Analytics Startup Plan

Synopsis: ***This document provides a high-level walkthrough of the activities required to guide completion of the analysis.***

Project	*Enhancing Wildfire Management through Early Detection and Size Estimation*
Requestor	*Centennial College*
Date of Request	*July 04, 2023*
Target Quarter for Delivery	*August 18, 2023*
Epic Link(s)	*https://open.alberta.ca/opendata/wildfire-data*
Business Impact	*Predicting the size of future wildfires to mitigate risk of spread and reduce damage.*

1.0 Business Opportunity Brief

Clearly articulated business statement of the Ask, opportunity, or problem you are trying to solve for. An important step is to understand the nature of the business, system or process and the desired problems to be addressed. This will be communicated back to All stakeholders for alignment.

Wildfire occurrence is a common and significant challenge in the province of Alberta, Canada. The region's dry and forested landscapes, coupled with frequent hot and windy conditions, create favorable conditions for wildfires. Alberta experiences a high number of wildfires each year, posing threats to both natural resources and human communities. As a result, proactive measures such as early detection systems, strategic fire management plans, public awareness campaigns, and community engagement initiatives are vital in mitigating the risks and minimizing the potential devastation caused by wildfires in Alberta.

This project aim to estimate the potential size a wildfire may attain in Alberta. By estimating it, we aim to enhance our understanding of wildfire behavior and improve community safety, resource allocation, and decision-making in wildfire management and response efforts across Alberta.

The specific ask:

Are there any predictive models or algorithms that can estimate the potential size of a wildfire?

Clearly articulate the specific task you will be conducting to help achieve the opportunity

Since the 1990s, artificial intelligence has been employed in wildfire science and management. According to Jain et al. (2020), the following modelling techniques such as decision trees, random forests, SVM, deep learning, Bayesian methods, naive bayes, clustering methods, and KNN are the methods that can be used for wildfire prediction. In her study on US wildfires, Srinivasan (2020) employed PyTorch, a deep learning framework, which demonstrated superior performance compared to Logistic Regression. By utilizing PyTorch, it highlighted the effectiveness of the approach in studying and predicting wildfires.

Machine learning (ML) models, according to research by Kondylatos et al. (2022), give a lot of weight to factors like soil moisture and relative humidity when generating forecasts about wildfires. These results imply that these environmental variables are critical to the modelling procedure and influence the precision of wildfire forecasts.

1.1 Supporting Insights

Define any supporting insights, trends and research findings. Where relevant, list key competitors in the market. What are their key messages, products & services? What is their share of market, nationally and regionally?

Alberta, located in western Canada, is a province known for its diverse landscapes, and abundant natural resources. Alberta, which is bordered to the west by the Canadian Rocky Mountains, is home to wide areas of forests, plrairies, and attractive river valleys and lakes.

Every year in the last ten years in Alberta has witnessed at least 1.4 million hectares of land scorched or more because of wildfires, with the exception of 2020. This increase is consistent with recent trends of rising temperatures in Canada Livingston (2023).

According to Bloomberg (2016), the Insurance Bureau of Canada reports that the damage from the wildfires, in 2016 was $3.58 billion, making it the most expensive disaster in the history of the insurance industry in the whole country. Nearly 90,000 people were compelled to flee due to fires occurred in May of 2016, which also caused the destruction of roughly 2,400 houses and other structures. Arson is to blame not climate change or human carelessness combined with a hotter and drier environment (Anderson et al., 2023). Given that this is a severe crime with a considerable impact on the residents' lives and health, it could be a serious threat to the province of Alberta.

1.2 Project Gains

Describe any revenue gains, quality improvements, cost and time savings (as applicable). What will you do differently and why would our customers care. What are the implications if we do nothing? This section is particularly key for prioritization against company goals and KPI's.

By establishing this project along with developing prediction models, the government of Alberta will be able to deploy resources effectively to effectively prevent wildfires from spreading. By precisely predicting the potential size growth of wildfires, the government can strategically deploy firefighters, equipment, and supplies. Benefits of this proactive approach include a quicker wildfire containment, potential cost savings, and less harm to the environment and wildlife. This approach also makes it possible for more effective and targeted firefighting actions. Additionally, by identifying factors that contribute to the spread of flames, such as weather conditions or vegetation density, the government may put preventative measures in place to minimize the frequency and intensity of wildfires, further lowering their occurrence.

