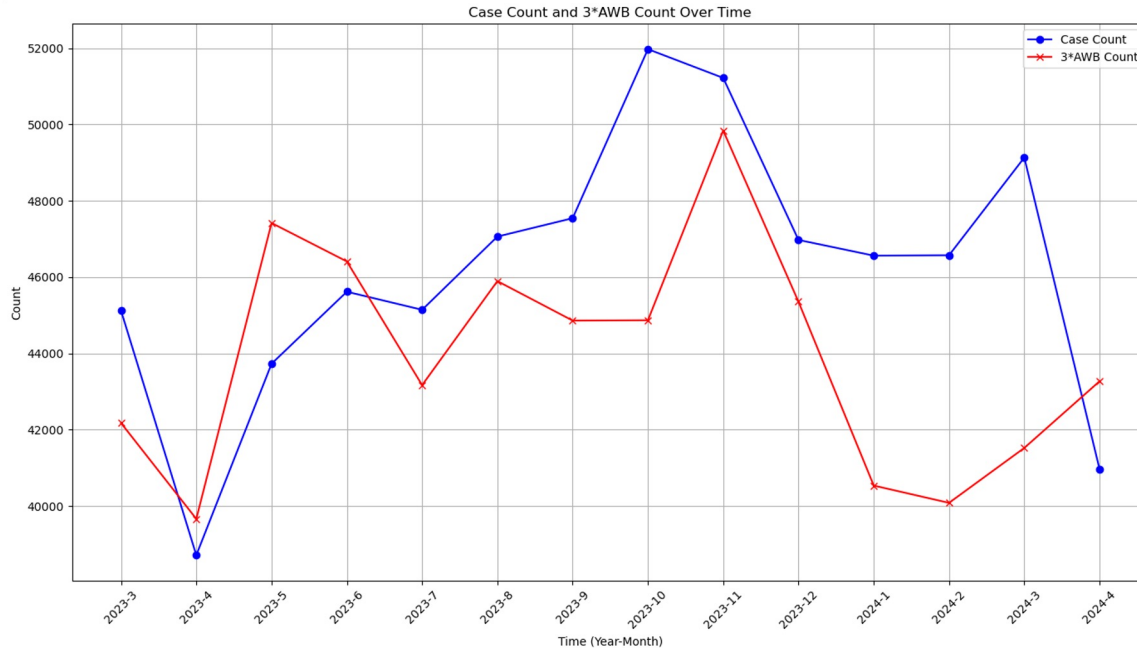
# Correlation requests / airway bills

There is a positive correlation (0.4) between airway bills and requests



# Correlation requests / airway bills

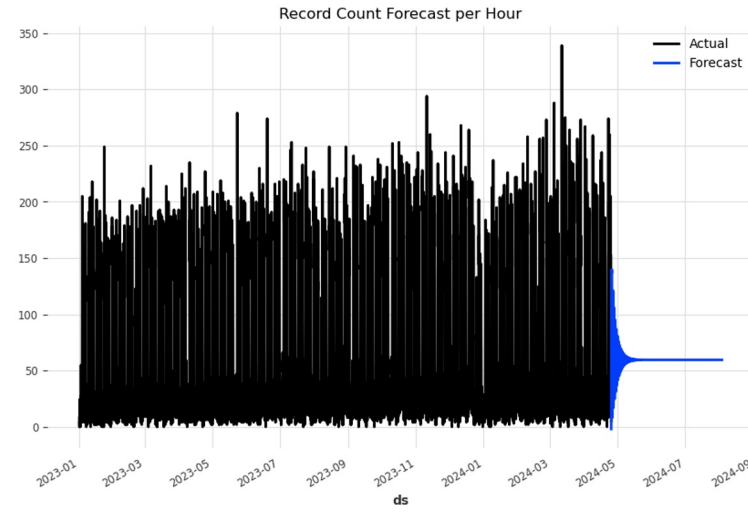
There is a positive correlation (0.4) between airway bills and requests



# Forecasting Challenge

## Shifts are only chosen once per year!

- We need to predict demand for the entire year ahead
- So we can't use autocorrelated / recurrent models (errors will accumulate!)



