Landslide Geometry Reveals its Trigger

Kamal Rana[1,2,3] , Ugur Ozturk[2,3], Nishant Malik[4]

[1]Chester F. Carlson Centre for Imaging Science, Rochester Institute of Technology, NY USA 14623 , [2]GFZ German Research Centre for Geosciences, Potsdam Germany 14473, [3]University of Potsdam, Potsdam Germany 14473, [4]School of Mathematical Sciences, Rochester Institute of Technology, NY USA 14623

Introduction

- Missing trigger information of landslides in landslide inventories.
- Trigger information of landslides assists in landslide hazard models that can mitigate losses.
- Landslides are projected as a polygon in landslide hazard models.

Data

- Six landslide inventories from JAPAN, including around 27,000 landslide polygon.

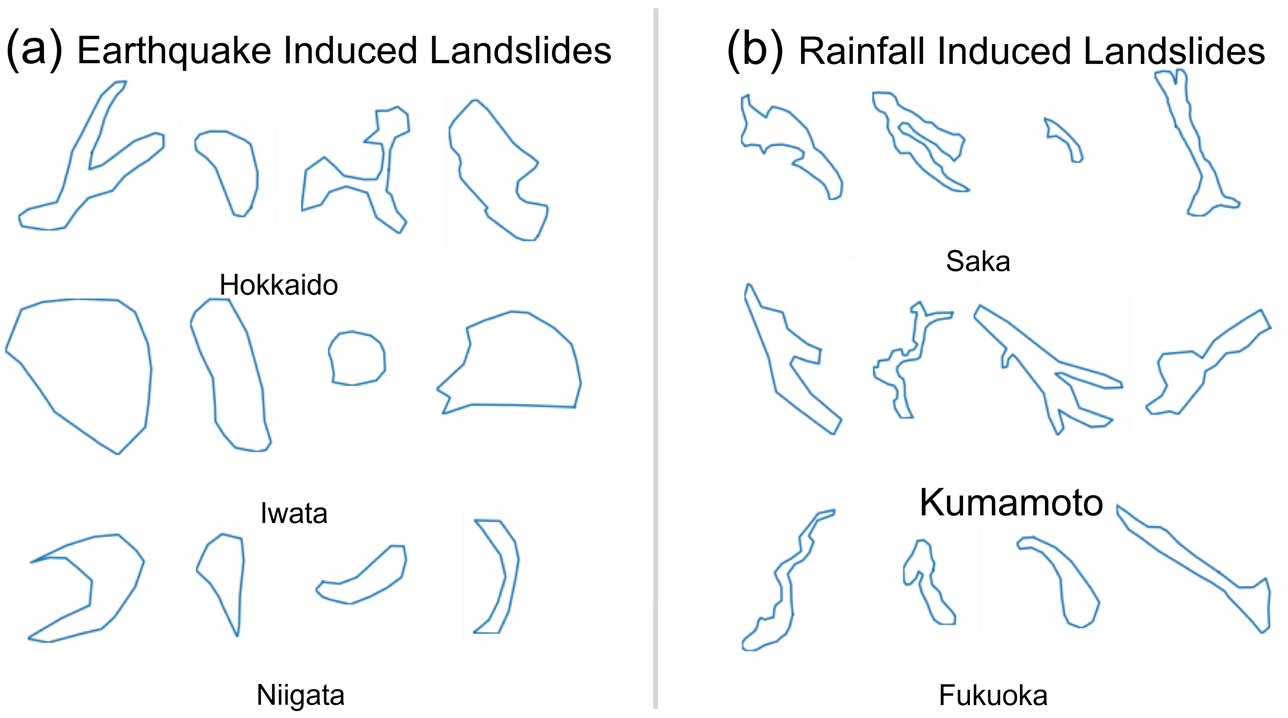

Figure1: Sample landslides planform from (a) Earthquake triggered inventories, (b) Rainfall triggered inventories.

Method

- Using random forest to classify the trigger of landslide.

