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Automated Crevasse Mapping Using Deep Learning Foundation Models to Analyse Climate Change and Glaciology

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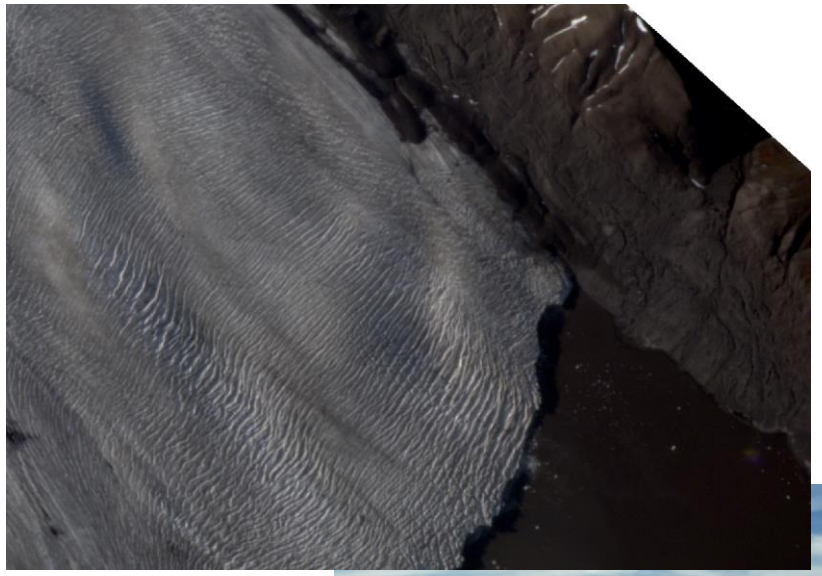
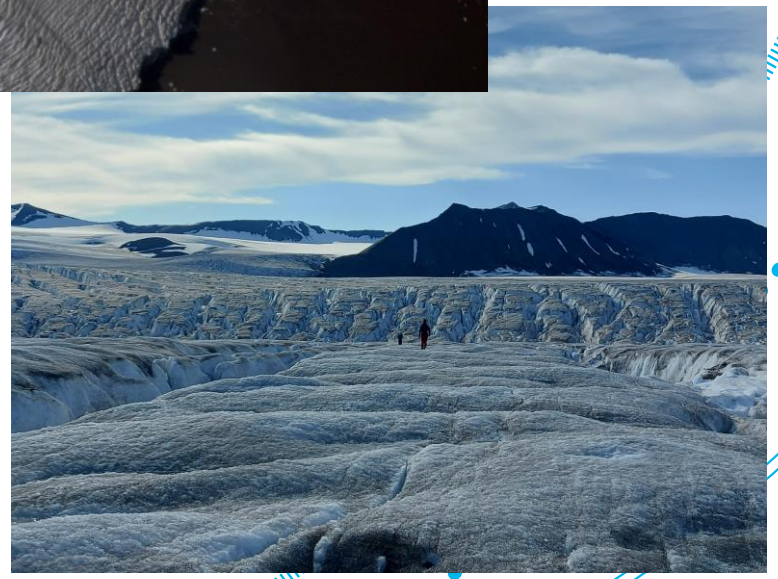
Introduction

- Computer Vision
- Automated Crevasse Mapping
- Arctic Glaciers
- Melting Glaciers
- Glacier Calving



