A comparison between image processing models featuring Human-drawn, Segment Anything (SAM), and Mask R CNN

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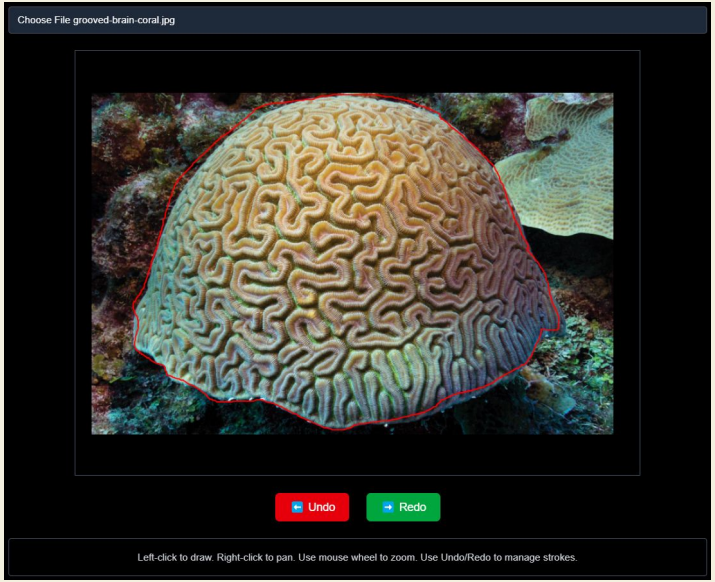
The goal of the project

To create a tool to outline coral in an image

To compare effectiveness of the automation tools, SAM and Mask R-CNN.



Why does this matter ?

Instead of spending large amounts of time identifying/outlining corals manually,

Researchers can now use image processing tools to automatically detect corals in images.

Tools such as Segment Anything (SAM) and Mask R-CNN are capable of quickly identifying objects in images.

Comparing these tools is essential to help researchers decide which is more suitable for their needs

Persona

Age: 25-45

Coral reef researchers

Automate the process of identifying corals

Tasks

SAM vs Human Drawn IOU ?

MASK R-CNN vs Human Drawn IOU ?

SAM vs MASK R-CNN IOU ?

What is better?

IOU: Intersection over Union

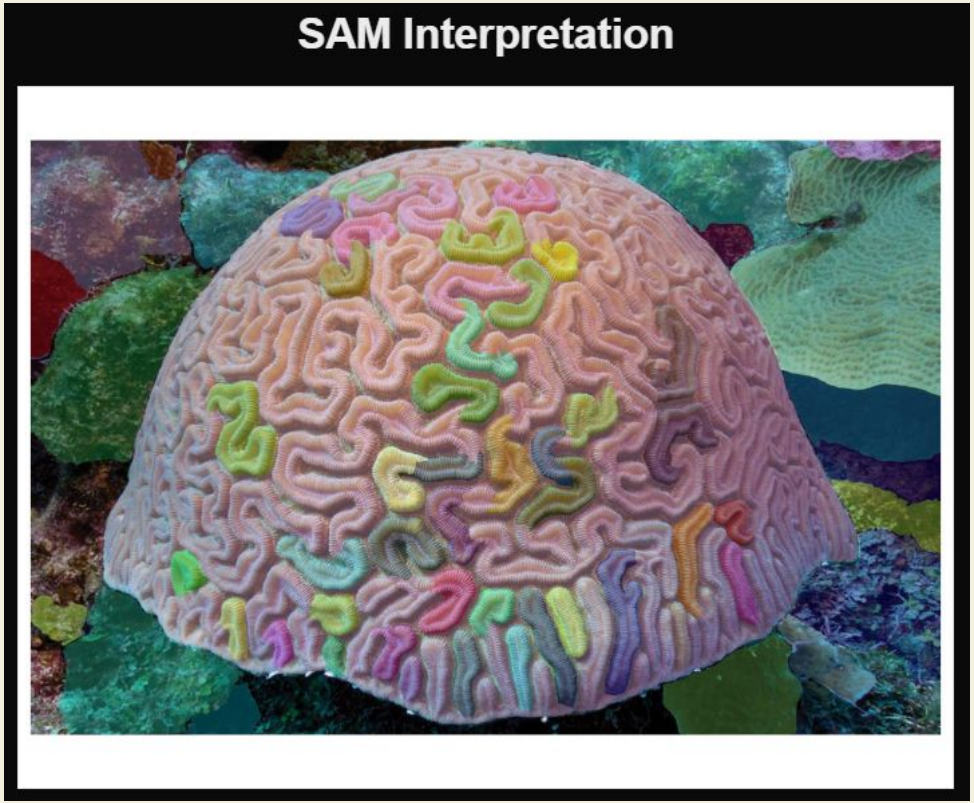
SAM Score

Mask R-CNN Score

Segment Anything Model (SAM)

