Forecasting of Staffing Needs

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Agenda

- Introduction
- The Data
- Data Science Approaches
- Timeline

Introduction

The Partner - Providence Health Care

- Providence Health Care (PHC) is a non-profit organization.
- Almost 9,000 people working at their 16 facilities - 6,000 staff, 1,000 medical staff/physicians, 200 researchers, 1,600 volunteers.
- PHC is the provincial centre for the care of six groups of people with often-intensive health needs.

Providence
HEALTH CARE
How you want to be treated.

Objective

The purpose of this project is to forecasting staffing needs in healthcare on a weekly basis, providing insight on how many back up staff PHC needs to have a full staff.

Final Product

The final product will consist of:

- a dashboard (developed in R Shiny or Tableau);
- the scripts containing the code used to proceed with the analysis; and
- a report outlining the methodologies and findings.

The Data

Data Description

EXCEPTION_CREATION_DATE	EXCEPTION_GROUP	JOB_FAMILY_DESCRIPTION	JOB_TITLE	PROGRAM	SUB_PROGRAM	SHIFT_DATE	EARNING_CATEGORY
2017-10-25	Leave of Absence	Registered Nurse-DC1	RN Vacation Relief	HEART LUNG	BARBARA HALL	2018-01-01	Relief Not Needed
2018-01-01	Casual Sick or Cancelled	Licensed Practical Nurse	Licensed Practical Nurse	MEDICINE	MSJ NURSING UNITS	2018-01-01	Relief Not Needed
2017-11-15	Swap	Registered Nurse-DC1	Registered Nurse	HEART LUNG	MELANIE MULDER	2018-01-01	PT Over FTE
2017-11-30	Vacancy	Care Aide (Resident)	Resident Rehab Care Attendant	SENIORS CARE	RES SVCS LAN	2018-01-01	Regular Relief Utilized
2016-10-04	Vacancy	Clerical Other	Clerk IV	SURGERY	OR PAR SPH	2018-01-01	PT Over FTE

Data Wrangling

- Raw data is based on exception record: one entry per record
- To apply linear regression: make each row a day, summarise the related variables
- Feature selection needed