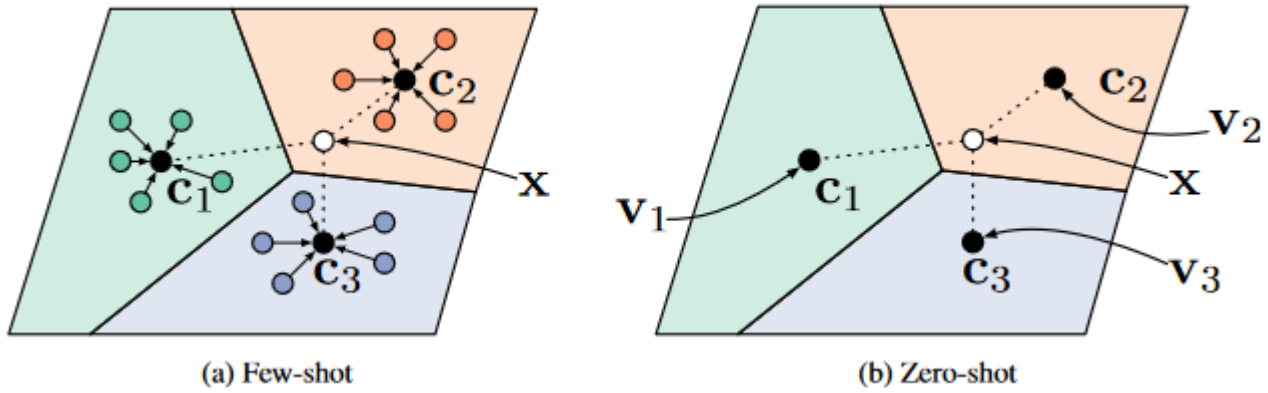


Gajek, IG PAS 2023

How well can deep learning foundation models generalise to a specialist downstream task with limited training data?

Zero/Few-Shot Learning

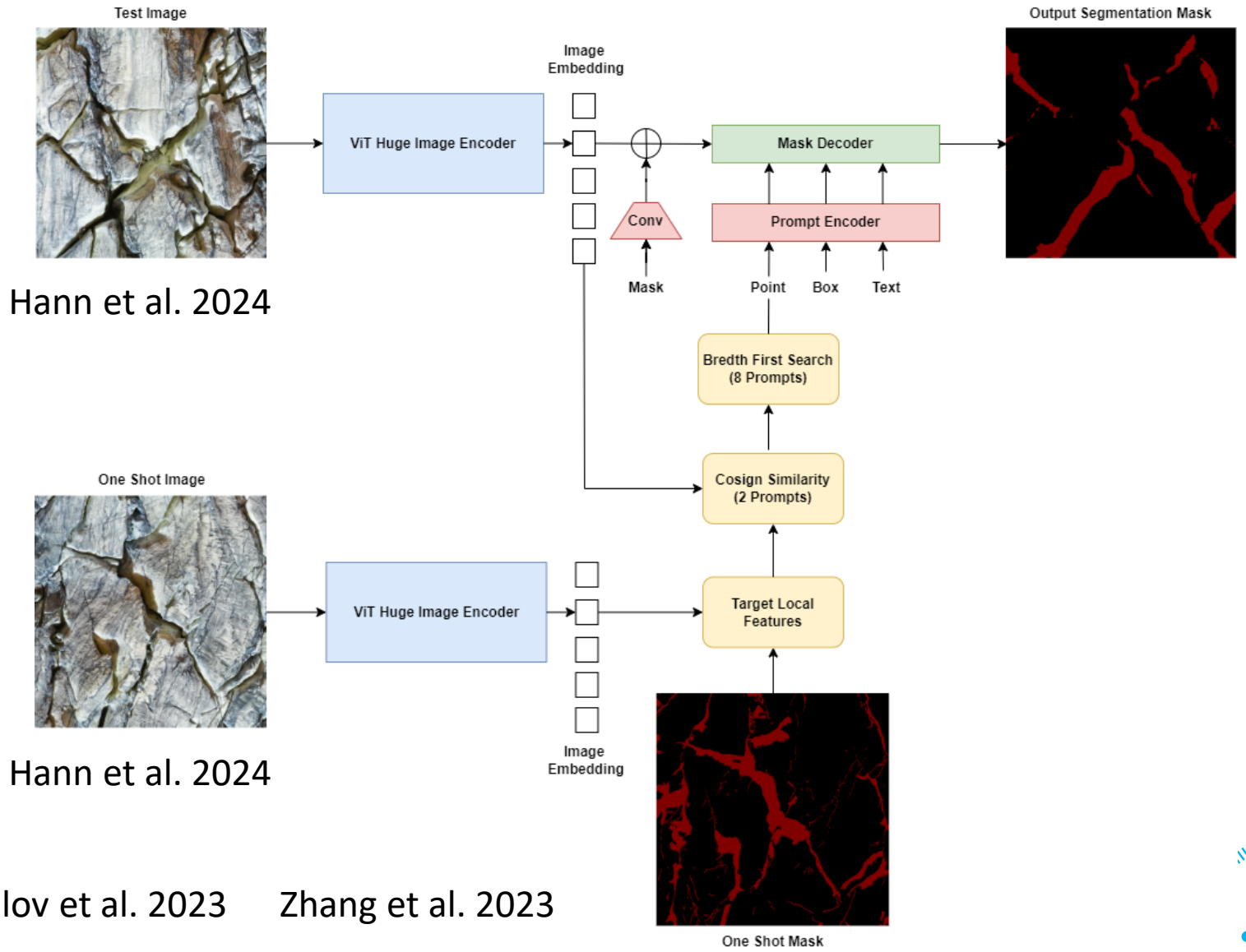
- Zero Shot Learning
- One Shot Learning
- Five Shot Learning
- Ten Shot Learning



