Identifying Moraine-Dammed Glacial Lakes Using Moraine Accumulation Characteristics and Vision Transformer

中国科学院青藏高原研究所
Institute of Tibetan Plateau Research
Chinese Academy of Sciences

Jinhao Xu[1,2,3], Min Feng[1,2,3], Yijie Sui[1,2,3], Zhimin Hu[1,2,3,4], Dezhao Yan[1,2,3]

1 Institute of Tibetan Plateau Research, Chinese Academy of Sciences, Beijing, China; 2 National Tibetan Plateau Data Center, Beijing, China; 3 State Key laboratory of Tibetan Plateau Earth System, Environment and Resources, Beijing, China; 4 GIS Application Research Key Laboratory of Chongqing Education Commission of China, Chongqing, China

Contact: xujinhao@itpcas.ac.cn

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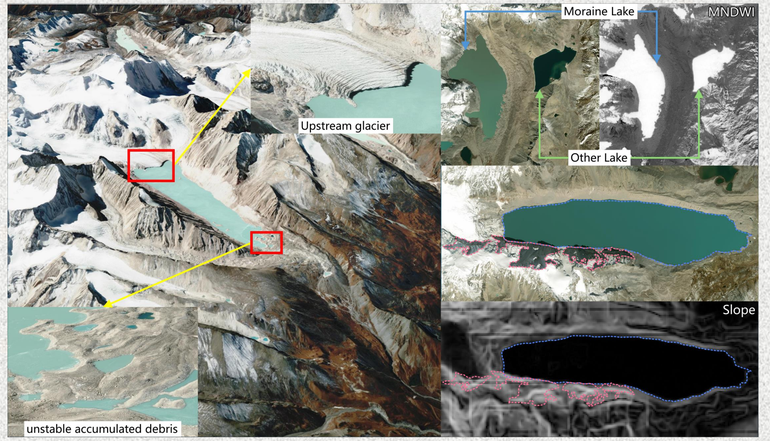
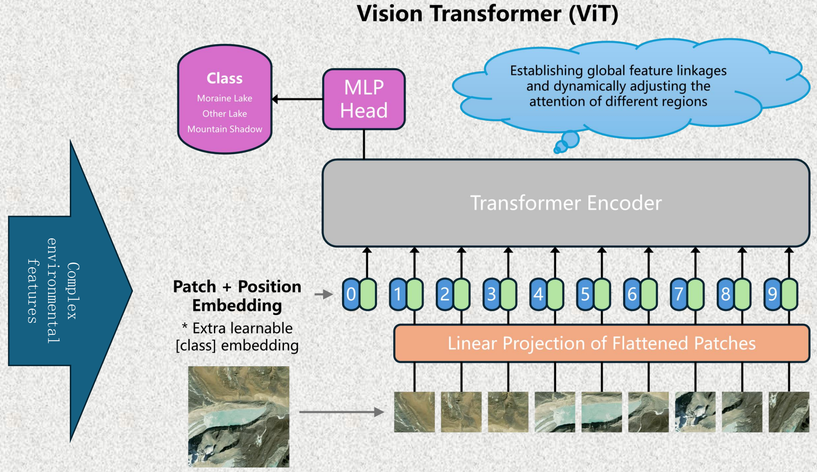
Introduction

- Moraine-dammed glacial lakes (moraine lakes) are the primary type of glacial lakes that cause glacial lake outburst floods (GLOFs).
- Due to similar spectral features, identifying moraine-dammed lakes with traditional indices or convolutional neural networks (CNNs) can easily confuse them with other lakes and mountain shadows.

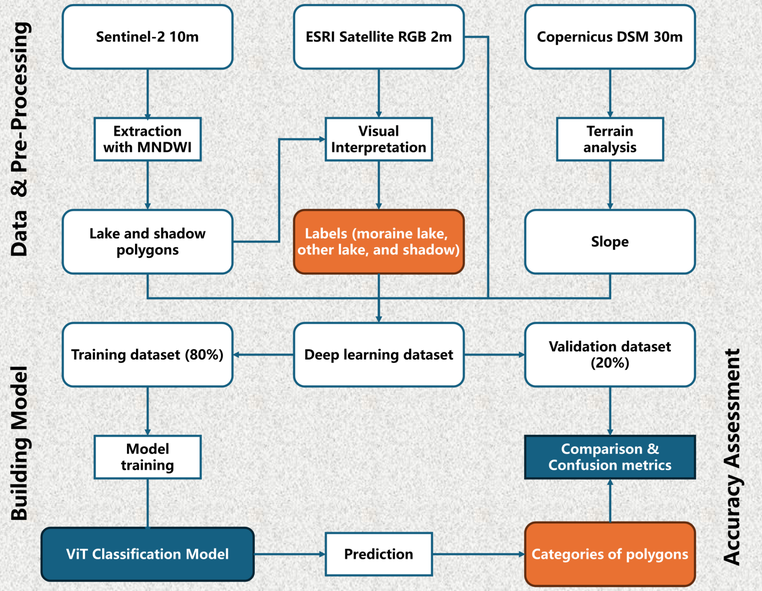


- Vision Transformer (ViT) captures global image information and focuses on highly variable environmental features, offering advantages in identifying similar objects across different environments.

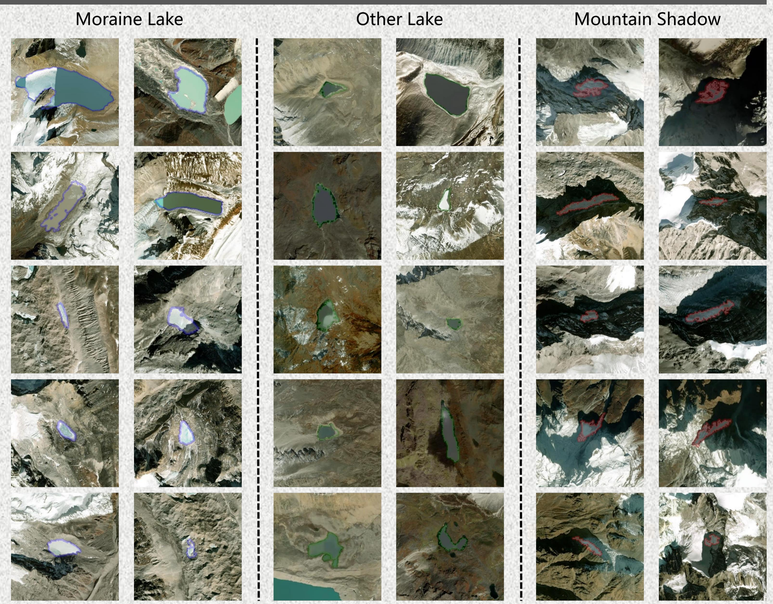


- Combining slope data can effectively help distinguish mountain shadows.

Methodology



Results



Conclusions

- Experimental results demonstrated that proposed method accurately identified moraine lakes, with precision, recall, and F1-score of 95.07%, 94.44%, and 94.75%, respectively.
- This study currently utilized a preliminary feasibility experiment with a small dataset collected in the central Himalayas. Future work will focus on testing the generalization ability in more scenarios and creating high-quality moraine lake datasets.
- ViT can effectively utilize global information and has great potential for applications in scenarios involving similar landforms in different environments, such as the identification of periglacial landforms.