sofvie

Module-7 Mid-Term Presentation

Capstone (ALY6980)

College:
College of Professional Studies, Master of Professional Studies in Analytics

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INTRODUCTION

- The given dataset consists of observations related to **hazard incidents in the domain of safety management**. It includes various columns such as 'Hazard_type', 'Hazard_identification', 'Completion_Time_Bucket', 'potential_risk', and more.

- The dataset, comprising approximately **14,000 records**, which are divided into further **24 columns,** and it was generated by combining different tables from Sponsor Sofvie.

- The **target variable** of interest in this dataset is **'Completion_time_bucket**', which represents the time taken to complete the hazard incident.

- This dataset **provides valuable information for analysing hazard incidents**, identifying potential risks, and evaluating the effectiveness of immediate and recommended actions taken.

- The aim is to explore patterns and factors affecting completion time to enhance safety management practices.

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PROJECT DESCRIPTION

- The project focuses on incident and hazard management using machine learning techniques to predict and prevent incidents, as well as efficiently address them when they occur.
- It involves analysing incident **trends over time**, predicting the likelihood of incidents based on historical data and employee/supervisor details, and identifying patterns in the data to provide recommendations for reducing risks and incidents.
- The project also aims to classify different types of hazards, determine appropriate actions, and establish timeframes for completion.
- The ultimate goal is to enhance safety for individuals and communities by ensuring that events and **hazards are proactively managed and resolved in a timely manner.**

DATA UNDERSTANDING

Target Variable

The target variable for analysis in this project is the **completion_time_bucket**. This variable represents the **time taken to address and resolve each hazard incident**. Understanding the factors influencing the completion time can help identify areas for improvement in incident management processes.

Dataset Source

The hazard data was collected from **various sources, including tables** from Sponsor Sofvie. These sources provide **comprehensive information** on incidents and hazards, ensuring the dataset's relevance to hazard incident management.

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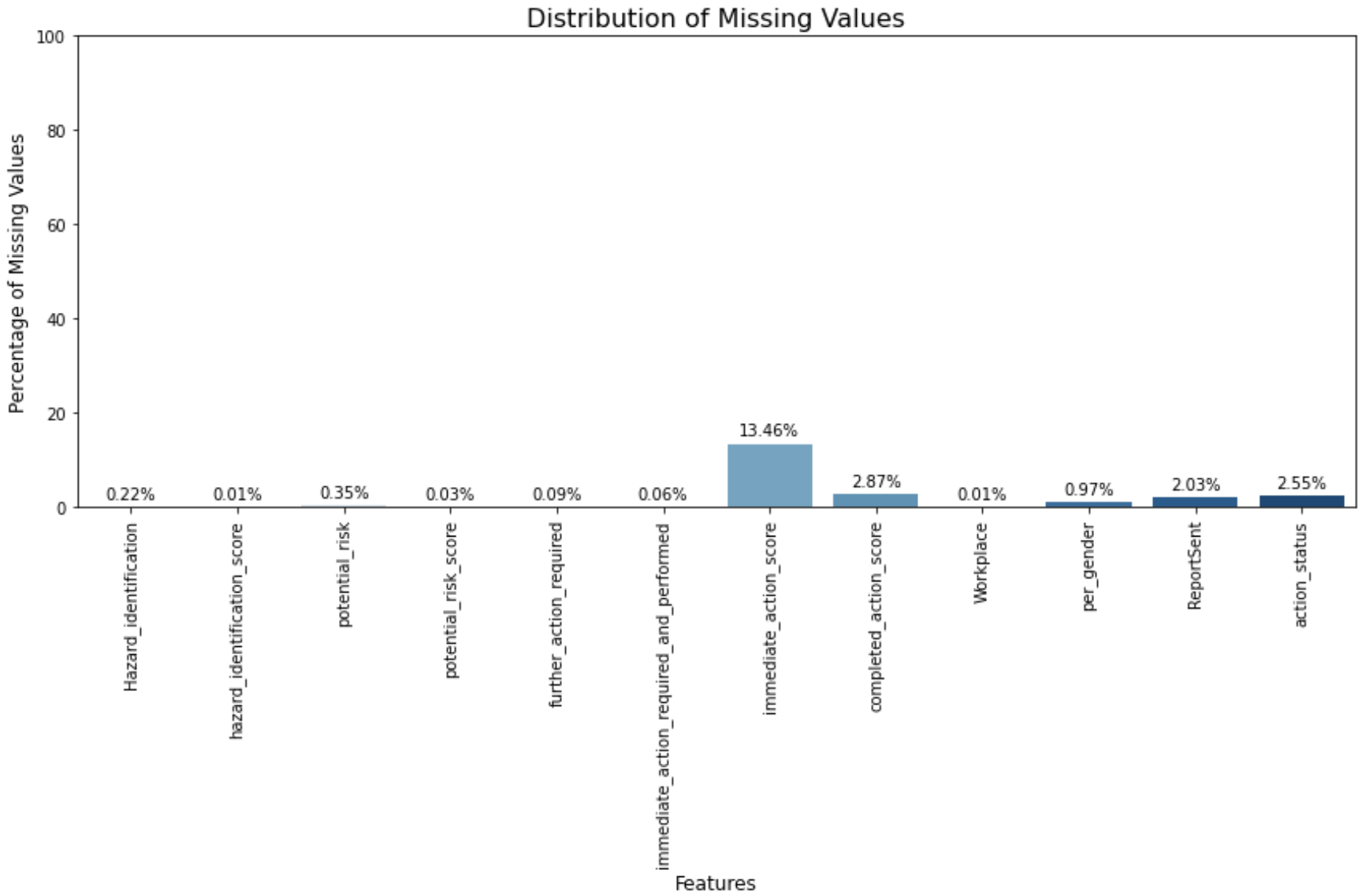
EXPLORATORY DATA ANALYSIS



