World Wide Technology

Make a new world happen

Aurum Mining Corporation (AMC)

Empowering the Health & Safety organization

Trilytics'23 Conclave Case Study

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Executive Summary

Data-Driven Insights

Data-Driven Decision-Making

Initiative Goal: *Enhancing Mining Safety: A Data-Driven Solution*

WWT recommends *conducting a thorough data audit and implementing data governance policies* **to solve for Aurum's data inconsistency issues:**

Preliminary Findings indicates that:

- *36,016 mining accidents led to a staggering loss of 1,364,430 workdays from 2000 to 2023, highlighting the need for proactive safety measures and mitigate revenue repercussions.*
- *24.76% of incidents occurred near the mine face and continuous mining and handling supplies or material were the leading method and activity during the accident while slip or fall of a person caused the highest average days lost and restricted.*
- *Finger and Back were the most commonly injured body part at 17.48 % and 14.67 % respectively while Shoulder injuries resulted in most days lost.*

Data Driven Approach:

- *In-depth data exploration and visualization provided valuable insights into incident patterns and key risk areas, empowering proactive risk mitigation through advanced data analytics.*
- *Machine learning-based algorithms can be automatically classify incidents from textual descriptions and other factors with an impressive accuracy of 92.46% and an overall AUC of 0.9855.*

WWT proposes that the steps are:

- ***Integrate data analysis into incident reporting:*** *Improve decision-making with insights*
- ***Implement proactive safety measures:*** *Prevent incidents using data-driven insights.*
- ***Combine data for root cause analysis:*** *Identify reasons behind incidents for effective actions.*
- ***Real-time incident monitoring dashboard:*** *Improve response time and safety.*

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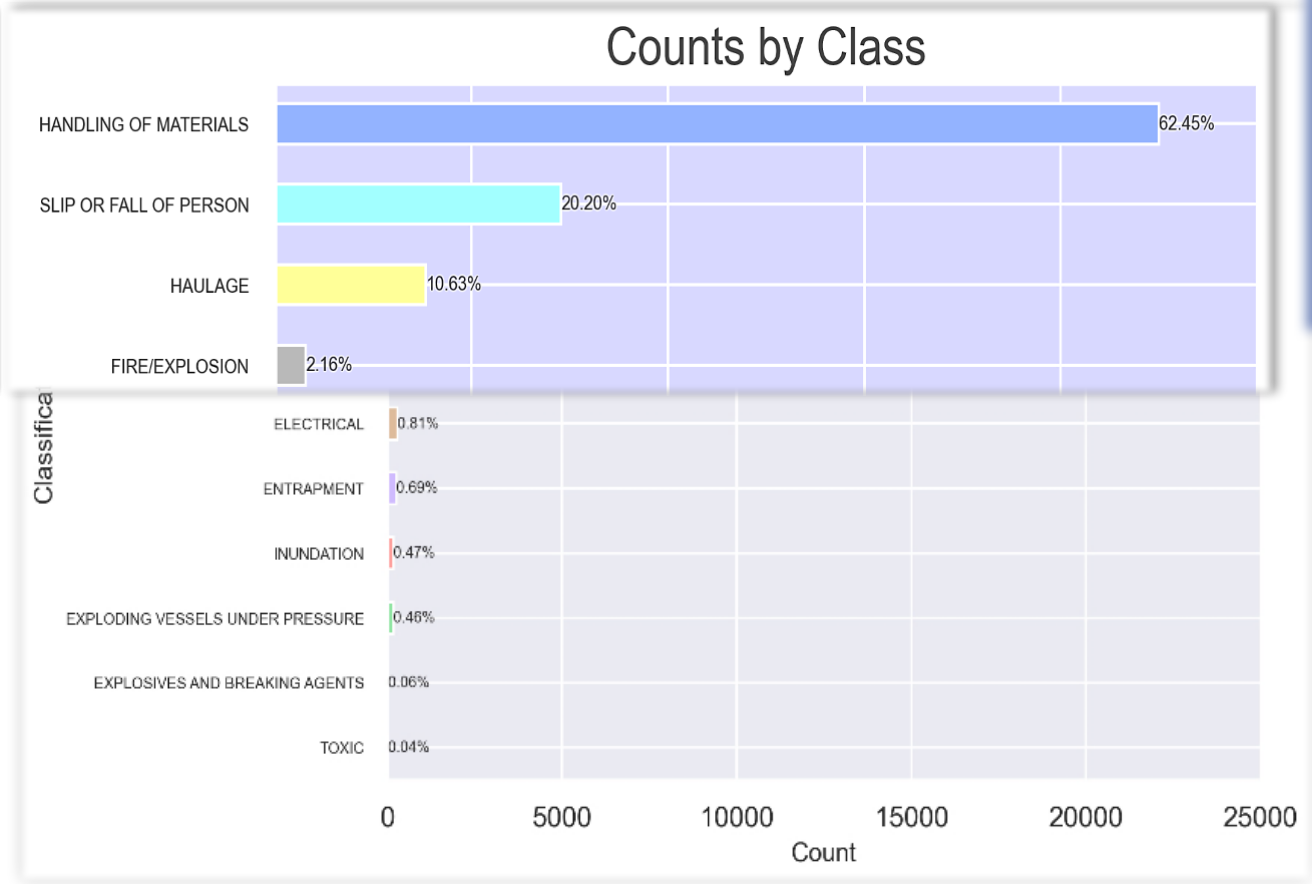
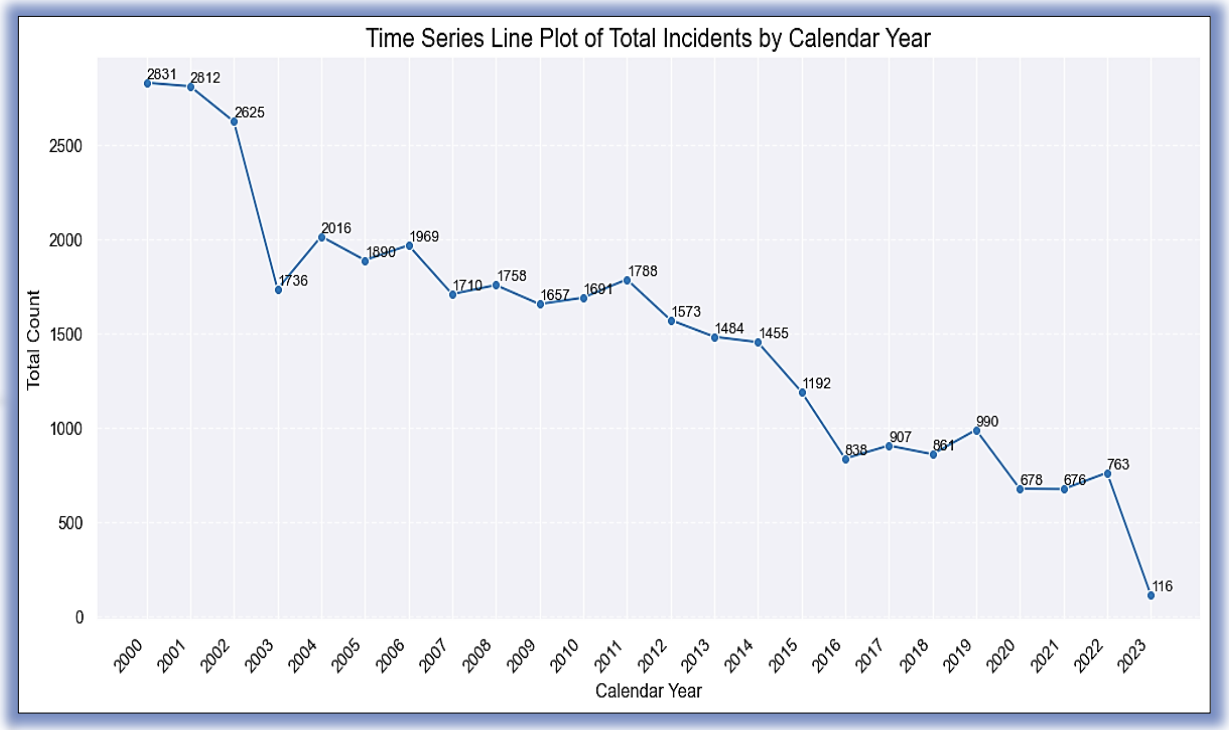
Introduction