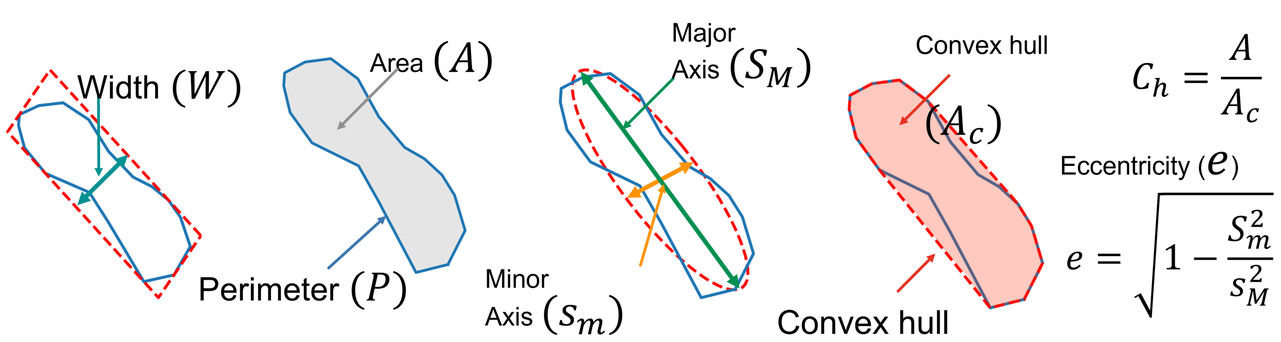

Figure2: features (left to right): width (W) of minimum area bounding box fitted to the landslide polygon, area (A) and perimeter (P) of the landslide polygon, minor (s_m) and major axis (S_M) lengths of an ellipse fitted to the polygon and convex-hull based measure $C_h = \frac{A}{A_C}$ where A_C is the area of convex hull fitted to the polygon.

Results

- Implementing random forest algorithm on geometric features of landslides.
- Minor axis length has maximum feature importance whereas perimeter has minimum feature importance.

