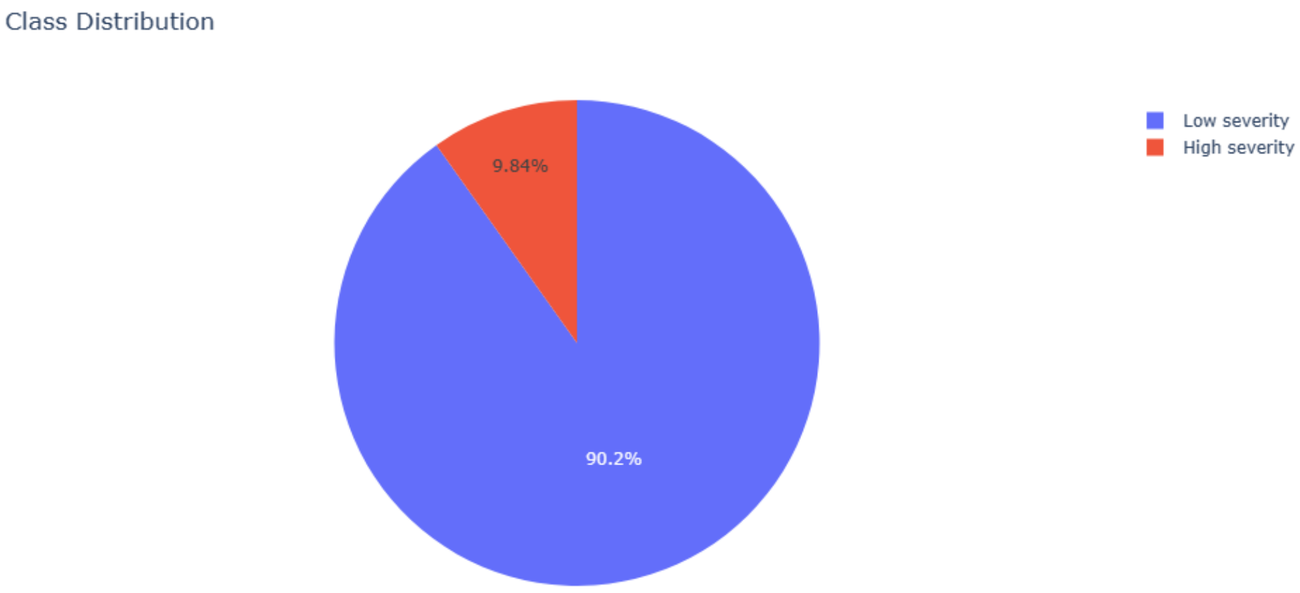
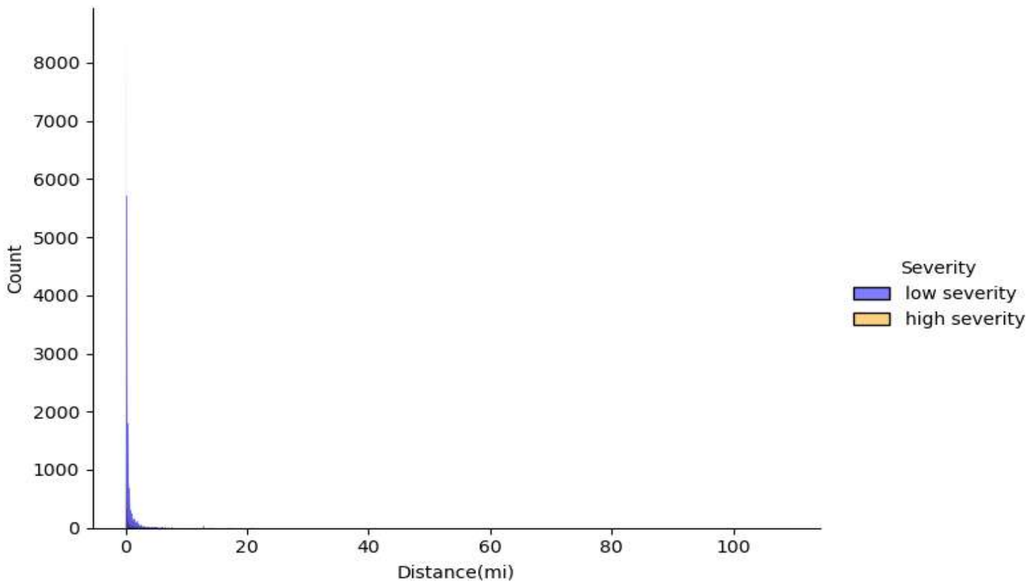
Infrastructure AI-ML Case Study

Road construction is an essential aspect of infrastructure development for any city or country. While construction is underway, it can cause traffic congestion, detours, and other inconveniences for commuters. It is crucial for the construction industry to evaluate and classify the severity of road construction to minimize disruptions and ensure public safety. This can be achieved through Auto-ML models that predict the severity of road construction based on various factors such as the location, duration, and type of construction. In this study, we aim to build a Auto-ML model that can accurately classify the severity of road construction for the construction industry.

