# Fire Department Response Time Predictive Analysis

Jackson Gawarecki, Dr. Robert Kelley

Bellarmine University Data Science Program

## Abstract

In emergency response, every second counts. This project aimed to create a robust model able to predict the response times of fire departments in the Louisville Metro and surrounding areas using a dataset from Louisville Metro Open Data. The analysis used decision tree regression to obtain a model with a relatively low root mean squared error. The average response time calculated for each event can be used to create city-wide benchmarks and allow decision-makers to re-evaluate how to approach emergency management. To combat potential overfitting or statistical issues, other models will be used in further analysis.

## Introduction

This project aimed to better predict the response times of fire departments in the Louisville Metro and surrounding areas. Using predictive analysis, the model forecasts the estimated response times of agencies based on given variables. By better understanding what and how variables affect the response time we can make emergency management more efficient and in turn, increase safety and welfare in our community.

## Materials and Methods

- Gathered Data using Louisville Metro Open Data.
- Cleaned data using Python to use in the model including the reorder of the priority column.
- Used Decision Tree Regression to formulate initial model for Response Time (seconds).

## Objective

- Develop a Robust Model
- Analyze Agency-Specific Response Dynamics
- Establish Benchmark Standards and Improvement Targets
- Enhance Emergency Management Decision-Making

## Results

- Average difference between training and test data (RMSE) of ~7 seconds
  - Figure 1 shows max depth of 10 to be ideal
- Priority Column re-ordering
- Potential overfitting issues

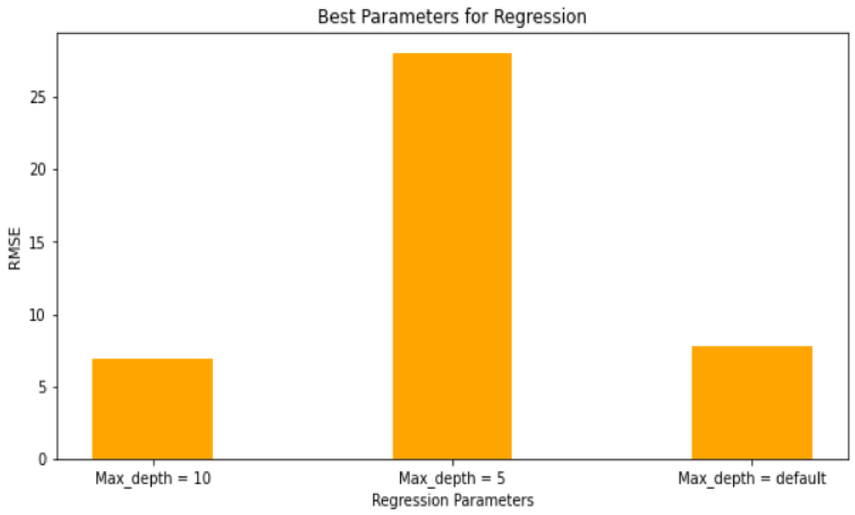


Figure 1 Shows Average root mean squared error (RMSE) for three variations of the Max depth parameter that deals with the complexity of the training data.

## Conclusions/Future Works

- Decision Tree Regressor fits well
- Random Forest and XGBoost models next
- Incorporate zip codes and regions
- Expand to create models for police and ambulances
- Gives telecommunicators accurate estimations to give those in need

## References

- Louisville Metro Open Data
- Python and Libraries
- Microsoft Excel
- Github
- ChatGPT/stackoverflow

## Contact

Jackson Gawarecki:

jgawarecki2@bellarmine.edu

Dr. Robert Kelley:

rkelley@bellarmine.edu