Enhancing Wildfire Management through Early Detection and Size Estimation

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Executive Summary

INTRODUCTION

- Alberta's ongoing wildfires have a significant impact on communities, wildlife ecosystems, and economic stability.

- The study of wildfire data makes it possible to select the best method for fire management strategies.

- Analyze Alberta's wildfire data from 2006 through 2021 to provide complete insights and strategies.

OBJECTIVE

- Deploy resources effectively to reduce cost, risk, and damage done by the wildfire.

- Perform a data-driven study using statistical analysis, and compare alternative models for evaluation.

- Improve fire fighting strategies.

- Identify the factors that have the ability to influence the size of a wildfire.

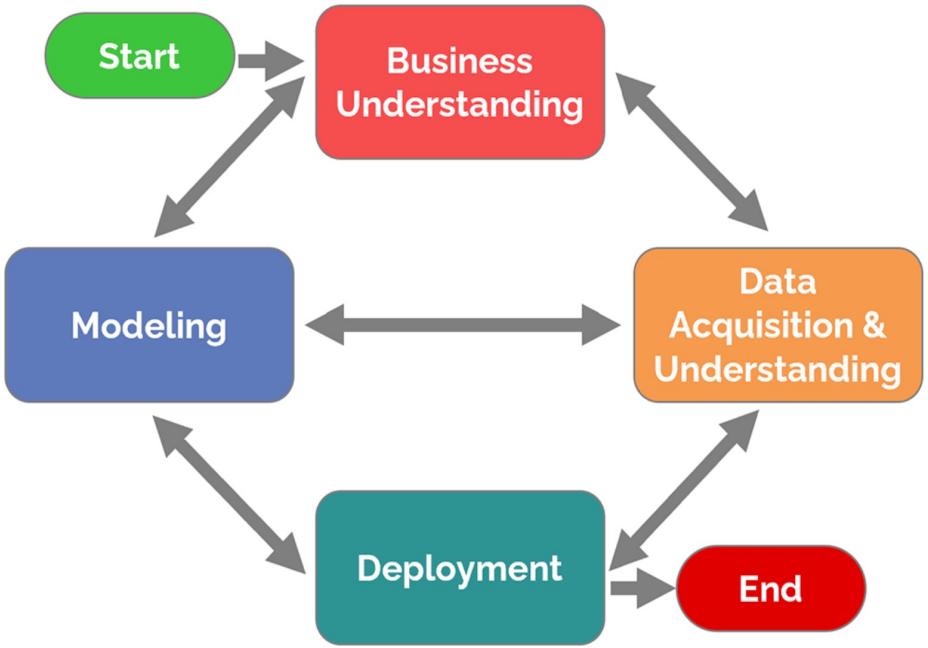
APPROACH

- Data Science Methodology

- Classification Models

Data Science Methodology

MS Team Data Science Process | Domino Life Cycle



Source: https://www.datascience-pm.com/tdsp/

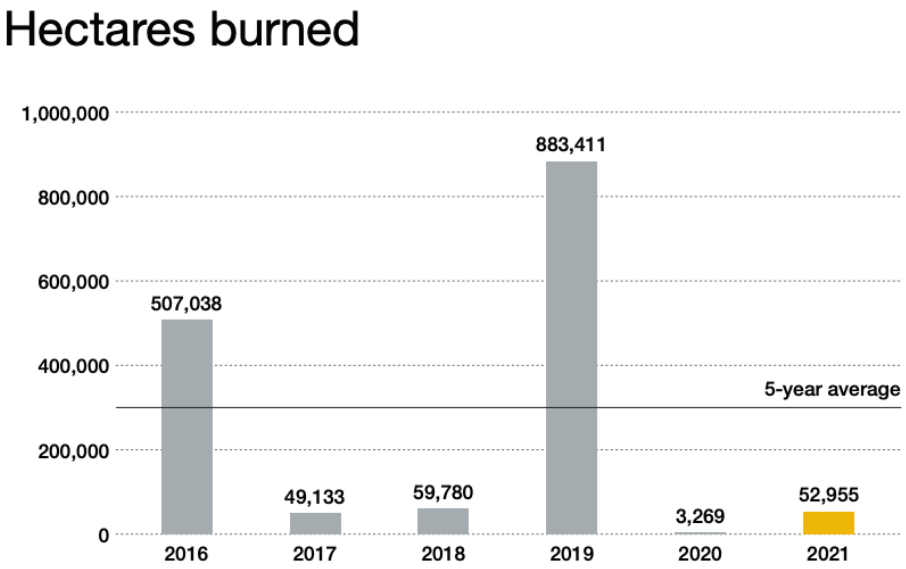
Business Understanding

Business Understanding

Alberta