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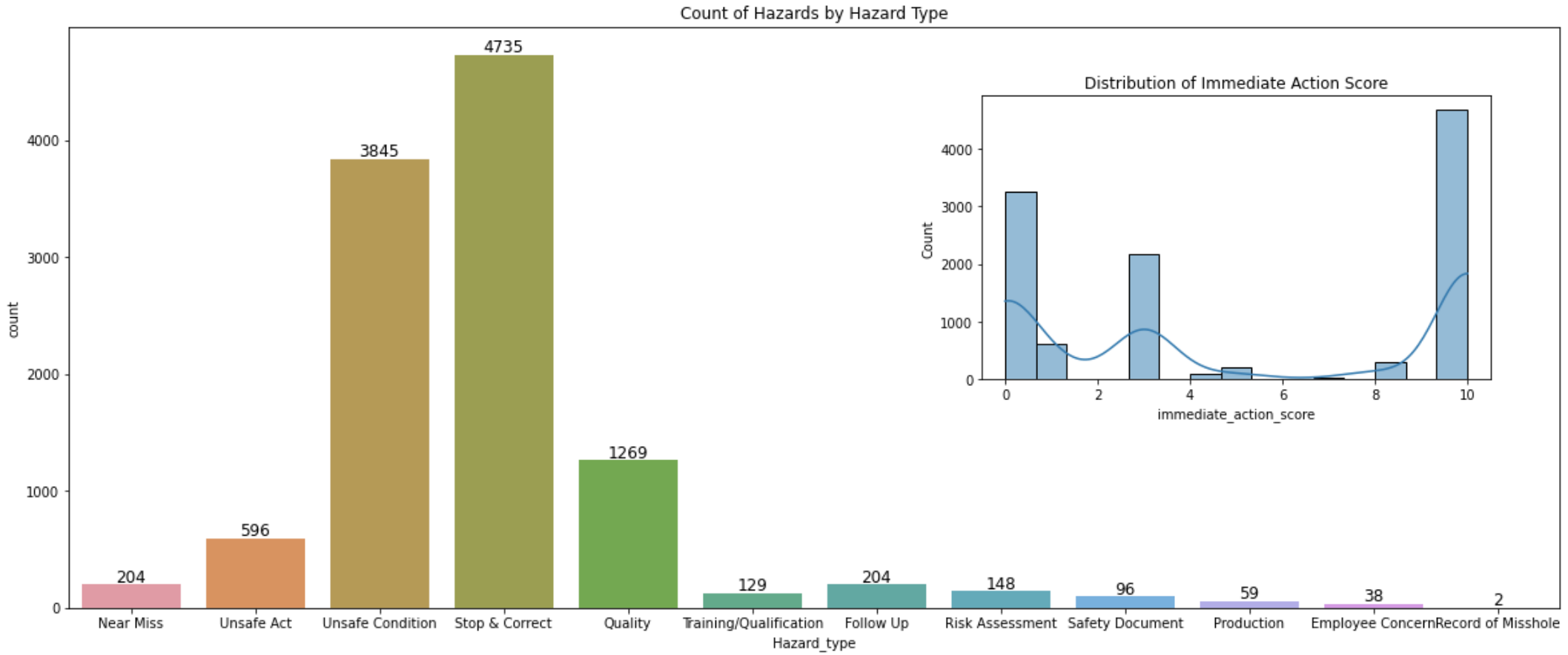
EXPLORATORY DATA ANALYSIS



