

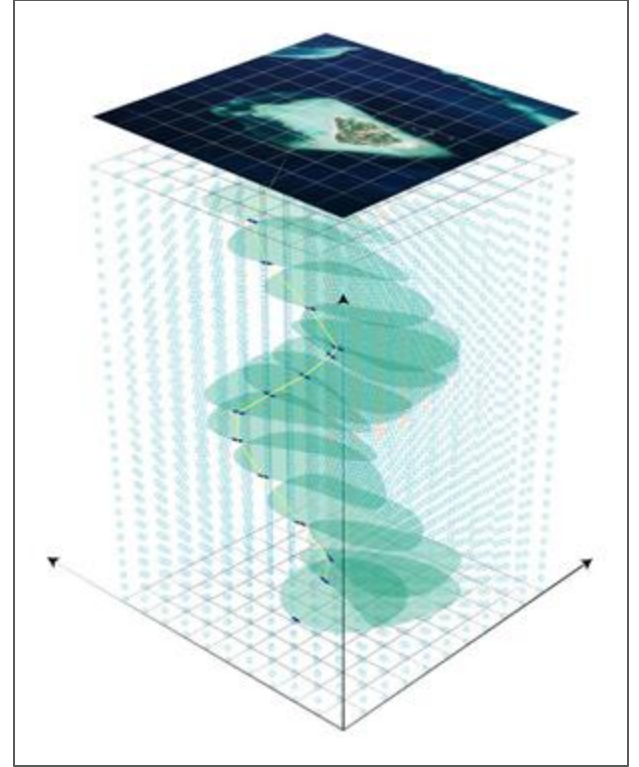
Utilizing Geospatial Foundation Model for Shoreline Delineation

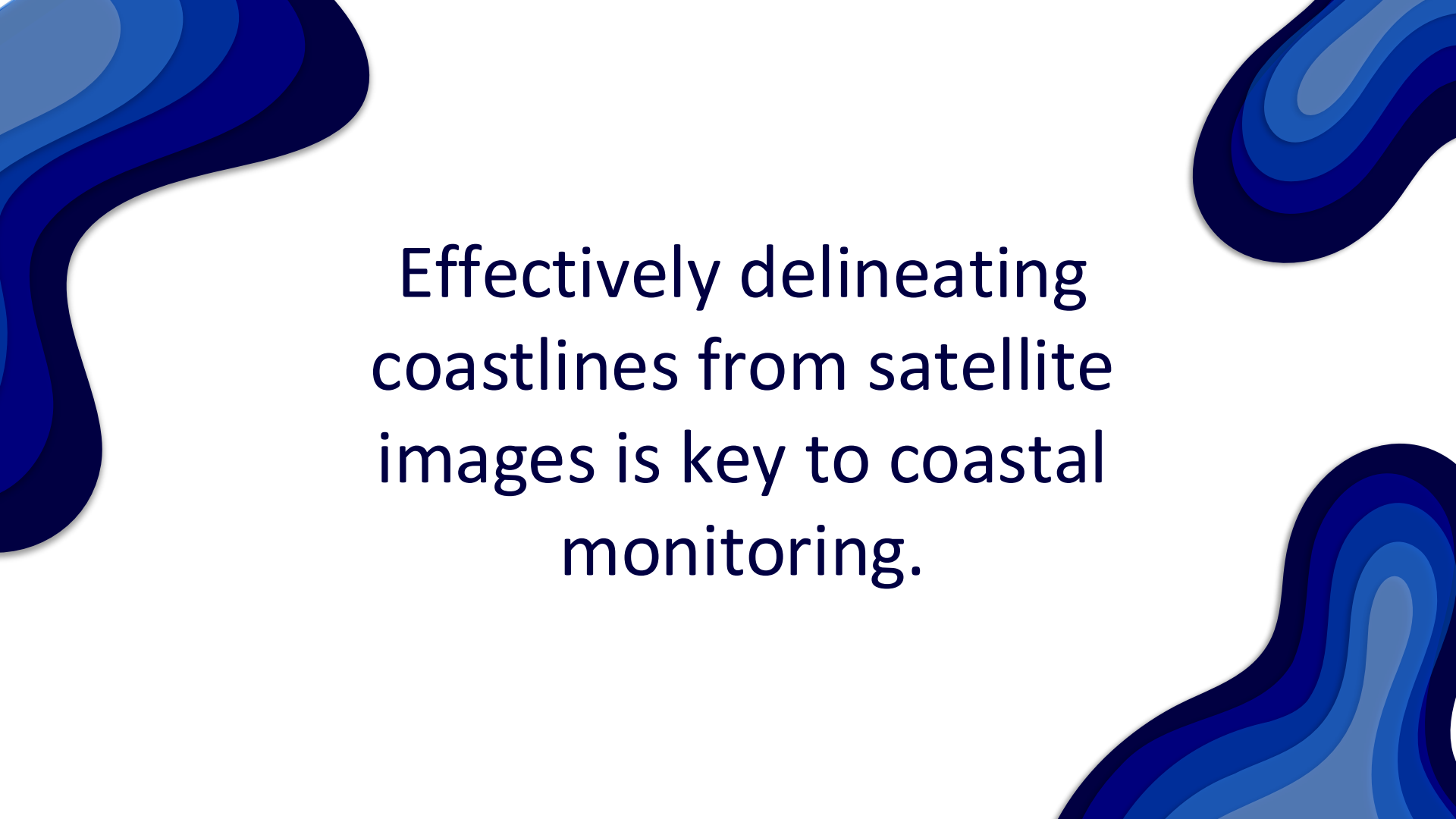
MIT Self Assembly Lab

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Zesk, Skylar Tibbits.