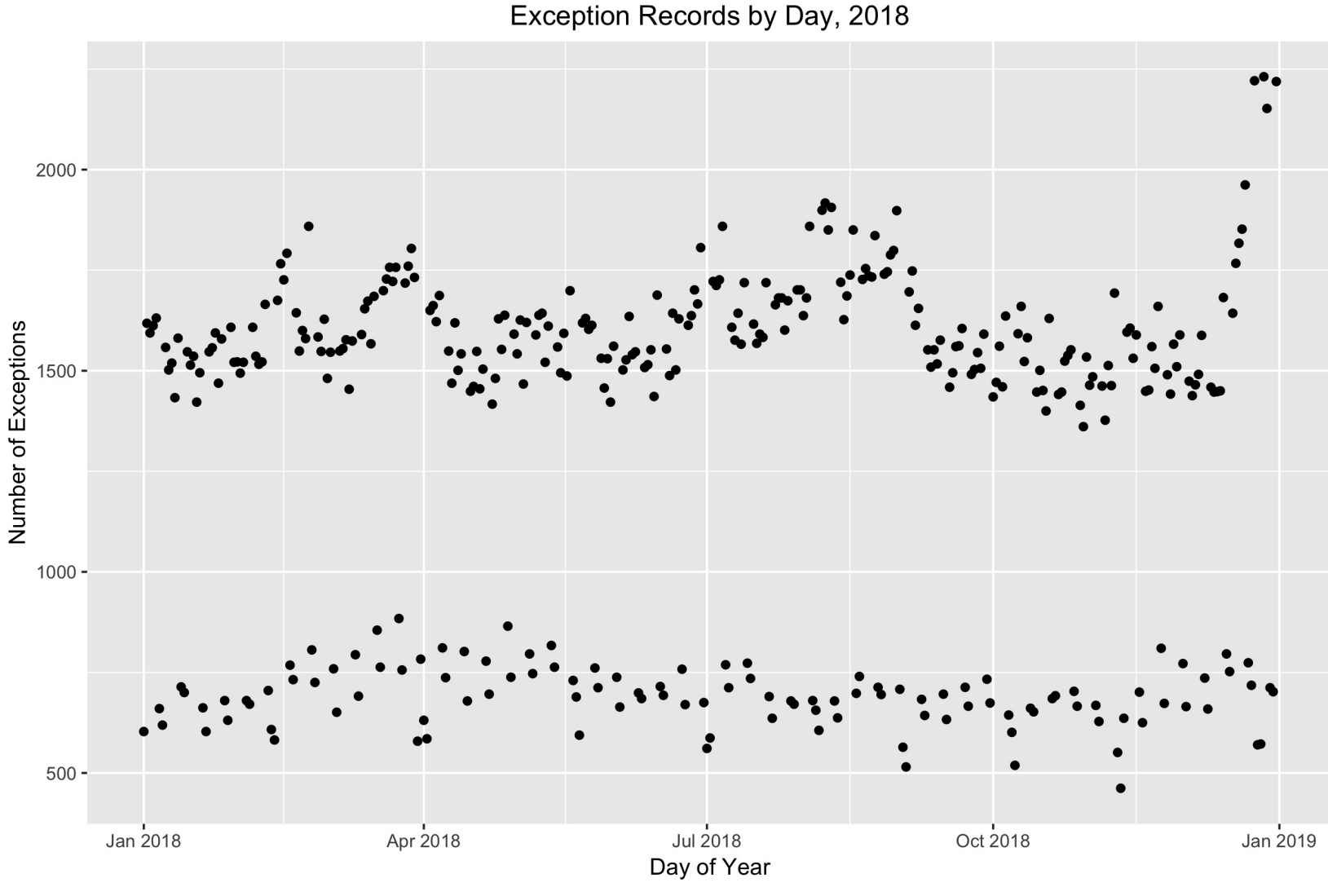
Feature Selection

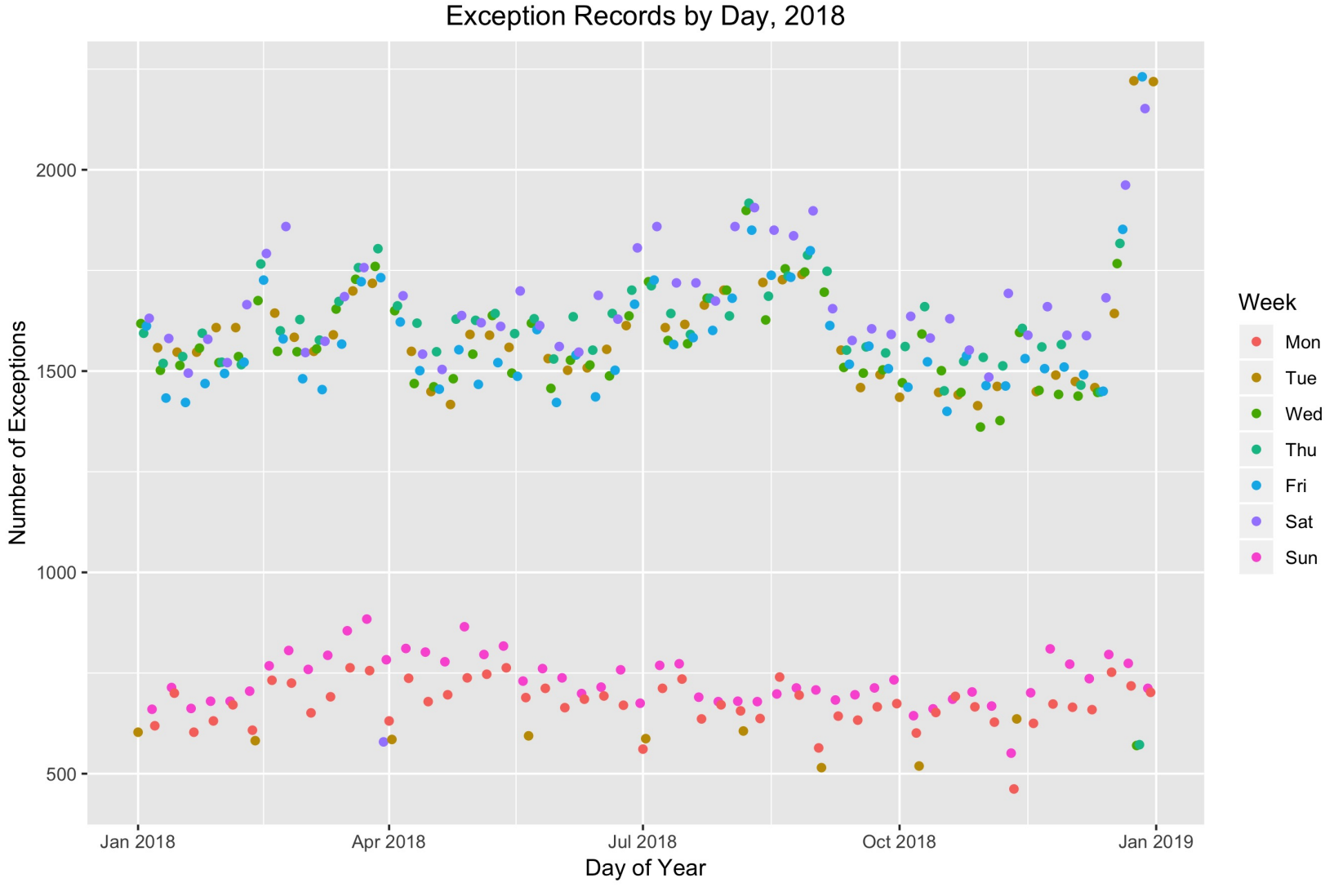
- Select correlated variables among 33 columns and other wrangled variables
- Some pontential related variables:
  - Numbers/Hours of exceptions that are filed ahead
  - Exception Group
  - Job Family
  - Program

