Review: Deep Learning and Machine Learning Models for Landslide Susceptibility Mapping with Remote Sensing Data

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1. Summary of the Paper

1.1 Motivation

The study develops landslide susceptibility map of Karakoram Highway (KKH) which is an international route connecting South Asia with Central Asia and China which is in great risk of natural disasters specially frequent landslides for its complex geological and climatic conditions by using deep learning (DL) and machine learning (ML) models with remote sensing data.

1.2 Contribution

The study has developed a updated LSM(landslide susceptibility map) using remote sensing data and the InSAR technique.It has applied and compared different models CNN(convolutional neural network), RNN(Recurrent neural networks), Random Forest, XGBoost which can reduce landslides by creating a more accurate LSM for the KKH region to help in hazard prevention and routine predictions.It has Identified 571 landslides where 24 are newly detected active and 547 from previous records in the KKH.

1.3 Methodology

It has processed using SBAS-InSAR and PS-InSAR techniques in Sentinel-1 data from June 2021 to June 2023 to identify landslides.It has used various indices such as NDVI and NDMI, to reflect vegetation and moisture .The dataset split training and testing was 70:30 where they applied ten-fold cross-validation to evaluate model performance.It has utilized four models—CNN 2D, RNN, Random Forest and XGBoost considering 15 landslide conditioning factors (LCFs) such as slope, aspect, and lithology.

1.4 Conclusion

This study has used PS-InSAR, SBAS-InSAR, and Sentinel-1 SAR datasets to measure surface displacement velocity in KKH.In the study 2D model outperforms other models in creating more accurate landslide susceptibility maps for the KKH region which can do hazard prevention, urban planning, and disaster reduction in the area.

2. Critiques or Limitations

2.1 1st Critique/Limitation

The regions have dense vegetated areas can have less accuracy as InSAR techniques with remote sensing data is not efficient.

2.2 2nd Critique/Limitation

The study needs high computational resources and large dataset requirements which which can be tough for many restricted resourced regions .

2.3 3rd Critique/Limitation

The study can not analysis the impact of varying temporal resolutions in the remote sensing which can cause less accuracy in landslide susceptibility map leading to wrong results.

3. Synthesis

3.1 1st potential

The study can integrate more remote sensing techniques, like LIDAR in order to have more accuracy in dense vegetated area with InSAR techniques

3.2 2nd potential

The study can improve into a more robust system by making it real-time landslide monitoring system using continuous satellite and ground-based sensor data.