- Mining is a dangerous industry. Accurately classifying incidents is crucial.
- Manually analyzing incident descriptions is time-consuming and prone to subjective interpretations.

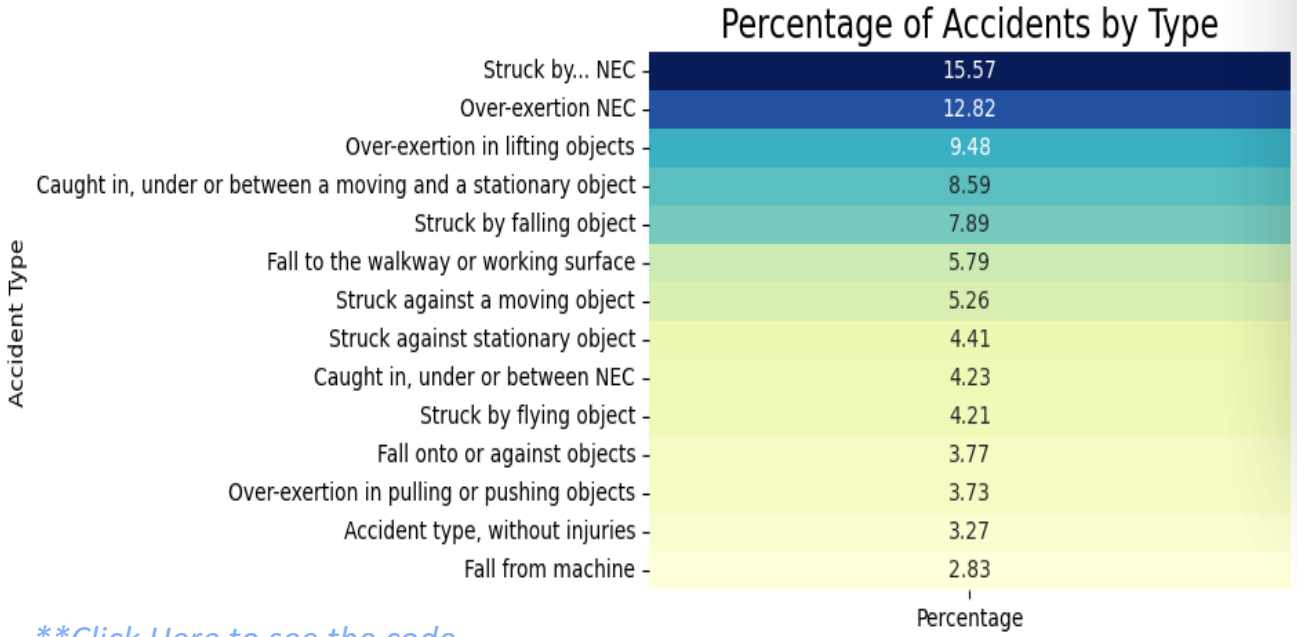




- By leveraging data and machine learning techniques, we can:
  - Streamline incident classification.
  - Provide actionable insights to the leadership to make informed decisions.
  - Establish a standardized framework for evaluating health and safety across different functions within the organization.