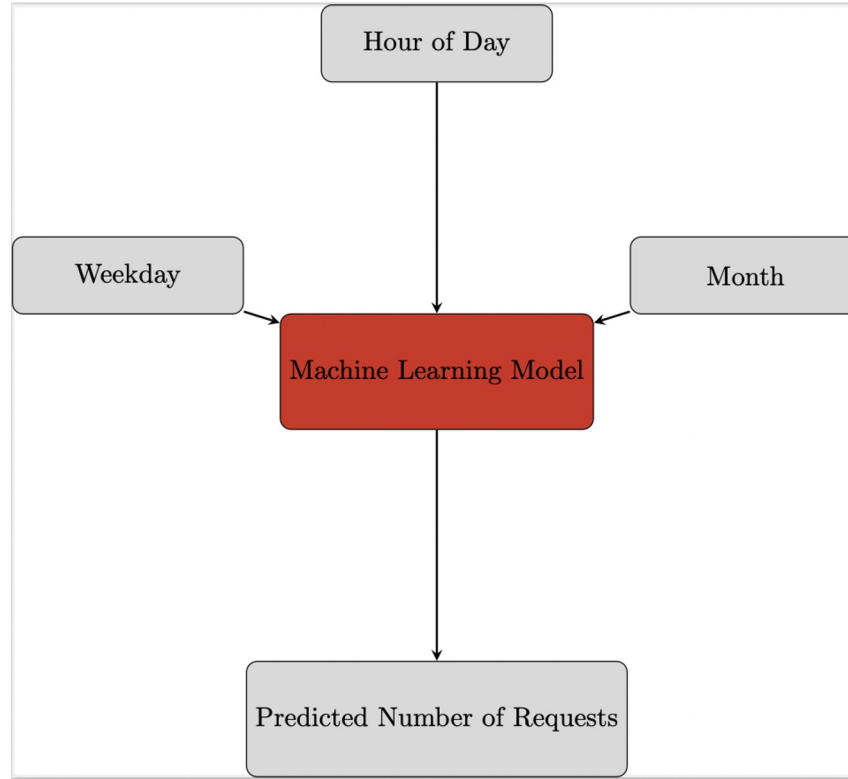
# Forecasting Challenge

Shifts are only chosen once per year!

- How to evaluate? We only have 15 months of data!
- Our solution: split into train/test set as follows:

1	2	3	4	5	6	7
8	9	10	11	12	13	14
15	16	17	18	19	20	21
22	23	24	25	26	27	28
29	30	31				