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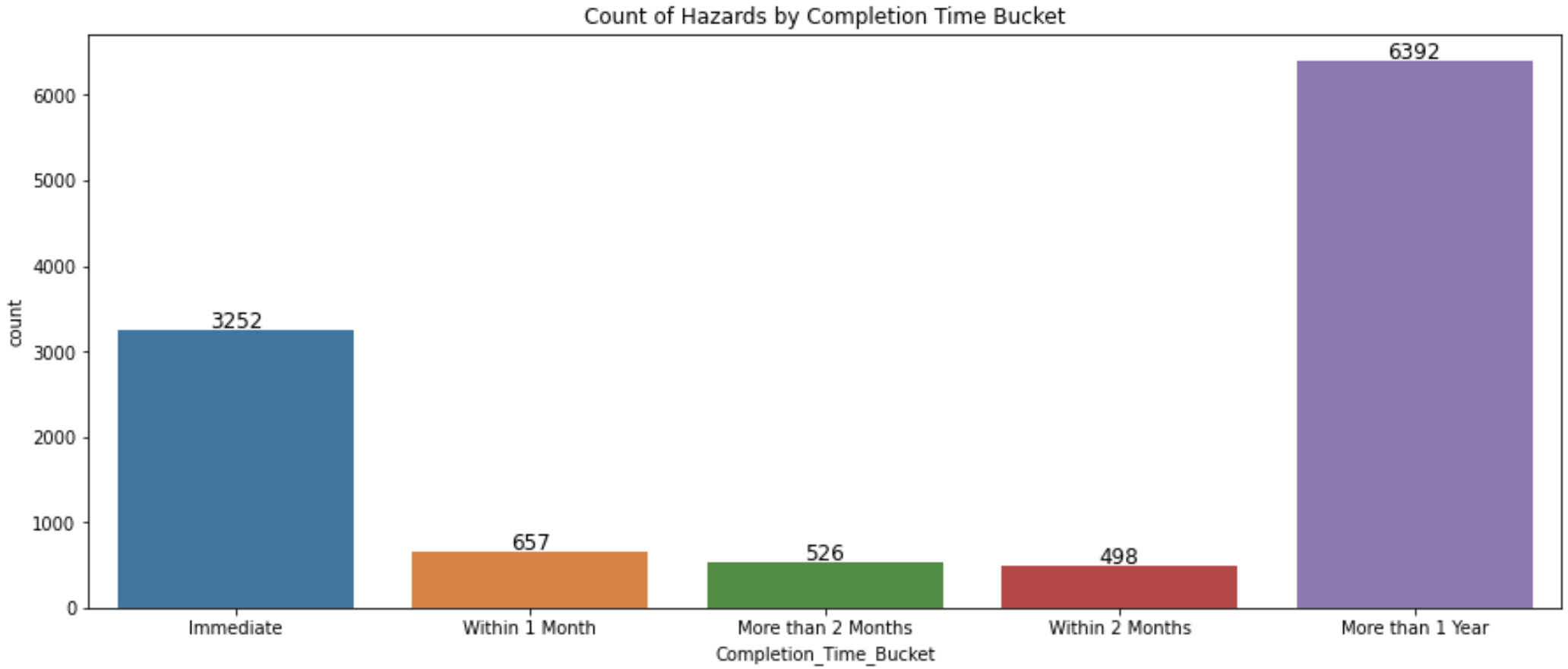
EXPLORATORY DATA ANALYSIS