Empowering Safety:

Unraveling Critical Discoveries from EDA



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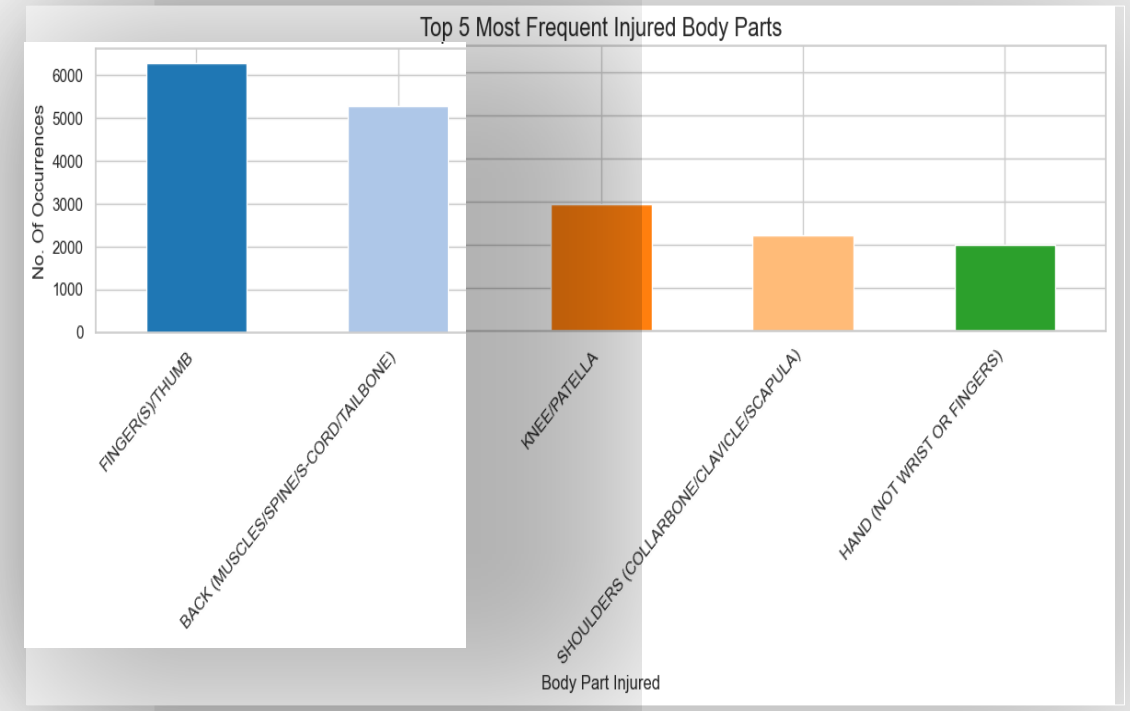
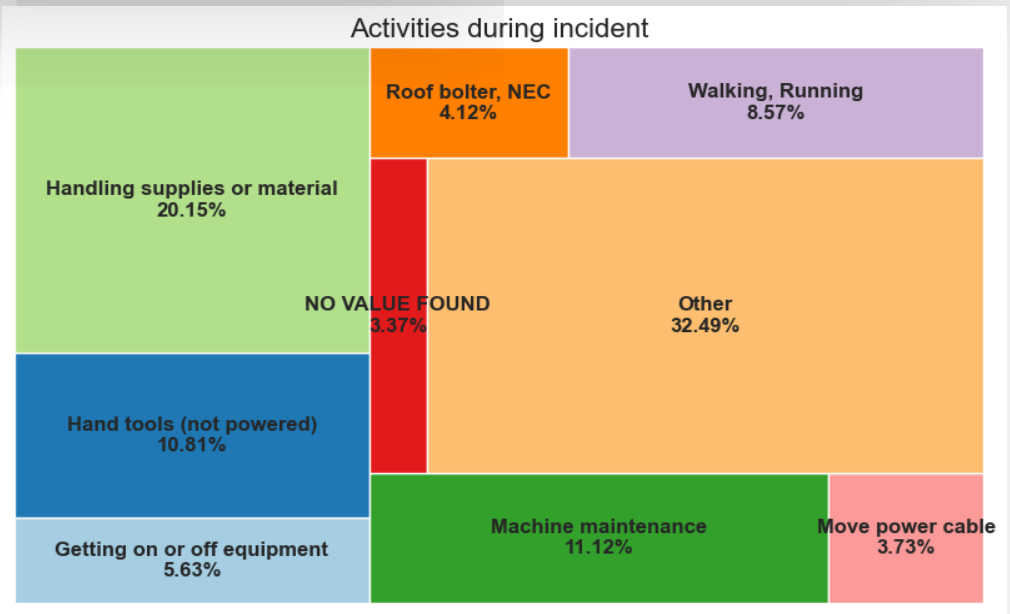




- The heatmap illustrates important accident types and their respective percentages, used for categorization.
- The bar diagram reveals the most injured body parts during a mining accident, with Fingers (thumbs) and Back region being the most affected.
- The mosaic plot illustrates activities and their respective percentages of accidental cases.