- Developed by Meta AI
- A general-purpose image segmentation tool
- Trained on the largest dataset ever created (SA-1B) ~ 1.1 billion segmentations masks across more than 11 million images from various categories
- Does not label and only segments

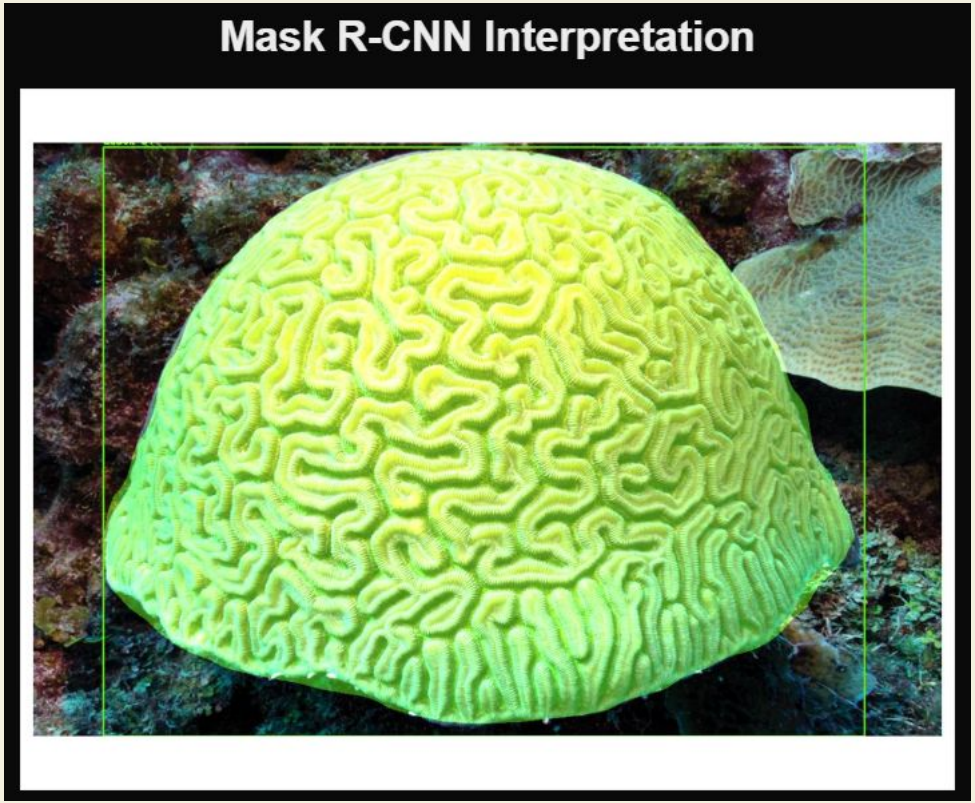
Sam Interpretation



Mask R-CNN

- Developed by Facebook AI (it came out earlier)
- Must be trained on a labeled dataset with predefined object categories
- This project uses a pre-trained Mask R-CNN model, trained on
- Microsoft Common Object in Context (MS COCO) ~ 333000 images across 80 object categories

