A Review of Artificial Intelligence Applications in Monitoring Slope Stability for Open Pit Mines

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# ABSTRACT

## Background

The fundamental objective of any mining operation is to extract the maximum amount of ore in a highly economical way while adhering to safety standards. From an economic and safety perspective, the stability of rock slopes in open-pit mine and quarry operations is crucial because unstable slopes have the potential to cause property damage and fatalities. To ascertain the probability of slope breakdown and how to prevent it, slope stability analysis is a crucial component of mining engineering (Baghbani et al. 2022; Meng, J, Mattsson, H, and Laue, J, 2021). There is an immediate need for a method for assessing slope stability that is dependable, affordable, and widely applicable. By examining research work conducted in slope monitoring and testing (Meng, J, Mattsson, H, and Laue, J, 2021; Sahoo et al 2022; Wang, S, Zhang, Z, and Wang, C, 2023; Yang et al 2023), there is a need for an alternative approach that makes use of artificial intelligence and machine learning (ML) techniques.

## Objectives

The main goal of this scoping review is to determine what has currently been researched and documented about the use of artificial intelligence in monitoring slope stability in open pit mines.

## Method

A scoping review will be conducted. Electronic bibliographic databases and resources for instance: OneMine, Research Channel Africa, Scopus, ScienceDirect, Web of Science, Taylor and Francis journals, GeoRef, EbscoHost, Proquest, Springer collection, Access World News, World Bank Group and SABINET African Journals, IEEE, will be searched to identify peer-reviewed publications, published in English, between January 2011 and December 2024, and related to application of Artificial Intelligence in monitoring of slope stability for open pit mines.

## Results

The results obtained from the search will be treated as follows: The total number of articles obtained and a clear inclusion criterion for the scoping review will be provided. The main themes that will emerge from the studies will be provided alongside insights. The machine learning methods utilized together with the performance metrics will also be discussed in this scoping review. The field of application, Approach used, Models Input and output parameters and findings will also be provided.

## Conclusions

This study will conduct a scoping review on the current state of application of machine learning for slope stability monitoring. Commonly used machine learning algorithms will be identified and the performance metrics used will also be provided.

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