COMBINING SATELLITES AND AI FOR NATURAL HAZARD DETECTION

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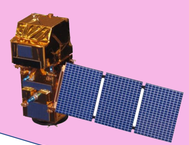
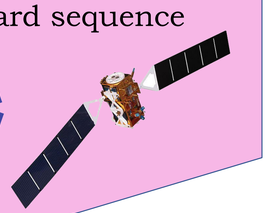
CLIMATE CHANGE

- CLIMATE CHANGE: Increases intensity and frequency of natural disasters in certain regions of the world
- CASCADING HAZARDS: Drought → fire→ intense rain → flood→ landslides
- GLOBAL COVERAGE: test cases have different climates (arctic, tropical), triggers (floods, glacial melting,),and sizes (1-70 km^2 of damage)
  - Chile, Canada, India, Indonesia, Brazil

SATELLITE IMAGERY

- IMAGERY: Optical, radar, and topography data can be expensive and difficult to process, thus, there is a need for a free, open-source, easy-to-use tool to monitor natural hazards
- HOW: Observe drastic vegetation change and surface deformation using satellite imagery and various change variables
- NOVEL: Free app that merges imagery & machine learning to monitor landslide hazard sequence





MACHINE LEARNING

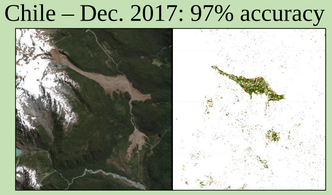
- UNSUPERVISED MACHINE LEARNING: algorithm finds similarities in pixels and groups them into categories or clusters without any user input
  - 80% of pixels used for learning; 20% for testing
  - Variable cluster number
- HOW: Input different combinations of the change variables into clustering algorithm and identify which performs best using Google Earth Engine

GOALS:

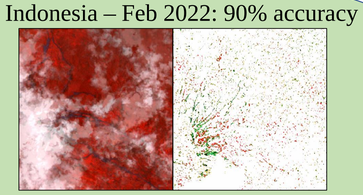
- Develop accurate global natural disaster prediction & monitoring tools
- Create easy-to-use apps for legislators, scientists, educators, and the public to stay informed about upcoming hazards

RESULTS

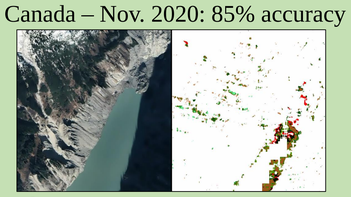
Chile – Dec. 2017: 97% accuracy



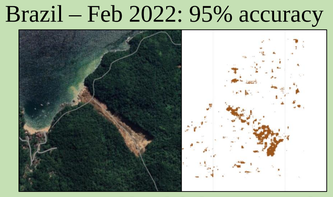
Indonesia – Feb 2022: 90% accuracy



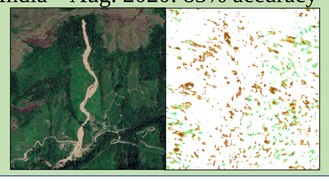
Canada – Nov. 2020: 85% accuracy



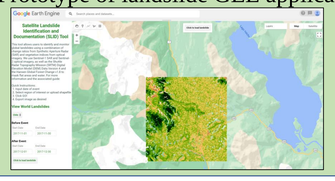
Brazil – Feb 2022: 95% accuracy



India – Aug. 2020: 83% accuracy



Prototype of landslide GEE application



OBSERVATIONS AND FUTURE WORK

- Mean accuracy: 90%
- Cluster number depends on landslide complexity
  - 5 clusters is most accurate for larger landslides, 11 clusters for smaller landslides
- Tool can detect not only removal of material, but accumulation as well

NEXT:

- Focus on prediction
- Combine with predicted fires for dry areas
- Create a water index for flooding
- Merge drought-caused fires and flooding to landslide components

OPEN-SOURCE AND CONTACT INFO

The landslide portion will be accessible by March 2023 with the final prototype in December 2023. The app will have a coinciding video and walkthrough.

To be notified when the tool is accessible to the public, email Teodora.Mitroi@colorado.edu or scan the QR code for my personal website and projects!

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