## **Model Card For Coral Reef**

**This model card template is taken directly from Mitchell, M., Wu, S., Zaldivar, A., Barnes, P., Vasserman, L., Hutchinson, B., ... & Gebru, T. (2019, January). Model cards for model reporting. In *Proceedings of the Conference on Fairness, Accountability, and Transparency.* (pp. 220-229).**

## **Model Details:**

* **Person or organization developing the model:** Team AiZoom (Sameer, Gordon, Drew)
* **Model date:** Jan 23, 2023
* **Model version:** Version 1.0
* **Model type: U-Net, semantic segmentation**
* **Paper or other resources for more information:** N/A
* **Citation details**
  + **U-Net:** Ronneberger, O., Fischer, P., & Brox, T. (2015, October). U-net: Convolutional networks for biomedical image segmentation. In *International Conference on Medical image computing and computer-assisted intervention* (pp. 234-241). Springer, Cham.
  + **Implementation:** [**https://github.com/bnsreenu/python\_for\_microscopists/blob/master/208-simple\_multi\_unet\_model.py**](https://github.com/bnsreenu/python_for_microscopists/blob/master/208-simple_multi_unet_model.py)
* **License:** N/A
* **Feedback on the model:** Mean IoU of 0.940 and F1 score of 0.856

## **Intended Use:**

* **Primary intended uses:**
  + Intended to use the dataset of “Coral Reef,” which is taken in Maldives, French Polynesia, and other Pacific atolls (Satellite images), to research geographical characteristics of these atolls
* **Primary intended users:**
  + Researchers are interested in geology, coral reefs, and environmental science-related subjects.
* **Out-of-scope uses:** 
  + Tracking the effects of global warming and climate change

## **Factors:**

* **Relevant factors:**  Satellite sourced aerial coral reef image analysis on account of the extreme variations in the size, color, shape, and texture of different images with different weather, environment, places, and time. Furthermore, dramatic changes in water turbidity between sites due to ocean currents and the presence of plankton and algal blooms could significantly alter the ambient lighting and image colors, making the task of automated image analysis even more difficult.
* **Evaluation factors:** Labeling accuracy (with or without an annotator), size, color, shape, and texture of different images of coral reefs with different brightness, weather, environment, places, and time.

## 

## **Metrics:**

* **Model performance measures:** F1: 0.856, mean IoU: 0.940, vegetation IoU: 0.926, reef-flat IoU: 0.921, ocean IoU: 0.974. Model evaluates an image in 1.5 microseconds making it enormously faster than shallow learning methods.
* **Decision thresholds:** Greatest value between three continuous predictions in each class’s channel.
* **Approaches to uncertainty and variability:** Image resizing and removal. Low resolution images thrown out. Images with cloud cover thrown out. Images with high resolution scaled down significantly.

## **Evaluation Data:**

* **Datasets:** 
  + Unlabeled and labeled images of coral reefs taken on Maldives, French Polynesia, and other Pacific atolls
* **Motivation:** 
  + To make a model distinguishing different segmentation of Coral reefs on account of the extreme variations in the size, color, shape, and texture of different images with different weather, environment, places, and time.
* **Preprocessing:** 
  + Image Resize
  + Rotate each image 90, 180, and 270 degrees
  + Take a mirror of each orientation and add it to the dataset
* **Note:** The accuracy of labels is not 100% and contributes to model inaccuracies

## **Training Data:**

* **Datasets:** 
  + NIR images with a label in “JPG\_Labeled” within “Coral\_Reef.”
* **Motivation:** 
  + To make an effective model for semantic segmentation of Coral reefs. Intended to be faster, and more accurate than results produced by shallow learning techniques.
* **Preprocessing:** 
  + - Labels produced via k-means clustering
    - Utilized near-infrared channels of satellite imagery

## **Ethical Considerations:**

* The dataset of “Coral\_Reef” is taken on Maldives, French Polynesia, and other Pacific Atolls, but that does not necessarily represent all of the coral reefs worldwide in different climates.
* We are still unsure of the equipment used

## **Caveats and Recommendations:**

* The accuracy of labels is not 100% and contributes to model inaccuracies.
* Does not capture the type of coral reef presented in the visuals and also shows inaccuracy in the amount of labeling because of the dataset's different colors, textures, and brightness.
* An ideal evaluation dataset would additionally include annotations for coral reef type, camera details, and environment (humidity/lighting) details.