# Forecasting





# Forecasting



## Forecasting models used:

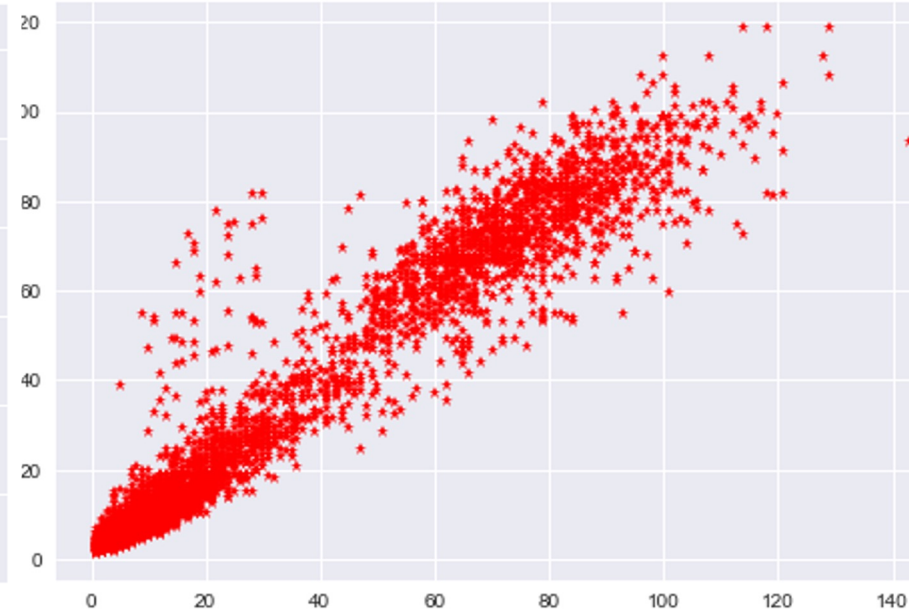
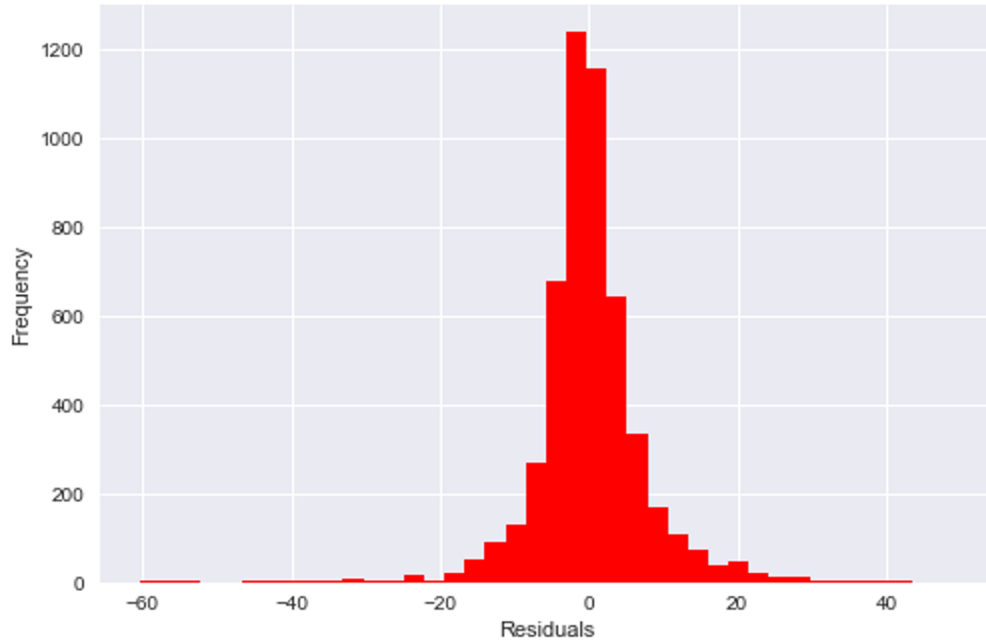
- Linear regression model.
- Support Vector Machine model.
- Random Forest Model.
- K-Nearest Neighbors (K-NN) regression model

Where the average of the train set is **27.6**

Model	MAE/train	MAE/test
LR	14.8	14.8
SVR	7.2	7.5
RF	4.9	6.4
KNN	5	7

# Forecasting

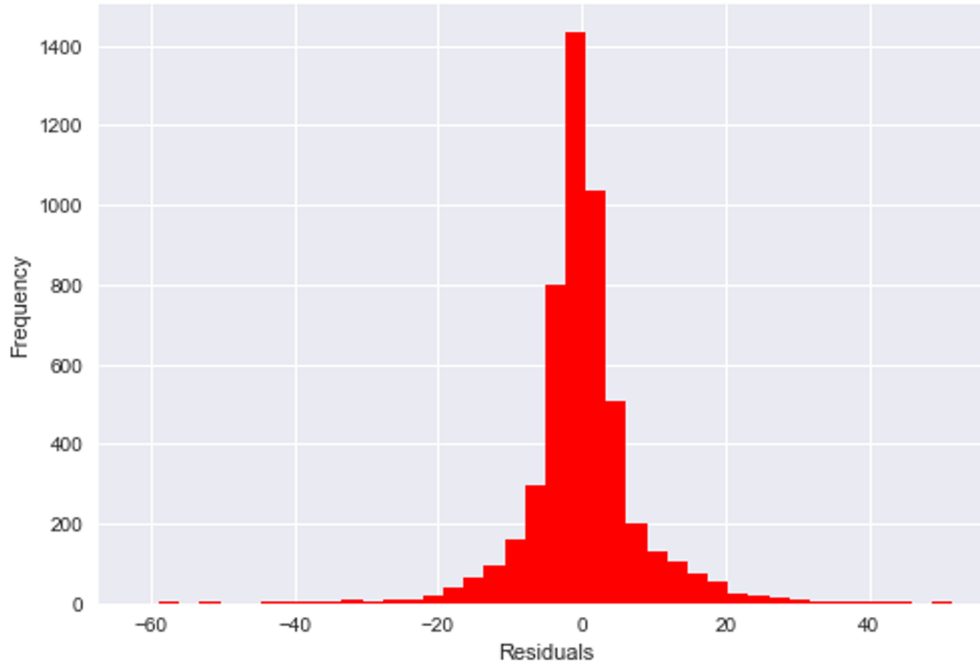
Histogram of Residuals (Random Forest Model)