Note: Completion of the following sections is possible only after a careful assessment and triage of the Ask. This is required to determine scope, resource, time, priority and data availability.

2.0 Analytics Objective

List the key questions, assumptions and define the hypotheses. Often the deliverable may not just be an analysis output, however a recommended operating model or blueprint for a pilot etc.

Note: Asking the right questions and truly understanding the problem will lead to the right data, right mathematics, and right techniques to be employed.

Key Questions:

- Could we use machine learning to determine the size of the wildfire?
- How does weather condition, humidity, and topography affect the speed and direction of wildfire spread?

- Can we predict the potential size and rate of spread of a wildfire based on early observations and initial conditions?

Hypothesis:

- Weather conditions and wind speed play a crucial role in determining the growth and spread of wildfires.

2.1 Other related questions and Assumptions:

List any assumptions that may affect the analysis

The following assumptions are :

- • The majority of wildfires are caused by human activity, including accidental igniting, defective equipment, and purposeful acts of arson. To lessen the incidence and effects of wildfires, it is essential to address these factors using awareness and preventative actions. The scope of this study is limited to the province of Alberta, focusing specifically on the wildfire situation within this region.
- The location and spread of wildfires are inherently unpredictable and can occur randomly, making it challenging to precisely anticipate their behaviour. Therefore, predicting the exact trajectory and extent of a wildfire's spread is often difficult, requiring continuous monitoring and adaptive strategies to respond effectively.

2.2 Success measures/metrics

What does success look like? Define the key performance indicators (success definition/indicators, drivers and key metrics) against which the objectives will be analyzed. These should be drawn from the interlock meeting with key stakeholders and will inform the approach and methodology for the analysis.

• Analyzed the outcomes obtained through various predictive modeling techniques for wildfire prediction.

• Determined the most effective model among the predictive models employed.

• forecasted the likelihood that wildfires in Alberta would reach particular magnitudes or sizes.

• Provided recommendations for implementing successful wildfire prevention and mitigation strategies.

2.3 Methodology and Approach

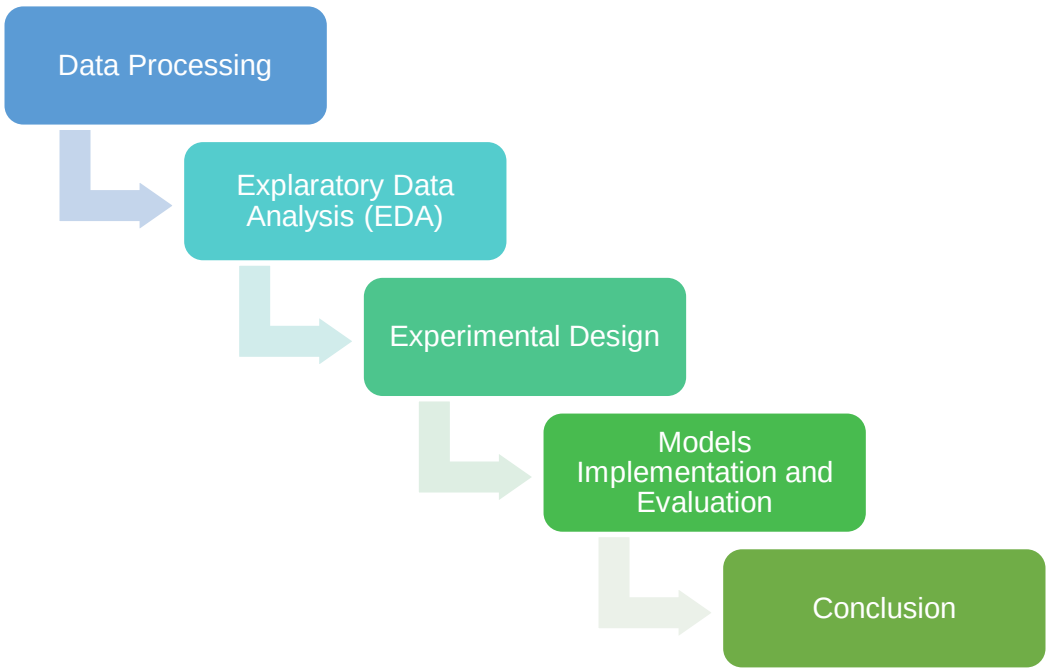
Now that you have a good understanding of the Ask and deliverable, detail the recommended approach/methodology.