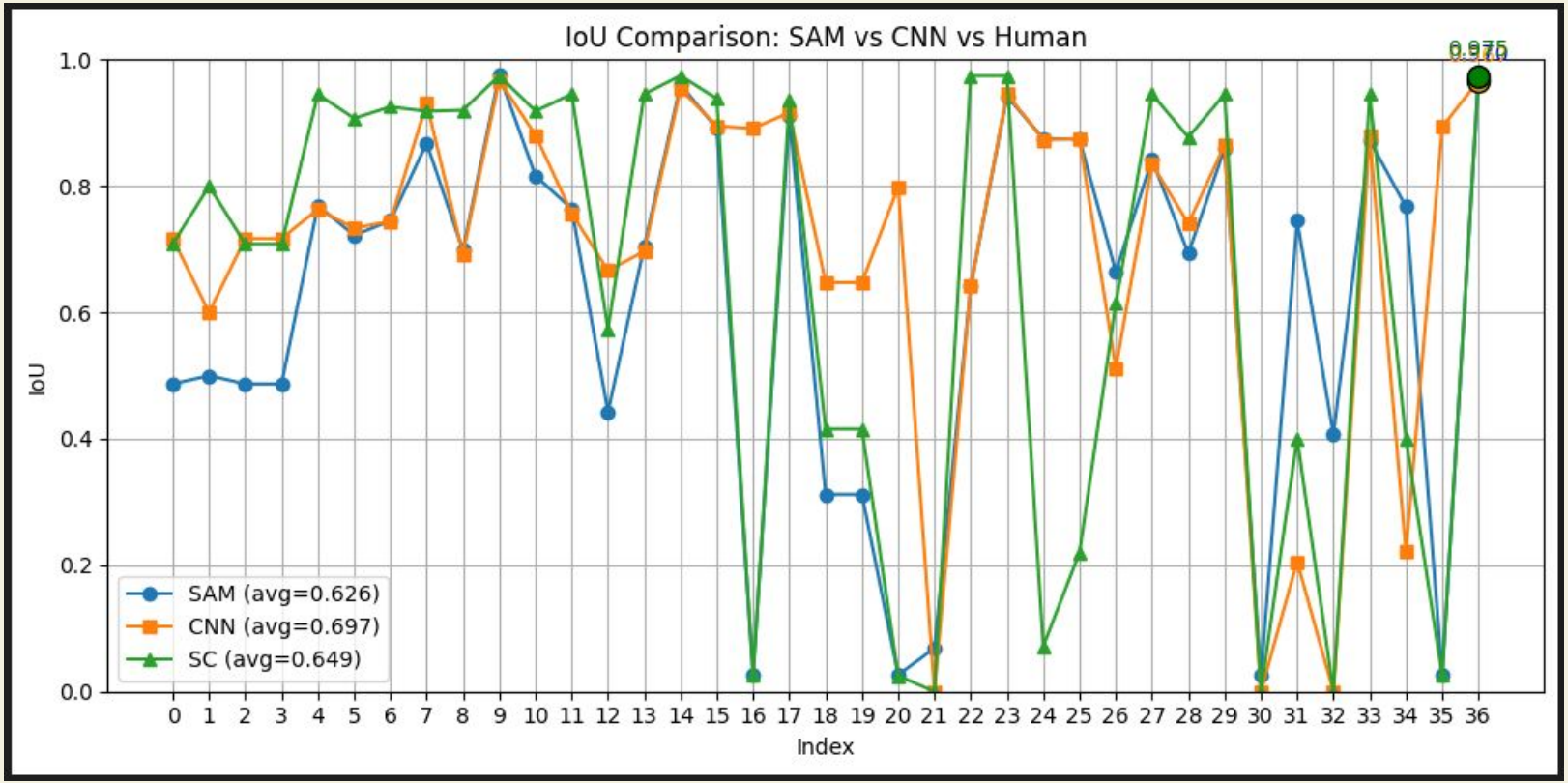
Mask R-CNN Interpretation



Demo

Questions ??

Results


IoU Comparison: SAM vs CNN vs Human
IoU
Index
SAM (avg=0.626)
CNN (avg=0.697)
SC (avg=0.649)

The results vary based on:

- Model configurations:
  - SAM - the model parameters on whether fine details should be included
  - Mask R-CNN - the confidence level

- The user who outlines the coral:
  - Is he an artist?
  - Lazy?
  - Understand coral to know which coral is which?

Conclusion

SAM is good at segmenting coral.

However parameters fine tuning should be priority when doing at large scale.

A better model might also help (We are currently running the basic model).

It is not flawless, so a human in the loop can be beneficial

Conclusion

Mask R-CNN process images much faster than SAM ~ model has less weight and generates fewer masks.

With the right training data set focused on coral, Mask R-CNN could outperform SAM in speed and accuracy.

It is a strong candidate for coral detection with labeling