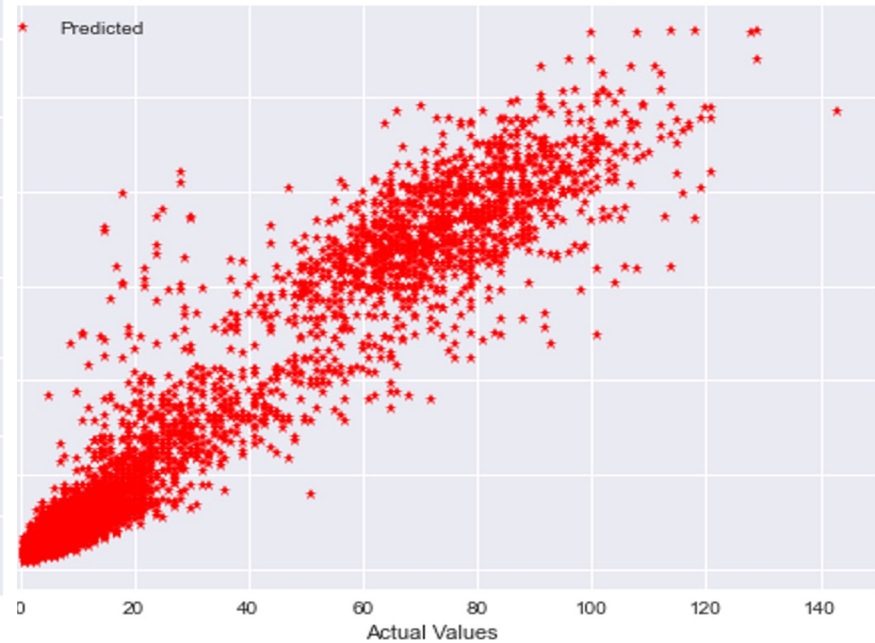
Random Forest Model

# Forecasting

Histogram of Residuals (K-Nearest Neighbors)

