The Changing Face of Earth

Computer Vision 2025

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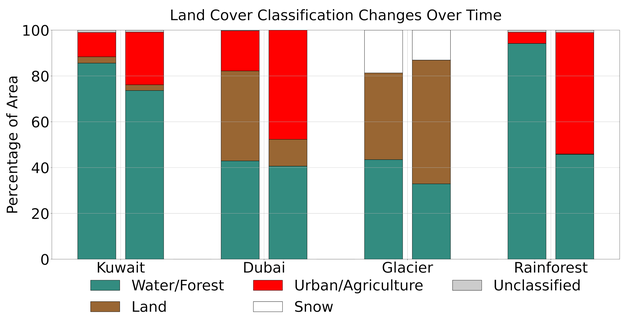


GUI FEATURES

Load Dataset Folder

TYPE OF CHANGE

- Heatmap
- Small/Large
- Slow/Fast
- Chronic Changes

TYPE OF VISUALIZATION

- Difference Highlights
- Timelapse
- Image Transition Slider
- Segmentation
- Statistics

Help | Reset Option | Smart Caption | Turbo

Pipeline

File Input → Select Image Folder, Sort Image Files

Preprocessing and Segmentation → Load RGB Images, Segment (land, water, urban, agriculture…), Scene Classification (nature or urban)

Image Registration → Register using Similarity Transformation, Select Reference Image, Transform All Images to Reference

Segmentation Transformation → Apply Computed Transformations, Generate Overlapping Segmentation Masks

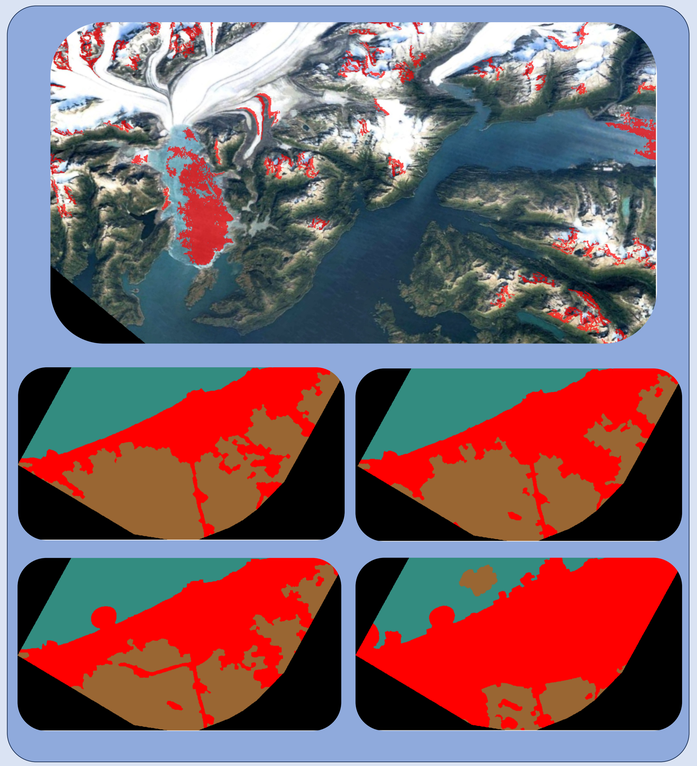
Visualization and Analysis → Display Registered Images, Show Segmented and Transformed Maps, Heatmaps, etc.

Scan to access our GitHub Repository

METHODS

- **Pipeline** as in [1,2]
- Segmentation based on **corners**, **color**, and **surface smoothness** [3,4,5]
- River **Detection** [6, 7]

RESULTS



CHALLENGES

- Datasets with homogeneous surfaces (e.g., Rainforest)
  → Preparing data specifically for Nature
- Tall buildings with varying viewing angles (e.g., Frauenkirche)
  → Mask highlights key structures and reduces background noise
- River Detection Errors (e.g., Rainforest)
  → Bridge gaps using edge proximity
- Water vs. Forest Misclassification (e.g., Kuwait)
  → Merge classes
- Shadow Misclassification (e.g., Frauenkirche)
  → Brightness filtering and reclassifying water areas fully surrounded by city didn't help

[1] Zhang, C., & Fraser, C. S. (2005). *Automated registration for change detection*. ISPRS Workshop, Hannover.
[2] Patel, M. I. et al. (2016). *HOG-SURF registration under illumination variation*. Procedia CS, 93, 382–388.
[3] Thakare, P. (2011). *Edge-based segmentation for urban scenes*. IJCS&E, 3(2), 899–904.
[4] Baral, S., & Sharma, R. (2023). *Smoothness-based snow/water detection*. Geosciences, 13(7), 193.
[5] Bhadoria, P. et al. (2021). *Color/spectral rule-based classification*. IJCSE, 9(2), 10–18.
[6] Li, Y., & Wu, J. (2015). *Shape/aspect-ratio filtering for river extraction*. Remote Sensing, 7(6), 7243–7263.
[7] Felzenszwalb, P. F., & Huttenlocher, D. P. (2004). *Graph-based segmentation by proximity*. IJCV, 59(2), 167–181.