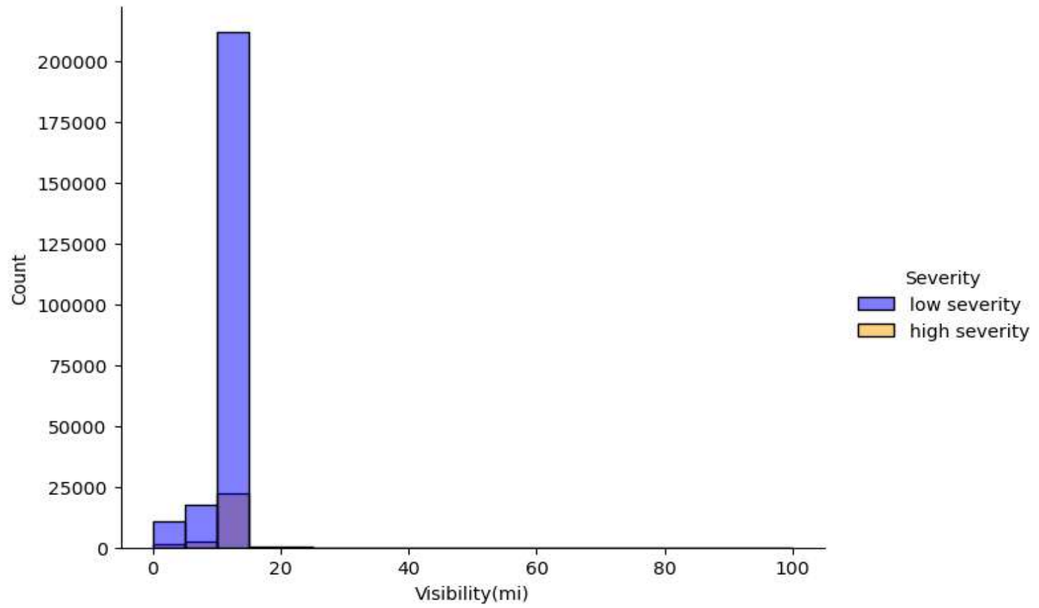


Severrity	No. of Cases
Low severity	240730
High severity	26270

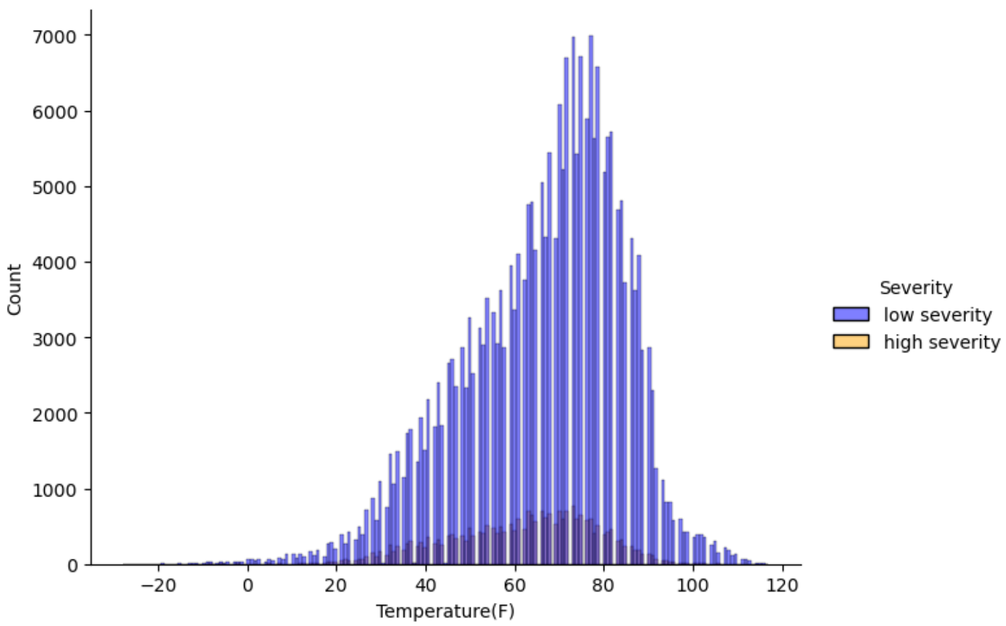
Features Responsible



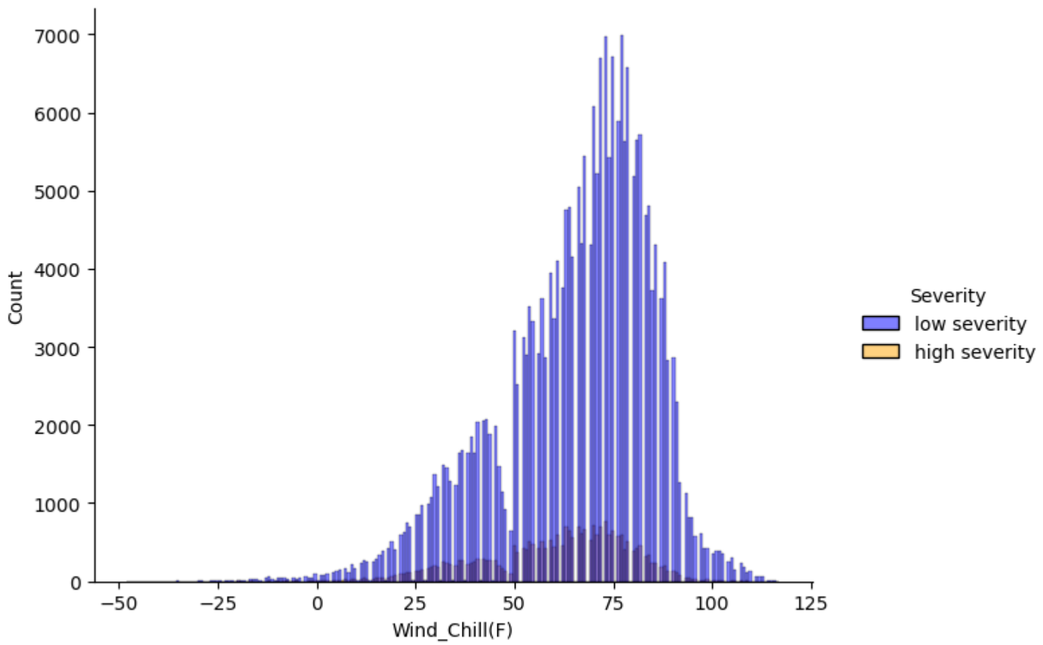
Distance is the length of the road extent affected by the construction. The **distance** can impact the access to resources such as water and electricity, which can affect the overall efficiency and effectiveness of the construction project.



Visibility can impact road construction severity in various ways. Poor visibility conditions, such as fog, heavy rain, or snow, can make it difficult for construction workers to see and perform their tasks, increasing the likelihood of accidents and errors that can lead to project delays and increased costs.



Extreme **temperatures**, either too hot or too cold, can affect the workability of construction materials and increase the risks associated with road construction work. For instance, in extreme heat, asphalt and concrete can become brittle, making it challenging to pour and work with them..



Wind chill is a measure of how cold the air feels due to the combination of actual air temperature and wind speed.

Auto-ML Methodology Results

Case	Percentile	No. of Features	Random Forest	XGBoost	RNN	MLP	Decision Tree	Average Accuracy
Case 1	25	10	95.77	95.68	57.41	72.94	77.08	79.77
Case 2	50	19	95.66	95.51	57.41	50.06	76.39	75
Case 3	75	29	95.45	95.53	56.47	70.99	76.3	78.9
Case 4	90	35	94.82	95.37	62.47	50	74.55	75.44

- Based on our observation , Random forest was the best performing algorithm with 95.77% accuracy in 25^{th} percentile.
- 25^{th} percentile is the best percentile with an average accuracy of 79.77%.

Conclusion