Business Understanding

Alberta Wildfire



Source: https://open.alberta.ca/opendata/wildfire-data

Business Understanding

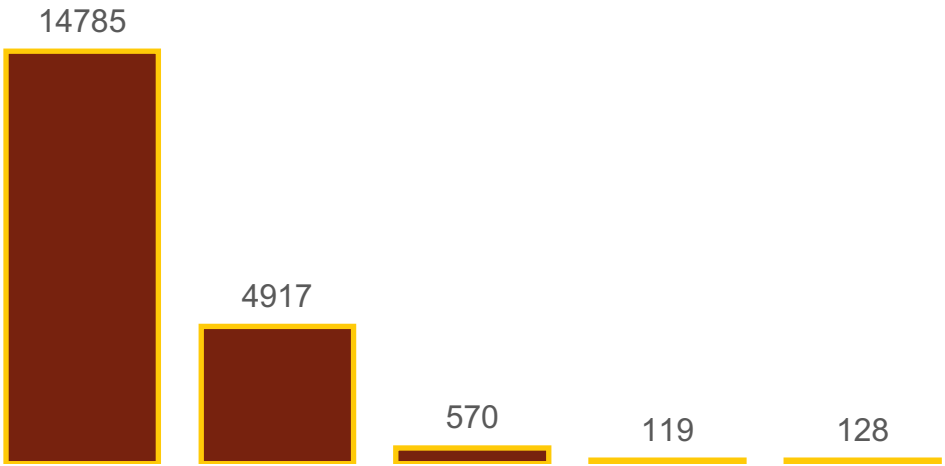
Alberta Wildfire

SIZE CLASS	A	B	C	D	E
Hectares	0 to 0.1 ha	0.1 ha to 4.0 ha	4.0 ha to 40.0 ha	40.0 ha to 200 ha	200 ha

Source: https://open.alberta.ca/opendata/wildfire-data

Business Understanding

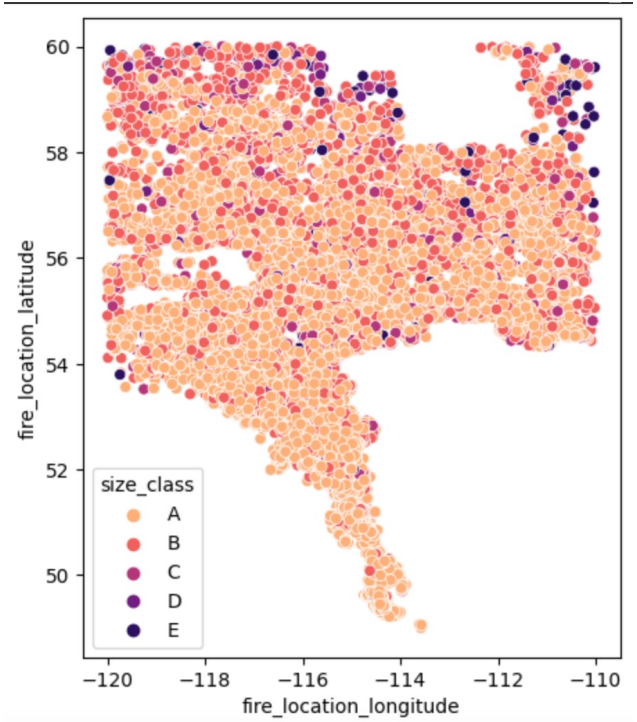
2006 – 2021 Observation



SIZE CLASS	A	B	C	D	E
Count	14785	4917	570	119	128
Percentage	72.06%	23.96%	2.78%	0.58%	0.62%

Business Understanding

2006 – 2021 Observation



Data Understanding

Data Understanding

34%
Temperature above 20 °C

82%
Wind Speed below 10km/hr

33%
West wind direction

42%
Human Activity

39%
Helitack Crew

90%
Dry/ not raining

71%
Provincial Land

33%
Lightning

55%
coniferous plant

68%
Humidity below 50 percent.

25%
May

Data Preparation

Data Preparation

Variables Investigation

- Missing Values
- Duplicate Checking
- Min/Max Values
- Mean Values

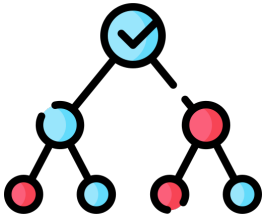
Data Cleansing

- Data Imputation
- Data Transformation
- Outliers Deduction
- Data Normalization