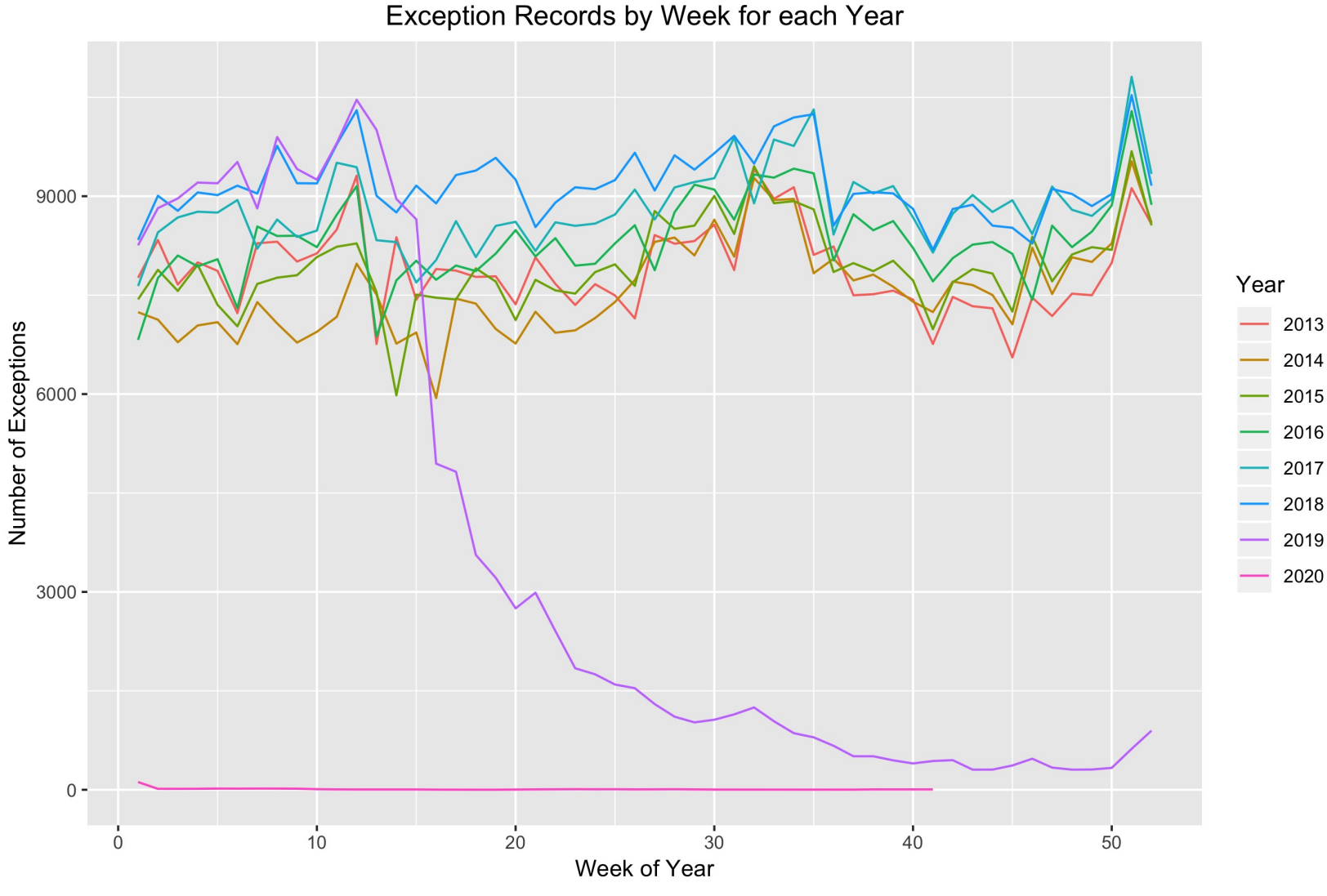
Data Science Approaches

- Time Series
- Linear Regression
- Neural Network

Time Series

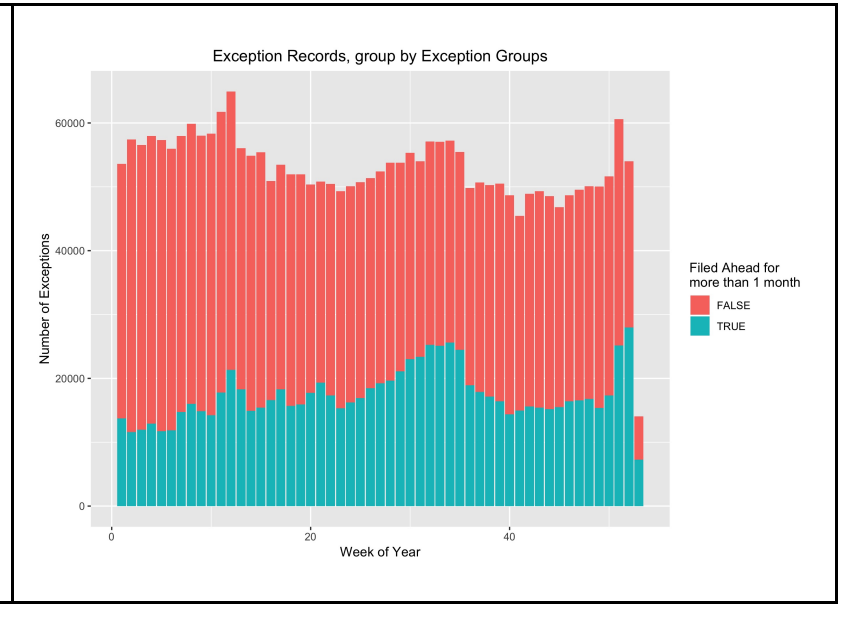

Exception Records by Day, 2018
Number of Exceptions
2000
1500
1000
500
Jan 2018
Apr 2018
Jul 2018
Oct 2018
Jan 2019
Day of Year


Exception Records by Day, 2018
Number of Exceptions
2000
1500
1000
500
Jan 2018
Apr 2018
Jul 2018
Oct 2018
Jan 2019
Day of Year
Week
Mon
Tue
Wed
Thu
Fri
Sat
Sun


Exception Records by Week for each Year
Number of Exceptions
9000
6000
3000
0
0
10
20
30
40
50
Week of Year
Year
2013
2014
2015
2016
2017
2018
2019
2020

Linear Regression


Exception Records, Filed Ahead or Not
Number of Exceptions
60000
40000
20000
0
0
20
40
Week of Year
Exception Filed Ahead
FALSE
TRUE


Exception Records, group by Exception Groups
Number of Exceptions
60000
40000
20000
0
0
20
40
Week of Year
Filed Ahead for
more than 1 month
FALSE
TRUE

Neural Network

Timeline

Time Period	Milestone
Week 1	Review documentation, and finalize the proposal reports to mentor and partner
Week 2	Data wrangling, feature selection, EDA and implement baseline model
Weeks 3 - 4	Explore different approaches to fit the models
Week 5	Build algorithms, testing, adjusting
Week 6	Improve the dashboard, wrapping up
Week 7	Presentations and reports

Thank you!