From Raw Data to Actionable Insights: Methodology for Data-Driven Analysis

Data Exploration

- Visual Inspection of rows and columns
- Data summarization for finding anomalies

Data Processing

- Dropping columns with more than 48% NA values
- NA value imputation with median for numeric and mode for object type

Feature Engineering

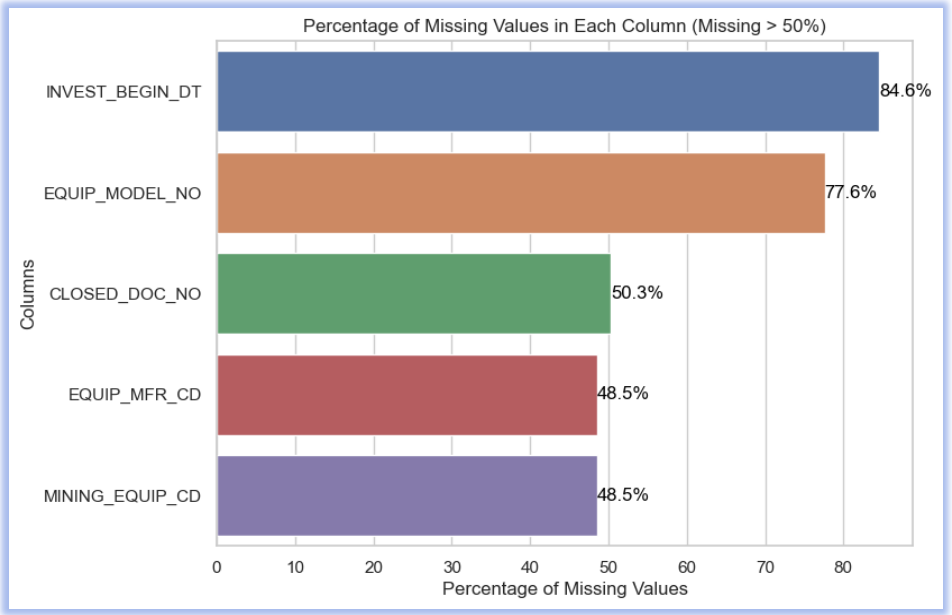
- Encoding of the categorical columns
- Tokenization of the Narrative column.

Model Fitting

- Splitting the data into test, train in ratio of 80:20
- Finding the most important features
- Fitting the Random Forest model for classification.
- Training the model & checking for accuracy.

Model Accuracy

- Confusion Matrix and ROC curve for measuring the model performance on the unknown data



- Random Forest is a machine learning algorithm for classification which aggregates multiple decision trees which improves predictive accuracy and reduce bias.
- It is chosen for accident type classification because it can handle complex relationships and is robust against overfitting.
- It is a suitable choice for this multi-class classification problem with textual descriptions.

Ensuring Robustness: Model Validation and Performance Assessment

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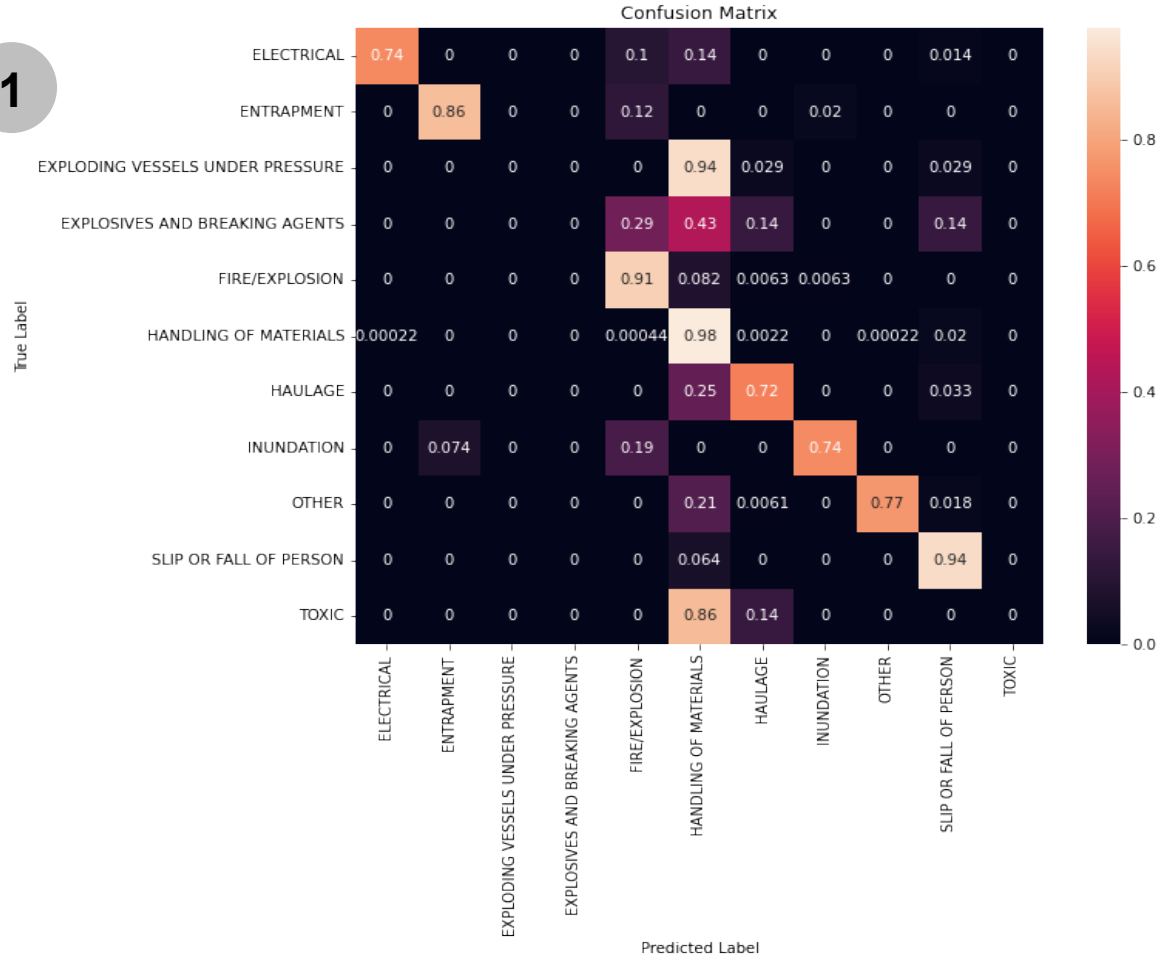