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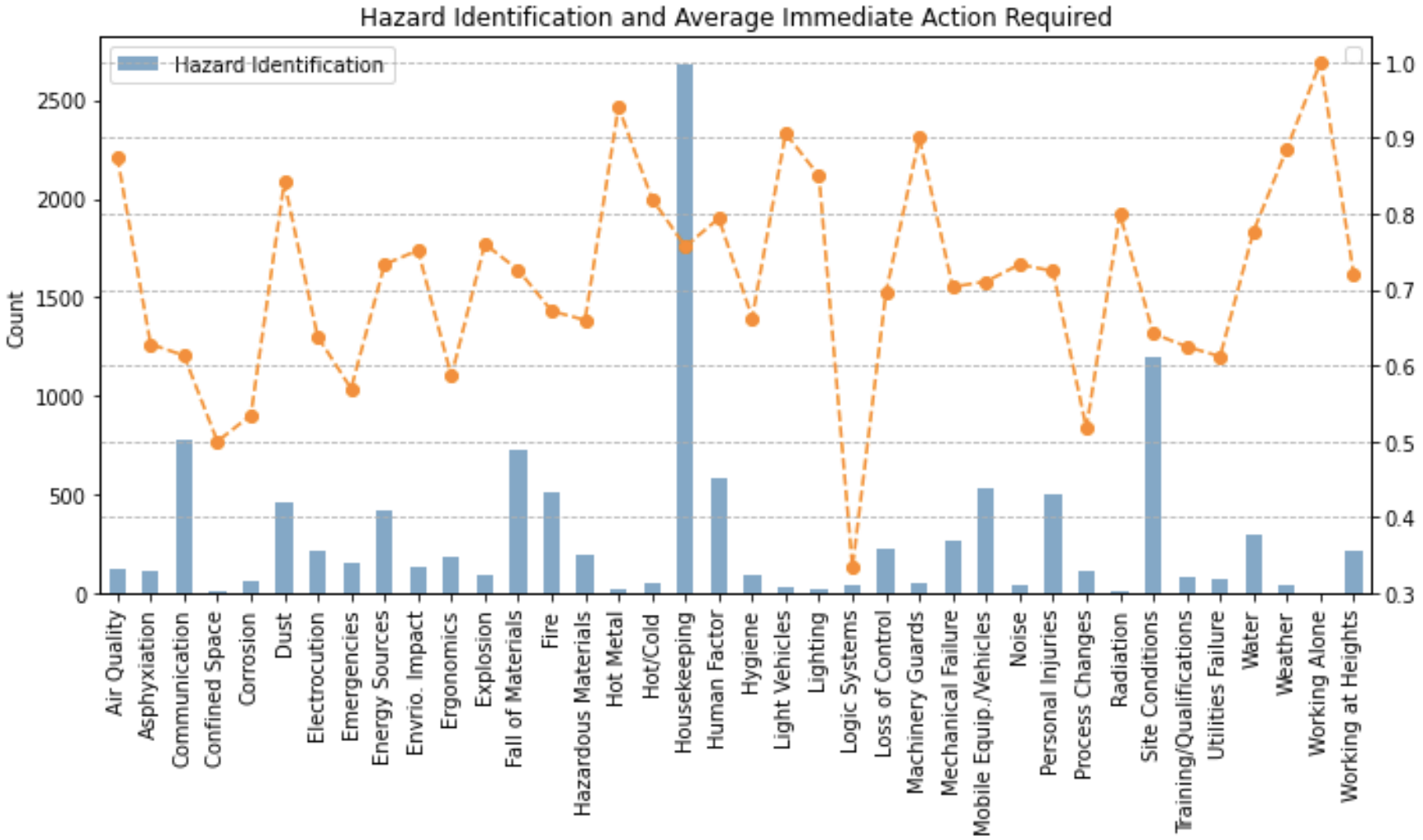