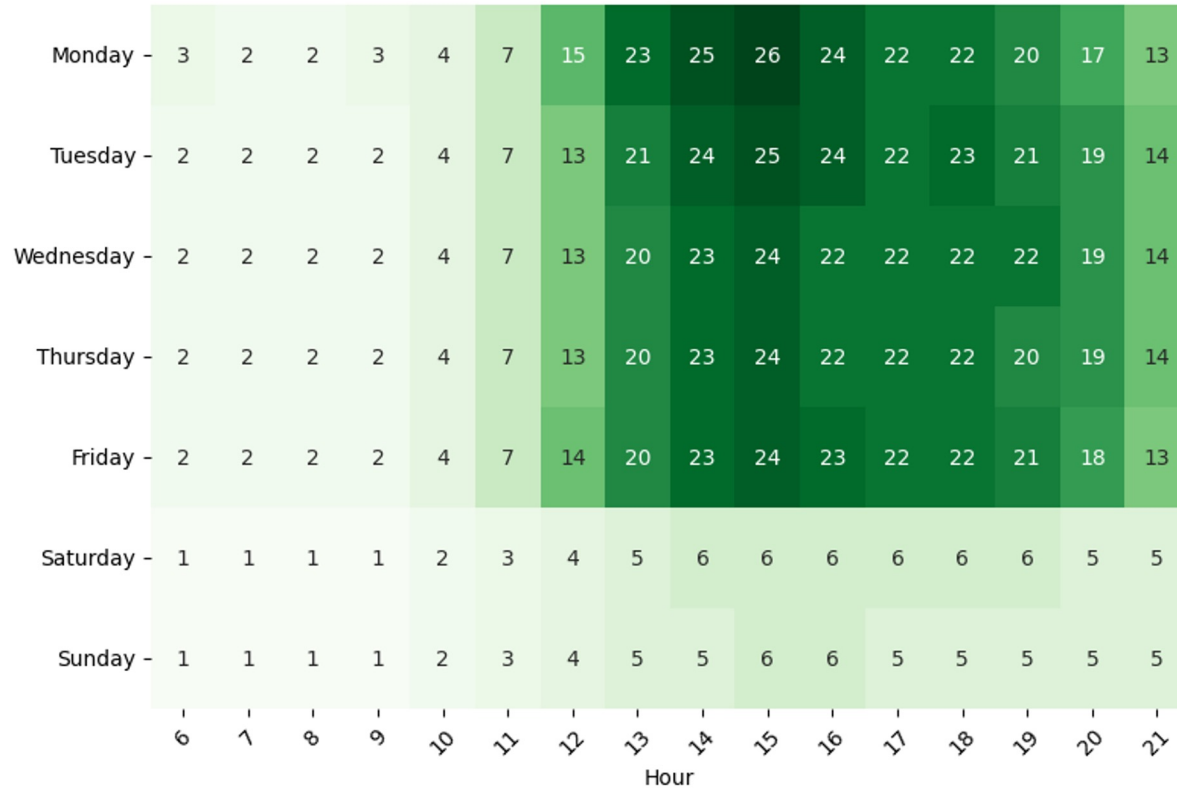


Actual vs. Predicted Values for Training Set



K-Nearest Neighbors (K-NN) regression

# Labour Realized Demand



# Optimisation model



- **Minimise the number of shifts required**

**Subject to covering all requests by language (EN/FR)**

- Assume that every needs to be answered within 1 hour
- Assume that every needs take about 10 minutes to be answered
- Assume that average need of the past year repeats itself
- Higher cost for bilingual staff and full time staff

# Scheduling for Monday

Hour	Total Demand	Total in Office	English FT Start	English PT Start	Bilingual FT Start	Bilingual PT Start
6	3	3			3	
7	2	1				
8	2	1				
9	3	1				
10	4	8		1		4
11	7	8				
12	15	15			3	4
13	23	23		1	4	3
14	25	26			6	
15	26	26				
16	24	28				7
17	22	28				
18	22	24				
19	20	20				
20	17	17				
21	13	13				

# Scheduling for Saturday

Hour	Total Demand	Total in Office	English FT Start	English PT Start	Bilingual FT Start	Bilingual PT Start
6	1	1			1	
7	1	1				
8	1	1				
9	1	1				
10	2	1				1
11	3	1				2
12	4	4				
13	5	5			1	
14	6	6			2	
15	6	6				
16	6	8				3
17	6	6				
18	6	6				
19	6	6				
20	5	6				
21	5	5				

# Conclusion

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- A relatively simple model can predict the **demand** quite well
- Many simplifying assumptions for the optimisation model
- Optimisation model should be viewed as “work in progress”



# Next steps



- Integrate prediction and optimisation models
  - Requires stochastic/robust/chance constraint programming
- Train model on more data (2, 3, ... years)
- Remove simplifying assumptions
  - Consider a realistic ratio between Full-time & Part-time employee
  - Consider a realistic ratio between bilingual & monolingual employee
  - Fair allocation to each employee and having job rotation

Questions?

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