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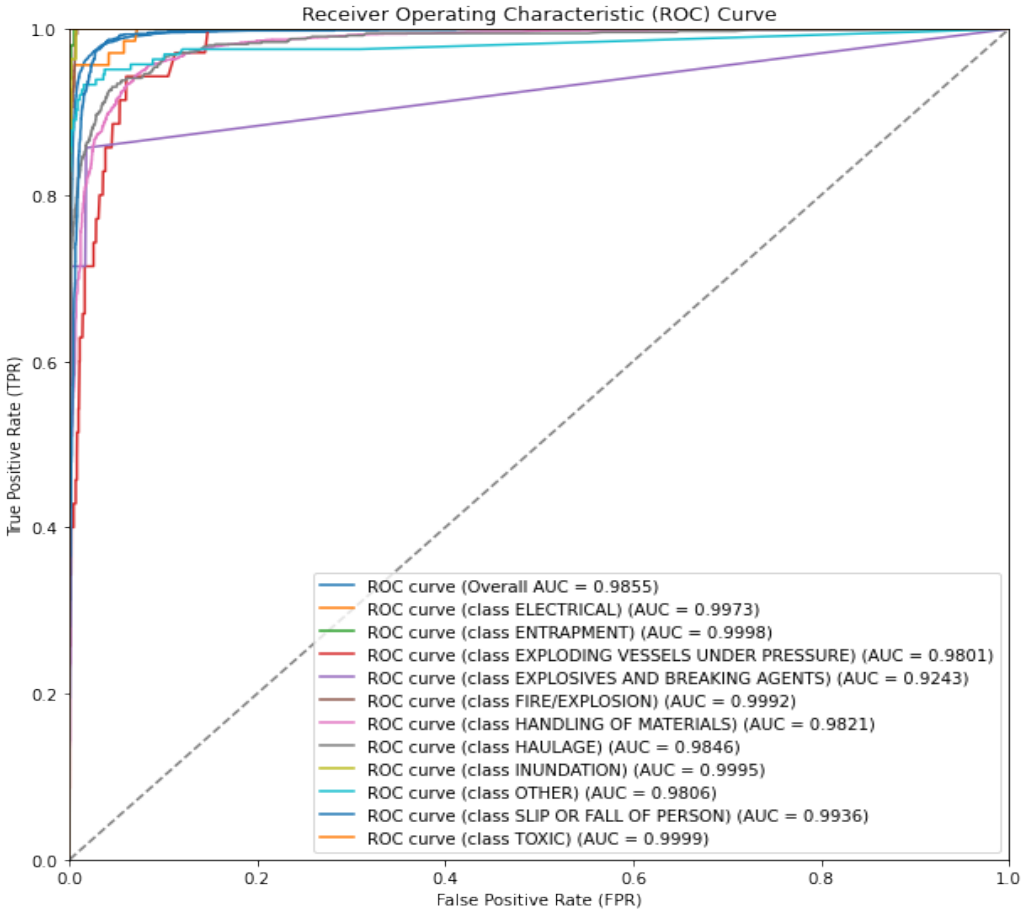


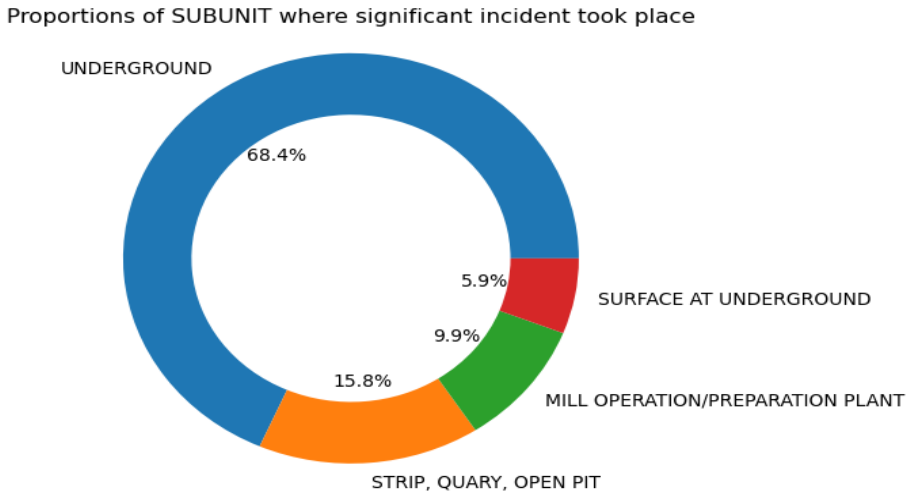
- The model achieved an impressive 92.46% accuracy despite the high class imbalance.
- However, misclassifications were observed, particularly in the 'Handling of Materials' category due to the dominant representation of that class in the data.