Type of Analysis: Decision Tree, Random Forest, Logistic Regression

The initial step is to use a decision tree methodology to determine the key variables (such as wind speed, topography, weather condition, etc.) that significantly correlate with the size of wildfires.

Methodology:

The workflow to build a models can be summarized graphically as follows:



Output:

The outcome will be a collection of results from several predictive modelling approaches, together with strategic insights and suggestions that will assist Alberta in allocating the right resources during wildfires.

3.0 Population, Variable Selection, considerations

Capture learning about the data available today location, structure, and reliability; this would include data in operational systems including dealer sourced, data warehouse and any CRM or email marketing systems available today.

Audience/population selection: The audience will be the government of Alberta, the province fire department and emergency responders.

Observation window: January 1996 – December 2021

Inclusions: N/A

Exclusions: N/A

Data Sources: https://www.alberta.ca/wildfire-maps-and-data.aspx

Audience Level: Professional

Variable Selection: All Variables

Derived Variables: None

Assumptions and data limitations: The data provided are based on wildfires that have been reported or registered in the province of Alberta; not all wildfires may be.

4.0 Dependencies and Risks

Identification of key factors that may influence the outcome of the project and likelihood of it happening:

Risk	Likelihood (based on historical data)	Delay (based on historical data)	Impact
Limited access to water source	*Moderate*	*Moderate*	The likelihood that a wildfire may start in an area without a local water supply increases the probability of extensive damage and makes control more difficult. Without access to water, battling a fire can spread more quickly and cause more damage, which makes it harder to contain and put out the flames.
Weather conditions	*High*	*High*	The behaviour and containment of fires are significantly influenced by the weather. High winds worsen containment efforts and increase fire spread. However, rain can help stop the spread of a fire.
Fire Fighter safety	*High*	*High*	The hazards firefighters confront when putting out

			wildfires are significant. They risk their lives by battling fires, smoke inhalation, and heat exhaustion. Additionally, they deal with unstable terrain, fallen trees, and unpredictable fire behaviour, all of which call for thorough preparation, training, and attention to safety procedures.
Funding and awareness	*High*	*High*	Public and government support and funding for efforts to avoid, prepare for, and reduce wildfires.
Limited Air Support	*High*	*High*	When fighting wildfires, the use of in the air assets, such as helicopters and air tankers, is essential because they can supply water or firefighting materials to inaccessible or remote locations, supporting ground workers in a critical manner.

5.0 Deliverable Timelines

List key dates and timelines as a work-back schedule. Activate line items based on complexity and line-of-sight required. Will set the stakeholder expectations for the process.

Item	Major Events / Milestones	Description	Scope	Date
1.	*Kick-off / Formal Request*	*Formal request of the project, discussion with the professor about the project requirements.*	• Expected deadlines for key deliverable.	*July 04, 2023*
2.	*Analysis Plan and Data Finalization*	*Selection of final raw data and creation of analysis plan*	• Goal and project scope.	*July 17, 2023*
3.	*Data Exploration and Analysis (EDA)*	*Exploratory Data Analysis*	• Methodologies to be used • Quality of data	*July 24, 2023*
4.	*Experimental Design and Modelling*	*Application of the selected modelling techniques*	• Data modelling	*July 31, 2023*
5.	*Analysis Completion*	*Formulation of Analysis based on the different models*	• Compiling of all models • Decide on which model is best	*August 04, 2023*
6.	*Conclusion and Recommendations*	*Draw conclusion and suggest recommendations*	• *Provide conclusion for the analysis*	*August 9, 2023*
7.	*Final Consultation*	*Final meeting with advisor*	• *Discuss the results and conclusion with the adviser*	*Augustt 11, 2023*
8.	*Final Revision*	*Completion of final project*	• *Finalize the report, aligned with the adviser suggestions*	*August 15, 2023*
9.	*Final Presentation*	*Presentation of the capstone project to advisors and students*	• *Project Submission and presentation.*	*August 17, 2023*

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