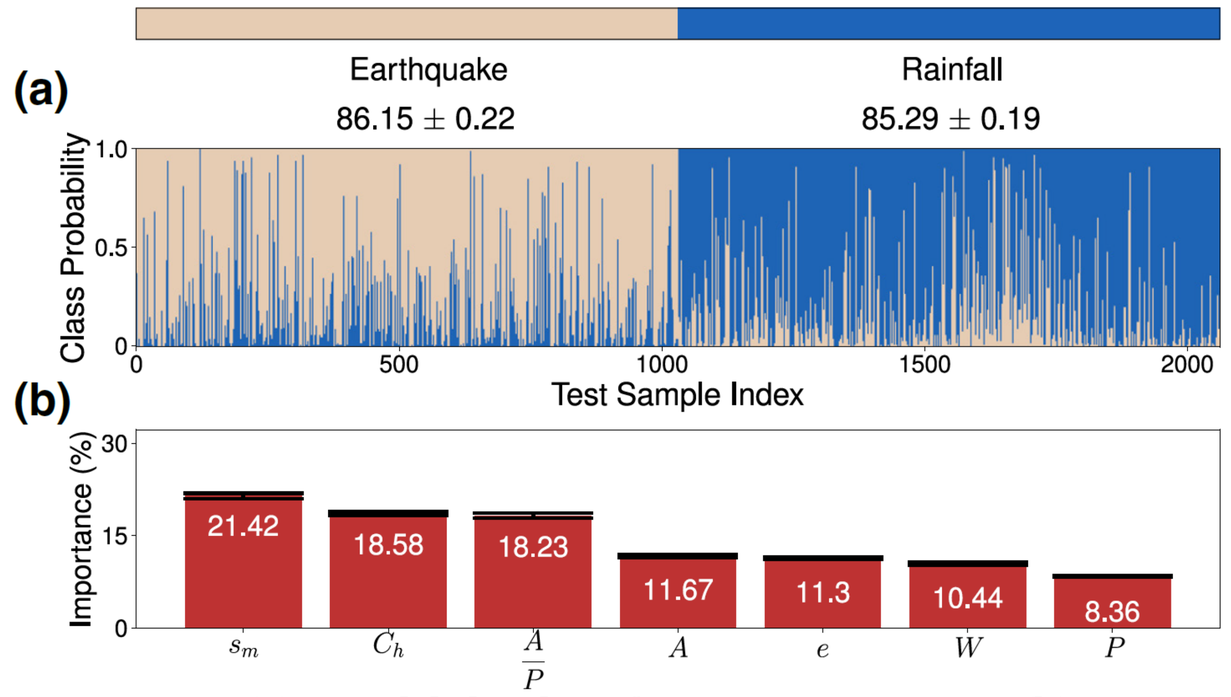

Figure3: (a) Landslide classification accuracies (b) Feature importance of geometric features

- Training the algorithm on five dataset inventories and testing on the sixth inventory.

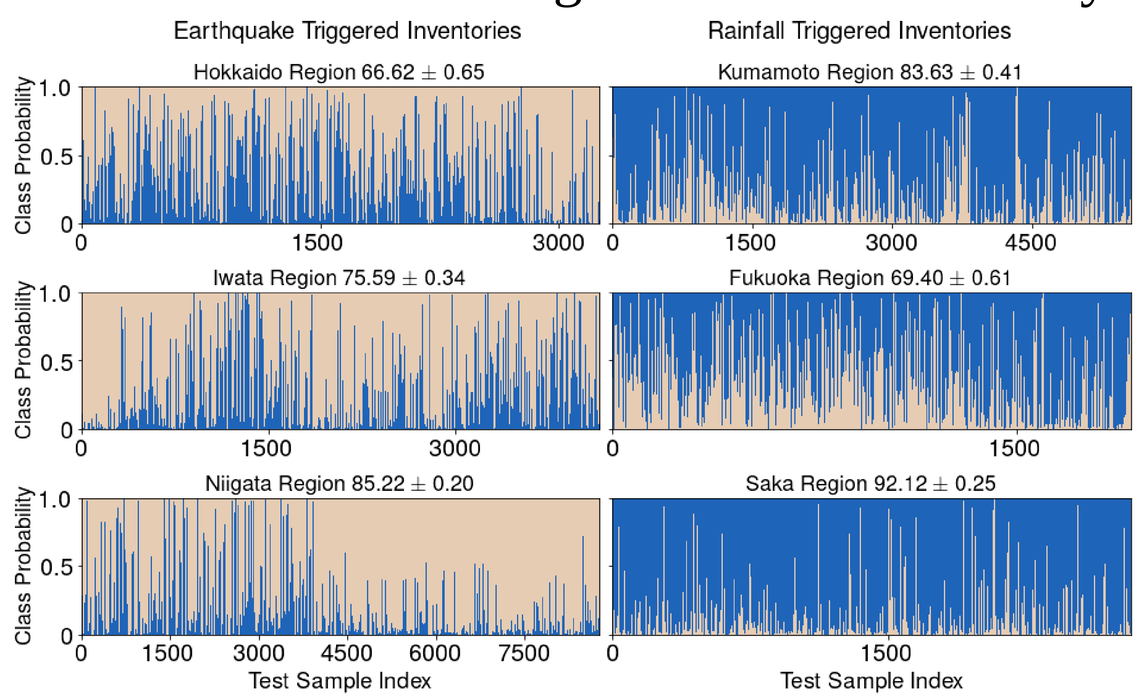

Figure4: Each Inventory landslides classification accuracy calculated using geometric features

Conclusion

- Landslides having identical trigger mechanisms exhibit similar geometric properties.
- Developed method fill the missing information by classifying existing landslides.
- A highly portable and accurate algorithm could be used in areas with similar tectonic and climatic features.

References