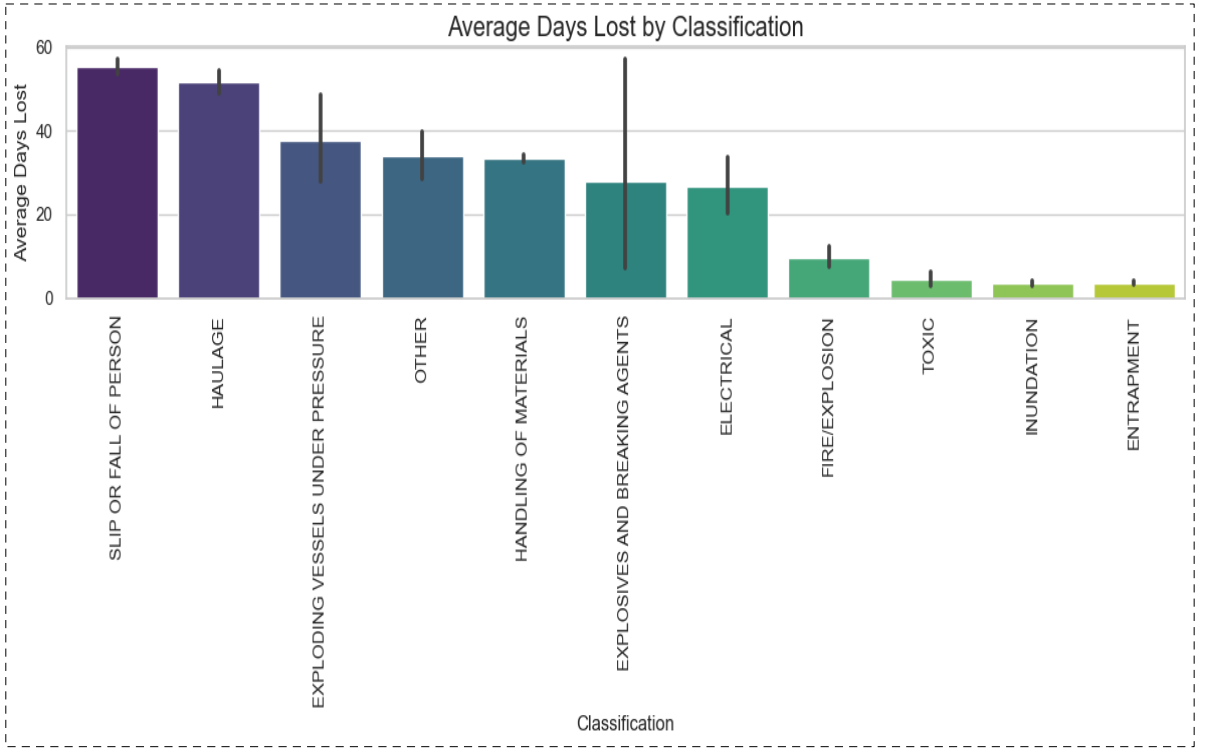
- The ROC curve showcases strong performance with an overall AUC of 0.9855.

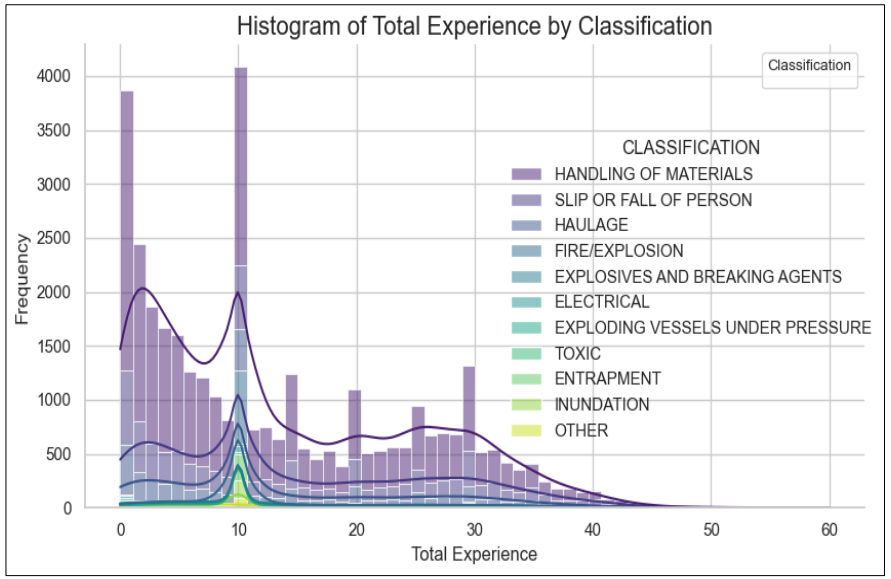
***Click Here to see the code*

Driving Success: Unlocking Business Value

- Improved Safety: Machine learning-driven incident classification identifies high-risk areas, allowing proactive safety measures to prevent incidents.
- Efficient Resource Allocation: Optimize resource allocation with data-driven insights, minimizing incident occurrences and their potential impact.



