Discussion: This study presents a novel approach to predicting fatal accidents in the construction industry using machine learning (ML).Future research directions include comparing results across different countries, gathering more accident reports, and exploring advanced techniques like natural language processing and deep learning to improve prediction accuracy In summary, the study provides valuable insights and recommendations for improving safety practices in the construction industry, emphasizing the importance of addressing both individual risk factors and their combinations to prevent fatal accidents.Recommendations include wearing personal protective equipment, implementing anti-instability measures, utilizing virtual construction scenes for hazard identification, and employing real-time wearable devices for monitoring Furthermore, the research underscores the value of specialized safety education for workers involved in high-risk tasks and emphasizes the role of employers and supervisors in transferring safety knowledge.It identifies unsafe construction conditions, such as working at height and using heavy materials, and suggests strategies for inspection, intelligent device implementation, and remote monitoring to mitigate risks The study also discusses the impact of weather conditions on fatal accidents, highlighting the need for precautions and planning to address weather-related hazards.The research found that certain combinations of causes have a significant impact on the occurrence of fatal accidents The methodology involved combining ML predictive modeling with permutation importance analysis to uncover hierarchical relationships among fatal causes.Moreover, it revealed that different types of fatalities have distinct combinations of causes, highlighting the need for tailored safety management strategies By incorporating combination detection into safety management practices, the study showed an 8.89% improvement in predictive accuracy compared to the original ML model.Recommendations include emphasizing fall protection measures and addressing hidden dangers in construction sites Overall, this study advances our understanding of fatal accidents in the construction industry by highlighting the importance of considering interdependencies and combinations of risk factors.By incorporating these findings into safety management practices, stakeholders can improve accident prediction and prevention strategies, ultimately enhancing worker safety The study highlights the importance of safety measures in reducing fatalities in the construction industry.By identifying the interdependence between various causes of accidents, the study emphasizes the importance of considering combinations of factors rather than focusing solely on individual risks.This underscores the significance of considering cause combinations in accident prediction and prevention efforts Furthermore, the research provides practical insights for improving safety practices in the construction industry.