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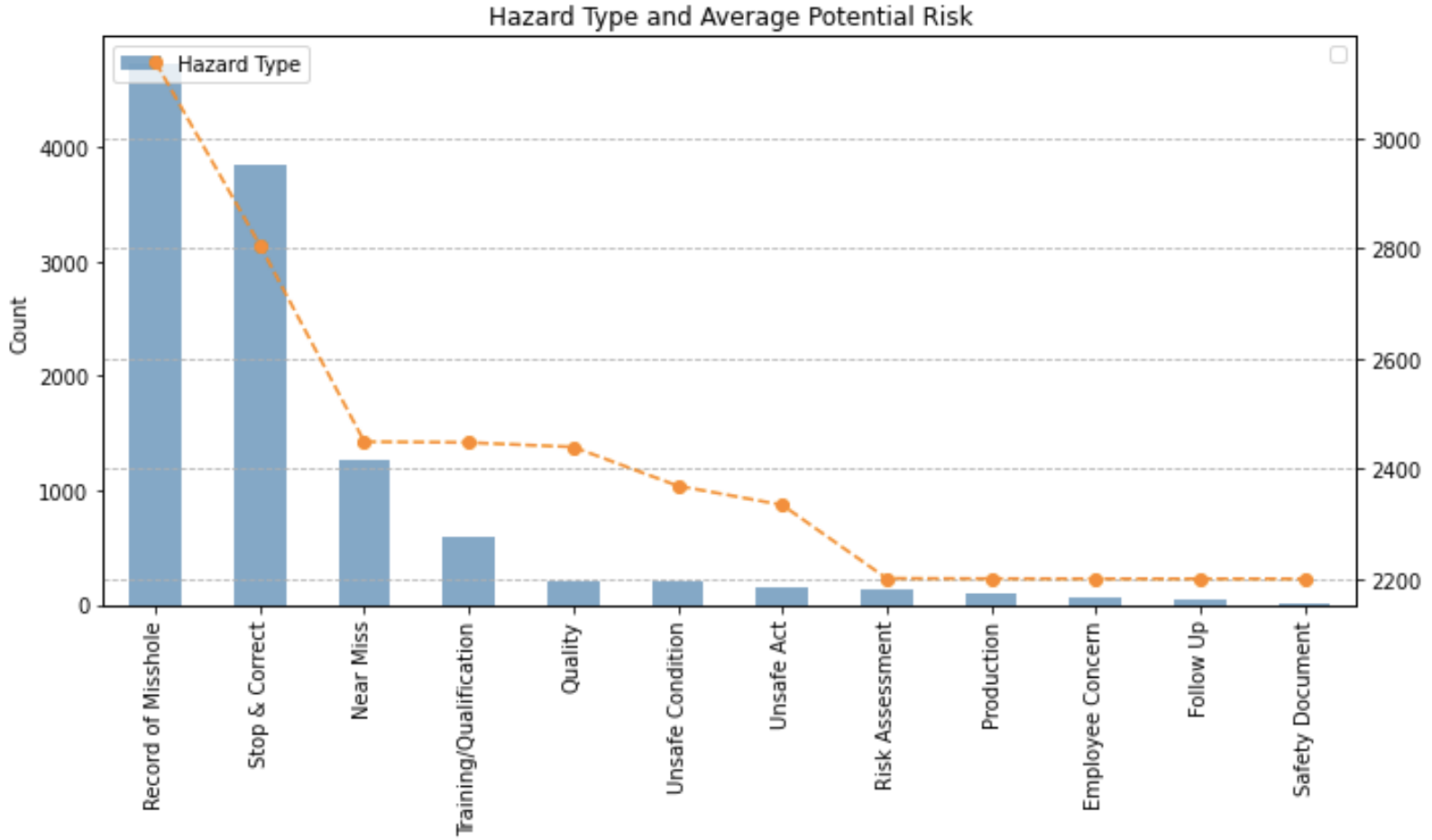

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BUSINESS QUESTION

Using the Trained Model, how company can predict the resolution time of the hazard which would help them to prioritize their work?