The Growing Islands Project, Self Assembly Lab.

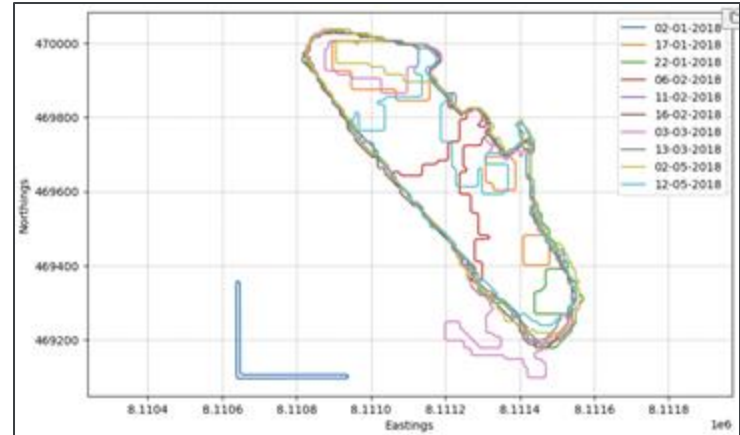


The image features three decorative elements in the corners: a large blue wavy shape on the top left, a smaller one on the top right, and another on the bottom right. These shapes are composed of concentric, wavy lines in various shades of blue, creating a layered, topographical effect.

Effectively delineating
coastlines from satellite
images is key to coastal
monitoring.

Challenges

1. Image Resolution and Accuracy (low resolution vs medium resolution)
1. Environmental complexity
1. Well-known toolkits such as CoastSat struggle with small islands.
1. Most other approaches build custom models – small islands remain underrepresented in training.



Prithvi EO 2.0

- Pre trained on 4.2 million HLS images at 30 m resolution
- ViT Backbone, MAE approach
- Two versions: 300M and 600M
- Benchmarked on GEO-Bench
- Can be fine tuned for segmentation, classification, or regression.
- Has *not* been applied for a coastal task

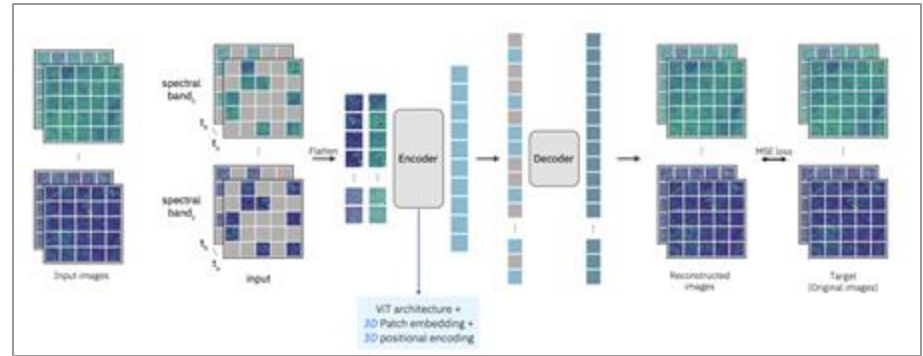


image credit: Jakubik et al.

Key Question: Can
Prithvi work well
under real-world
constraints to
segment small island
shorelines from
Sentinel-2 data?



Released Maldives Dataset

- **225** multispectral images (5 bands) from Sentinel-2 at 10 m resolution.
- Hand-labeled using Kili Technology to generate masks.
- Random subsets of training dataset: 5, 10, 25, 50, 75, 100, 125, 150, 181 (all) images.
- Held out test and validation sets of 22 images each.



Experimental Setup



Results!



Highlights:

Fine tuning on even 5 images yields decent IoU score of 0.8509.

At a small training dataset, Prithvi 300M does significantly better than Prithvi 600M; otherwise, difference is minimal.

Training Dataset Size	Prithvi 300M IoU	Prithvi 600M IoU	Prithvi 300M F1	Prithvi 600M F1
5 images	0.8509	0.7977	0.9612	0.9429
10 images	0.8720	0.8927	0.9664	0.9743
25 images	0.9423	0.9311	0.9870	0.9845
50 images	0.9427	0.9475	0.9871	0.9880
75 images	0.9470	0.9538	0.9881	0.9896
100 images	0.9536	0.9577	0.9896	0.9905
125 images	0.9593	0.9616	0.9908	0.9913
150 images	0.9570	0.9529	0.9904	0.9894
181 images	0.9529	0.9553	0.9894	0.9899

Our Contributions

1. **First** (known) evaluation of a GFM, namely Prithvi, on the task of shoreline segmentation.
1. Positive results = solution for extracting coastlines from satellite images of small islands.
1. Emphasis on **real-world applicability**:
 - a. Achieved solid performance even with:
 - i. Small datasets
 - ii. Frozen backbone
 - iii. Low resolution images

Future work: continue developing our methods further for more thorough delineation and shoreline analysis.

Thank you!

For further details, see our paper!



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