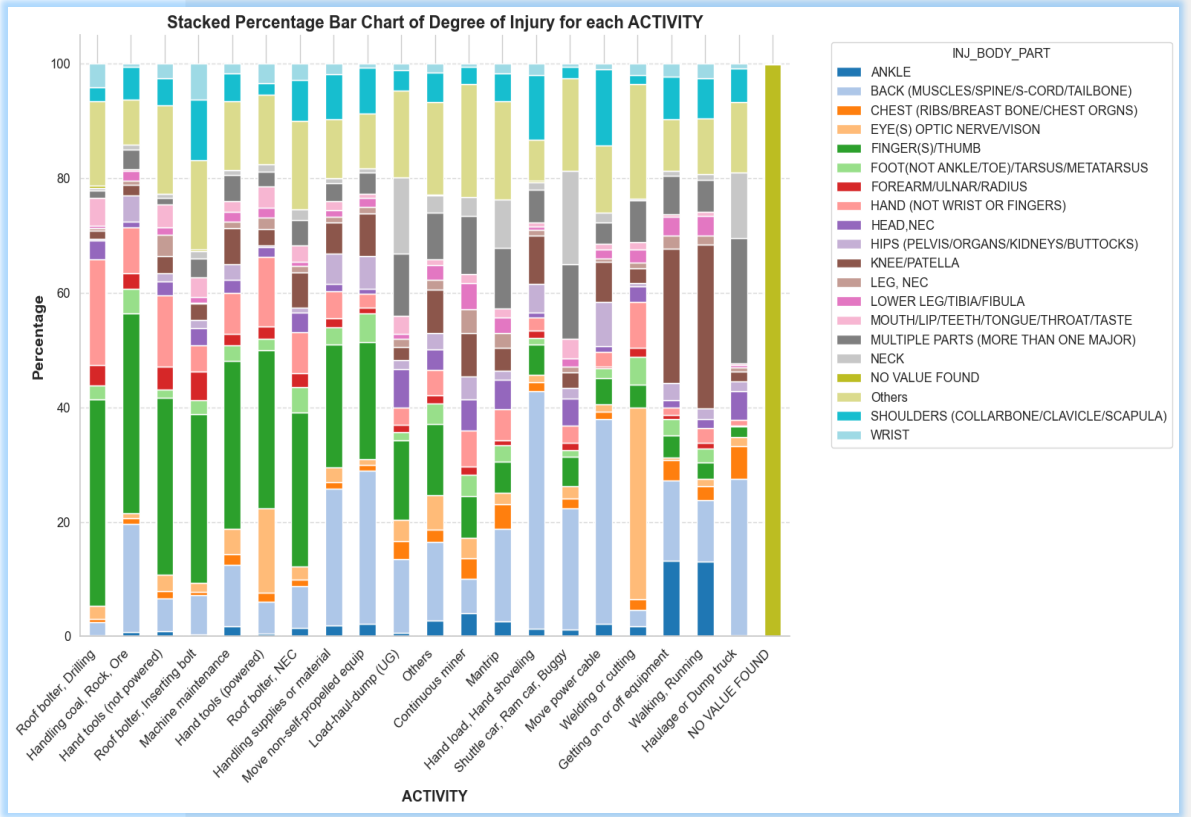




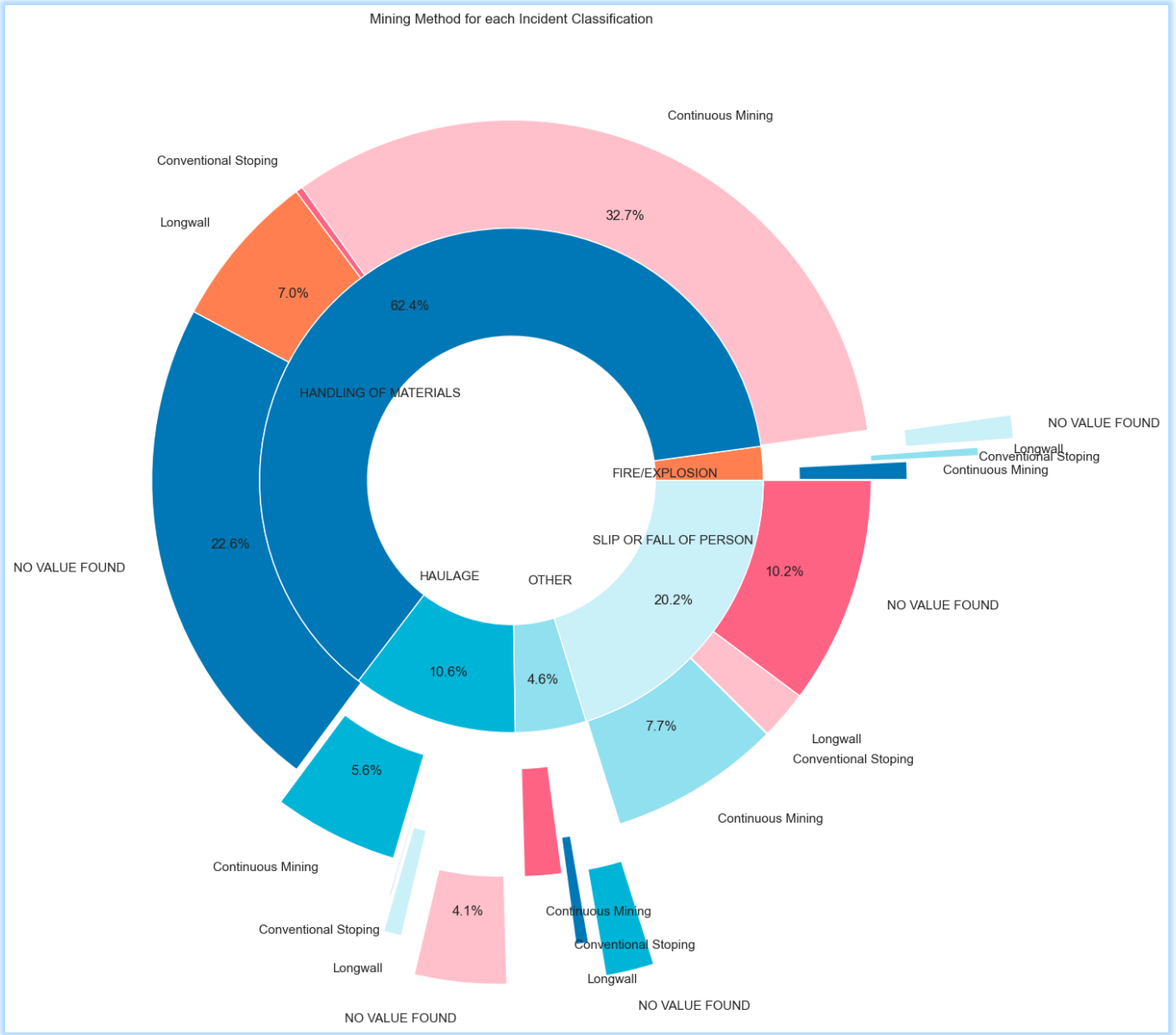
- Standardized Framework: Implement a consistent incident classification system across AMC operations for streamlined reporting and analysis.
- Continuous Improvement: The machine learning model adapts over time, enabling ongoing refinement and enhanced performance.
- Compliance and Reporting: Facilitate compliance with regulations and improve reporting accuracy through automated incident classification.