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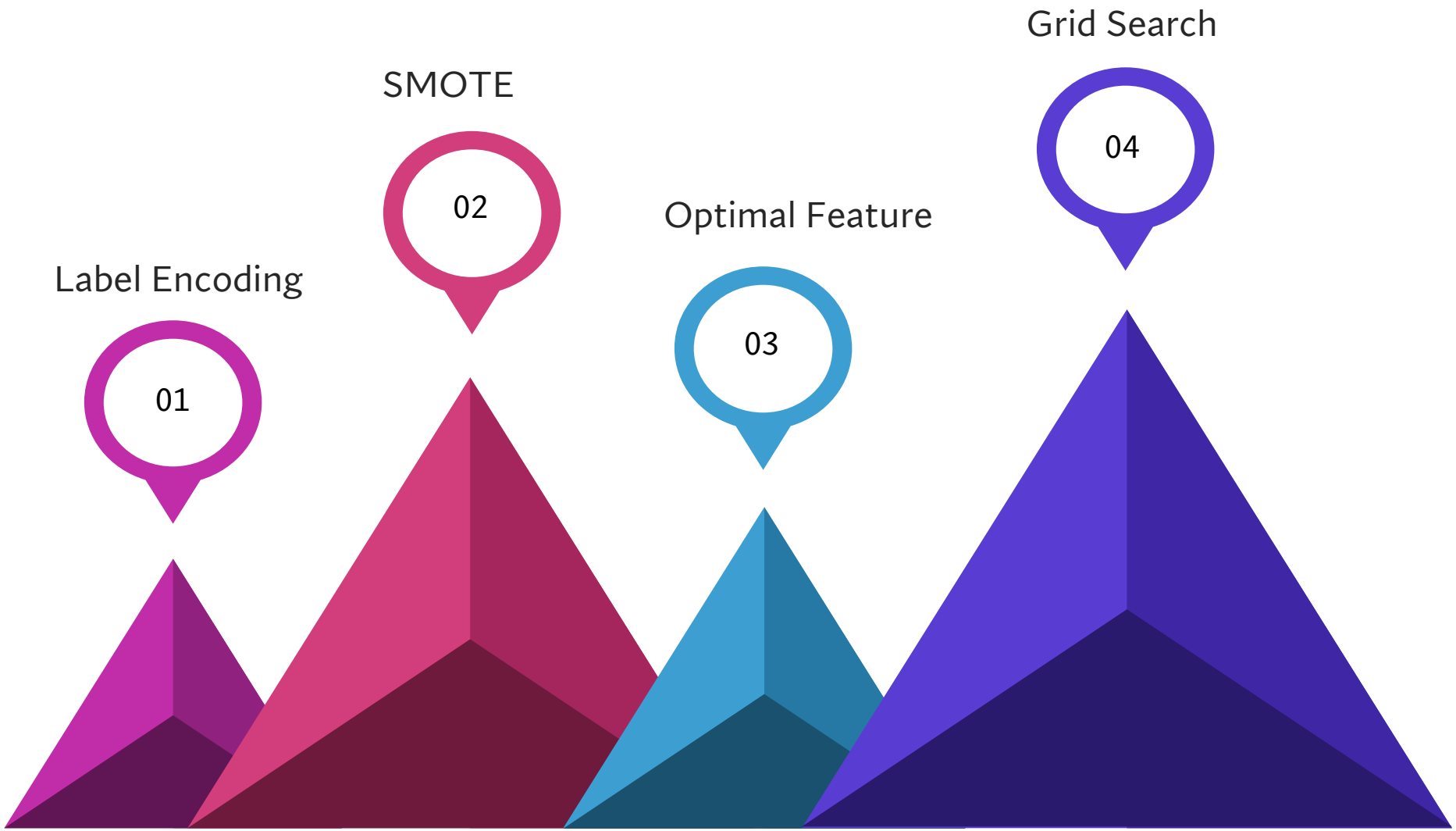
POWERFUL TECHNIQUES