In conclusion, predicting the severity of road construction can be a valuable tool for the construction industry in managing resources, scheduling work, and mitigating potential risks. This is a countrywide dataset of road construction and closure events, which covers 49 states of the US. Construction events in this dataset could be any roadwork, ranging from fixing pavements to substantial projects that could take months to finish. The data is collected from Jan 2016 to Dec 2021, using multiple APIs that provide streaming traffic incident (or event) data. These APIs broadcast traffic data captured by a variety of entities, such as the US and state departments of transportation, law enforcement agencies, traffic cameras, and traffic sensors within the road-networks. The dataset has 1,687,861 records with 17 Categorical Features and 18 Numerical Features. 90.2% of the dataset shows road construction severity is low.

For classification, models were created with algorithms using Auto-ML techniques like Decision Tree, Recurrent Neural Network, Multilayer Perceptron, Random forest and XGBoost . With these models, performance measurement values were obtained for feature sets of 10, 19, 29 and 35. The Auto-ML algorithms were able to predict whether road construction severity is high or low with an average accuracy between 70% – 80% and helped to identify factors that determine whether road construction severity is high or low. The major factors include Distance, Visibility, Temperature and Wind chill. When the results are examined, it is observed that with the addition of each new feature, the success of classification decreased. Based on the performance measurement values obtained, it is possible to say that the study achieved success in classifying whether road construction severity is high or low. Overall, the application of Auto-ML in the construction industry has the potential to revolutionize the way construction projects are managed and executed.