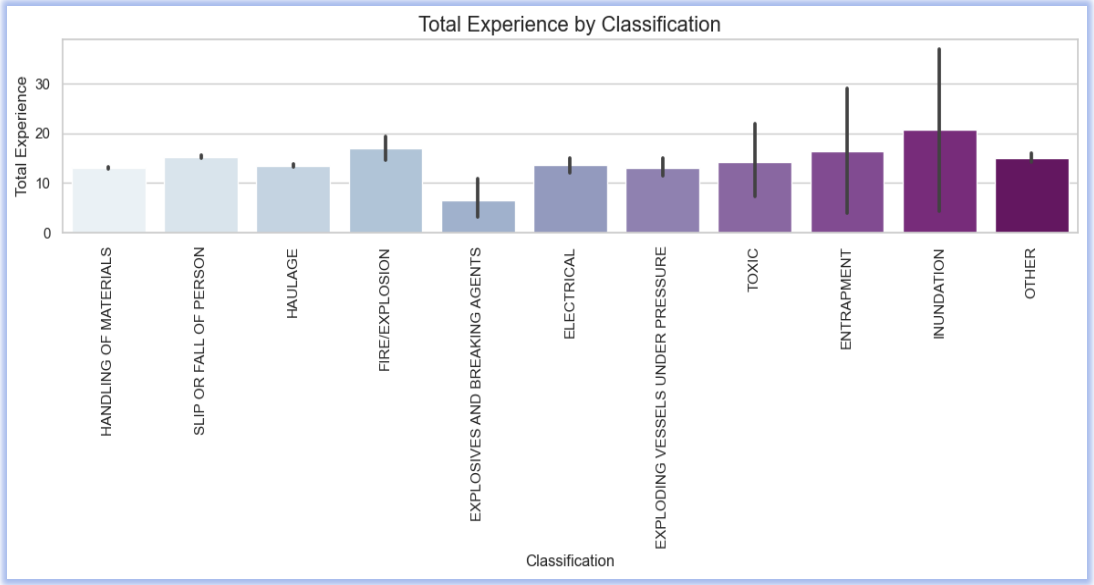
Powering Data-Driven Decision-Making

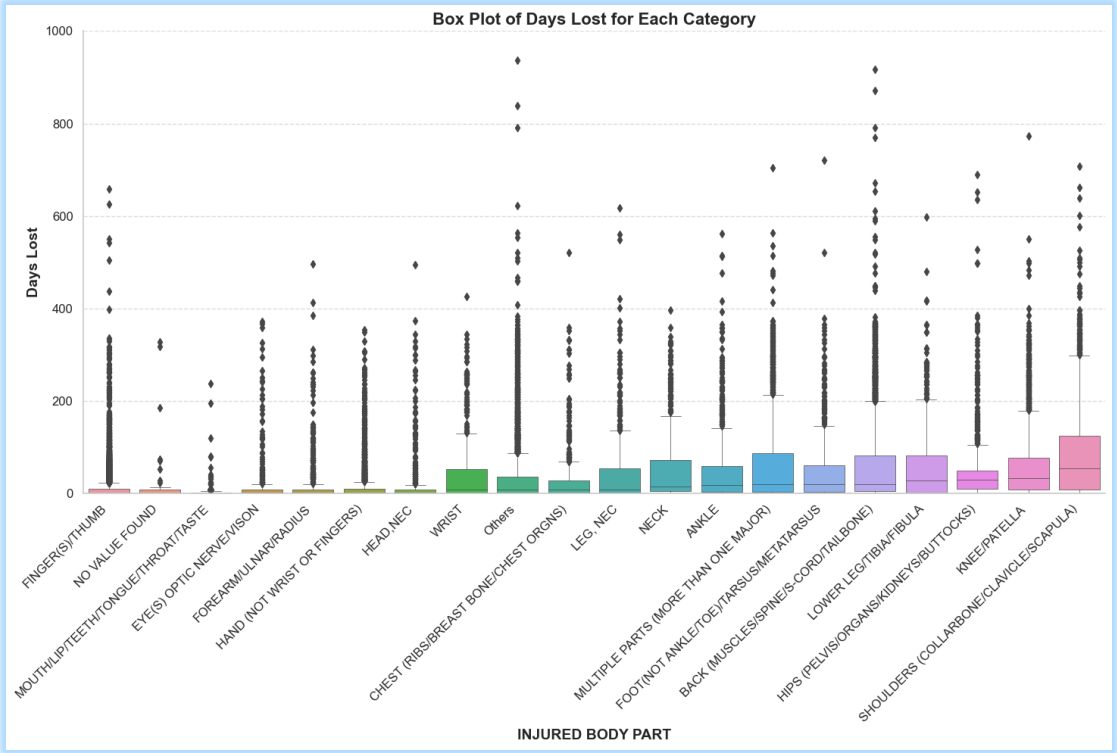
Model Integration	Benefits
Integrate model into incident reporting system.	Automated classification process.
Implement real-time incident monitoring dashboard.	Consistent and standardized incident categorization.
Combine data with root cause analysis.	Proactive response to emerging safety risks.
Identify safety trends and patterns.	Targeted safety measures.
Implement proactive safety measures.	Data-driven approach.
Involve stakeholders.	Increased employee engagement.
Introduce safety performance incentives.	Improved safety culture.
Communicate data-driven safety efforts.	Reduced incident rates.



Appendix: Key Findings







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