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DATA PREPARATION FOR MACHINE LEARNING

Label Encoding

In order to prepare the dataset for the ML model, we applied label encoding to categorical variables such as

- 'Hazard_identification',
- 'immediate_action_taken',
- recommended_action',
- 'Workplace',
- 'Completion_Time_Bucket',
- 'Hazard_type',
- 'Supervisor_Name'.

SMOTE

To address class imbalance in the **'Completion_Time_Bucket'** variable (target variable), we used the SMOTE (Synthetic Minority Over-sampling Technique) algorithm to generate synthetic samples of the minority class, ensuring a balanced representation of different completion time buckets and improving the model's performance.

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DATA PREPARATION FOR MACHINE LEARNING

Recursive Feature Elimination with Cross Validation

In order to determine the **optimal number of feature**s for the ML model, **we applied** Recursive Feature Elimination with Cross-Validation **(RFE-CV**), which **systematically selects features based on their importance and performance,** ultimately improving the model's predictive ability and reducing dimensionality.

Grid Search

To find the **best combination of hyperparameters** for the ML model, we utilized **Grid Search**, which exhaustively **searches through a specified parameter grid** and evaluates the model's performance for each combination, allowing us to identify the optimal hyperparameters that maximize the model's accuracy or other desired metrics.

MACHINE LEARNING MODELS & EVALUATION

Model	Selected Features	Class	Accuracy	Precision	Recall	F1-Score	Execution Time
XGB Classifier (Imbalanced)	3	immediate	0.82	0.67	0.89	0.76	10.41 sec
		more than 1 year		0.98	0.96	0.97	
		more than 2 months		0.27	0.15	0.19	
		within 1 month		0.22	0.08	0.12	
		within 2 months		0.33	0.12	0.17	
XGB Classifier (Balanced)	15	immediate	0.81	0.71	0.83	0.77	28.39 sec
		more than 1 year		0.99	0.97	0.98	
		more than 2 months		0.20	0.17	0.18	
		within 1 month		0.27	0.19	0.23	
		within 2 months		0.25	0.17	0.21	

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MACHINE LEARNING MODELS & EVALUATION

Model	Selected Features	Class	Accuracy	Precision	Recall	F1-Score	Execution Time
Random Forest Classifier (Imbalanced)	15	immediate	0.83	0.66	0.94	0.78	19.17 sec
		more than 1 year		0.99	0.97	0.98	
		more than 2 months		0.19	0.08	0.12	
		within 1 month		0.24	0.06	0.09	
		within 2 months		0.48	0.08	0.14	
Random Forest Classifier (Balanced)	13	immediate	0.81	0.67	0.92	0.77	24.58 sec
		more than 1 year		1.00	0.96	0.98	
		more than 2 months		0.21	0.13	0.16	
		within 1 month		0.23	0.08	0.12	
		within 2 months		0.37	0.10	0.16	

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CONCLUSION

- Since there is only a **slight difference** that can be noticed, we identified with the last three classes, which are **more than two months, within one month, and within two months**, for the Random Forest and XG-Boost models, which were created with two types of data, balanced and imbalanced.

- Both machine learning models performed well when they were compared, but the XG-Boost model has better result matrices when compared to the other one.

Recommendation : *We would advise our sponsor to train the **XG-Boost model** to forecast the resolution time based on the business question.*

Future Work : Now, let's move on to our next strategy,

- We would like work on the same dataset by dividing in before and after COVID-19 situation.
- Will try to analyze COVID-19 data and find appropriate patterns which discloses more insights.
- Moreover, we will try optimize prepared models with other suitable techniques.

Thank you!

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