# ABSTRACT

Life and infrastructure are at serious risk from earthquakes, and planning response to catastrophe can be substantially improved by early detection. In order to differentiate between earthquake and non-earthquake events, this study investigates the use of machine learning techniques such as Random Forest and XGBoost model for the categorization of seismic data.

Particularly in seismically active areas like the Tehri Dam area in Uttarakhand, India, earthquake detection is an essential part of disaster risk management. Using seismological data from the Tehri Dam region, this dissertation explores the use of machine learning algorithms for precise and effective earthquake detection.

Estimating and analyzing the key characteristics that aid in the identification of seismic occurrences is the main goal of this study. Random Forest and XGBoost models, two ensemble learning approaches renowned for their resilience and feature importance, are used in the study. The raw seismic data has been pre-processed first, and the models are trained on this data to evaluate their performance in detecting seismic attributes and eliminating noise from the data. For greater interpretability, feature importance is evaluated using built-in metrics.

The findings highlight important contributing factors that have a major impact on detection accuracy, including P-wave arrival time, signal amplitude, energy content, and frequency-related traits.

The results underline the relevance of regional feature analysis in strengthening seismic monitoring close to vital infrastructure, such as the Tehri Dam, and the potential of machine learning in improving early earthquake detection systems.

Keywords: Tehri region, seismic attributes, Random Forest, XGBoost.