Modelling

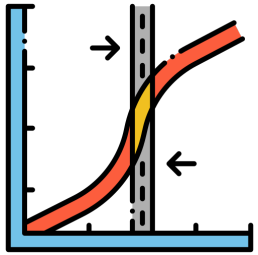
Modelling

Decision Tree

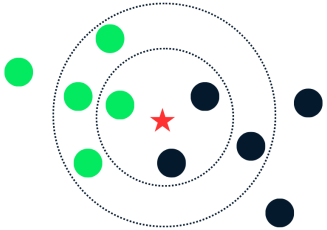


Random Forest

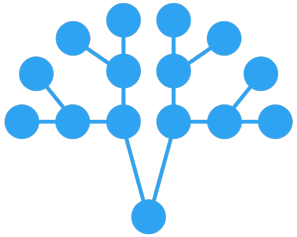
Logistic Regression



K-Nearest Neighbor (KNN)

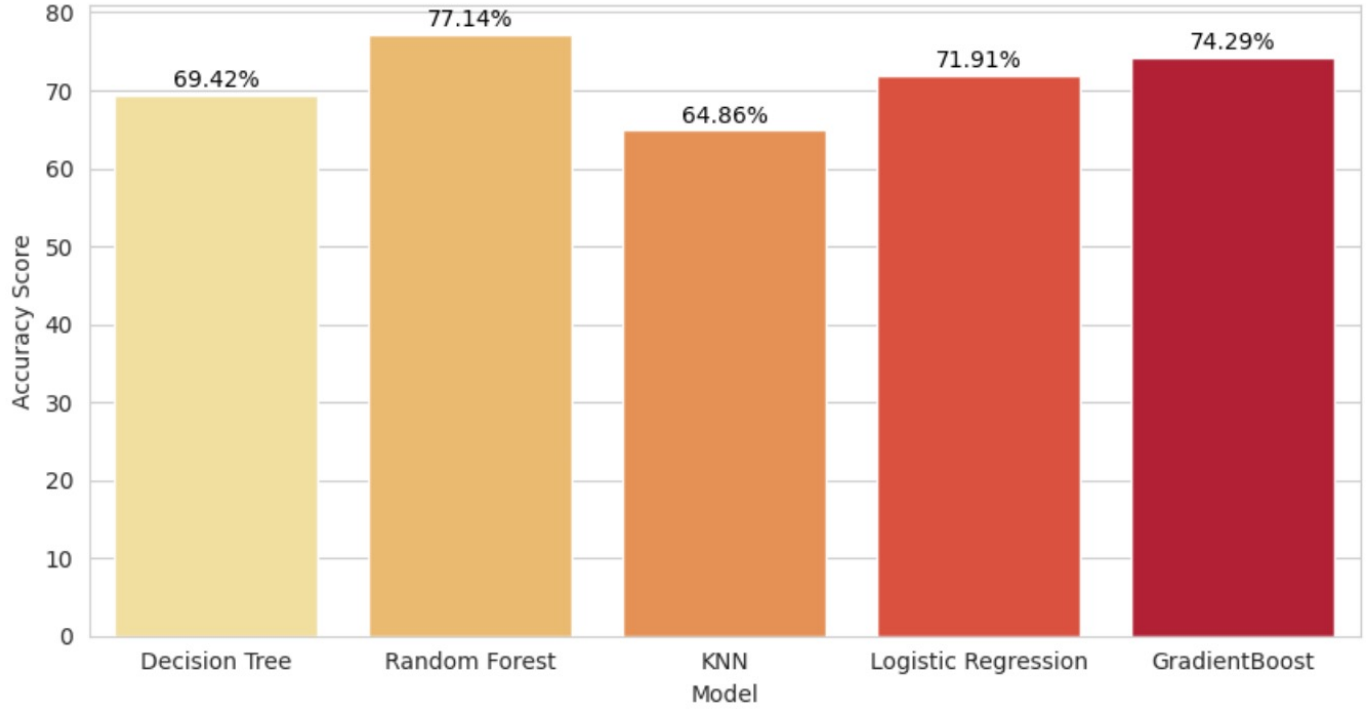


Gradient Boosting



Modelling

Result



Conclusion and Recommendation

Conclusion

- The month of May experiences the highest frequency of wildfires.
- Wildfires tend to grow more quickly when influenced by west wind directions, enabling them to spread more quickly.
- The time between the start of a wildfire and when it is declared under control has a substantial impact on the growth of the wildfire.
- Size Class E is more common in Alberta's North East Region.
- The Boreal Spruce, a coniferous plant, is the main fuel type for wildfires.
- A fire's behaviour and growth are unaffected by its slope or location.

Recommendation

Take control of the wildfire situation as soon as possible to limit the rapid growth and possible damage.

From April to September, strengthen the monitoring system in order to detect wildfires quickly and effectively. Provide sufficient staff and resources to ensure effective control.

Allocate funds for the acquisition and maintenance of airborne firefighting equipment to improve wildfire response and control capabilities.

Implement strict fire bans and restrictions during dry seasons. and foster a culture of fire safety and responsibility among residents.

Identify coniferous areas and create accessible pathways to neighbouring water sources for successful firefighting.

Thank you!