Snell, Swersky, and Zemel 2017

Few-Shot learning is a type of Meta-Learning that has performed well on foundations models.

Foundation Models



Hann et al. 2024

Hann et al. 2024

Kirillov et al. 2023 Zhang et al. 2023

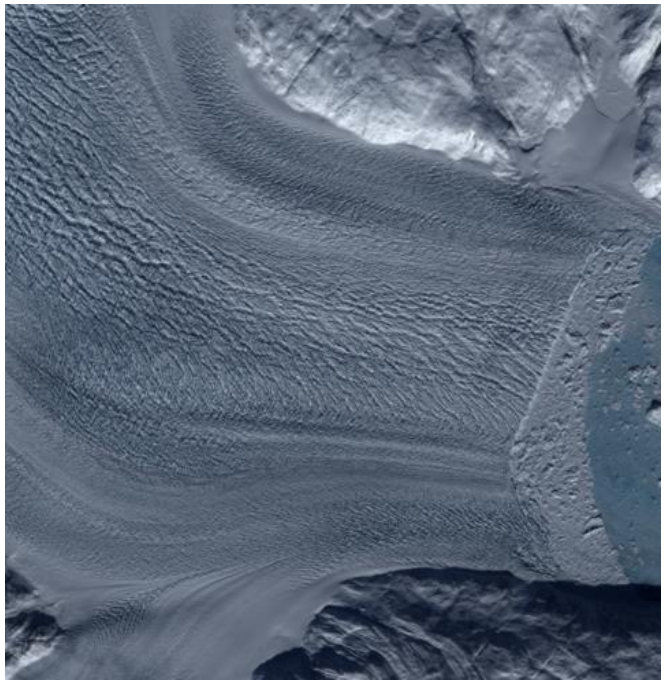
Remote Sensing Data

Drone Data

Hann et al. 2024

QGIS 1:30 Overall Resolution

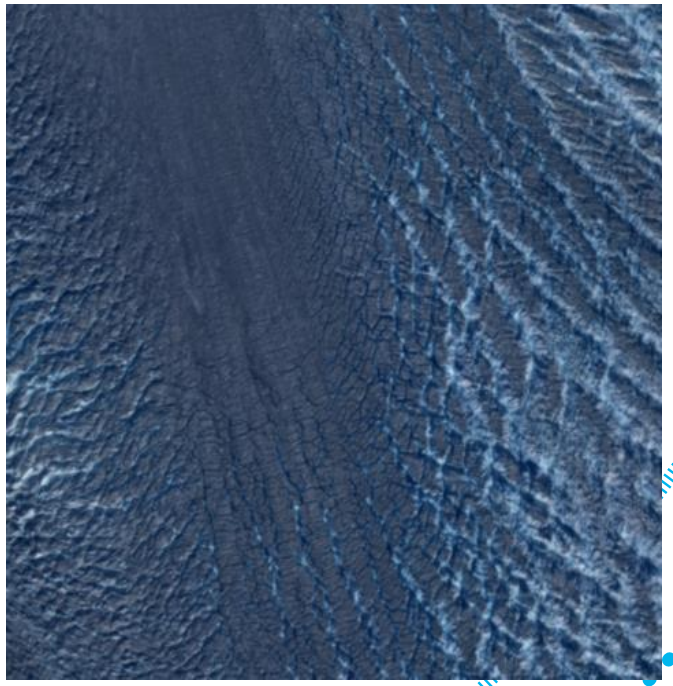
Sentinel-2



ESA 2023

10m Resolution per Pixel

Planet.com



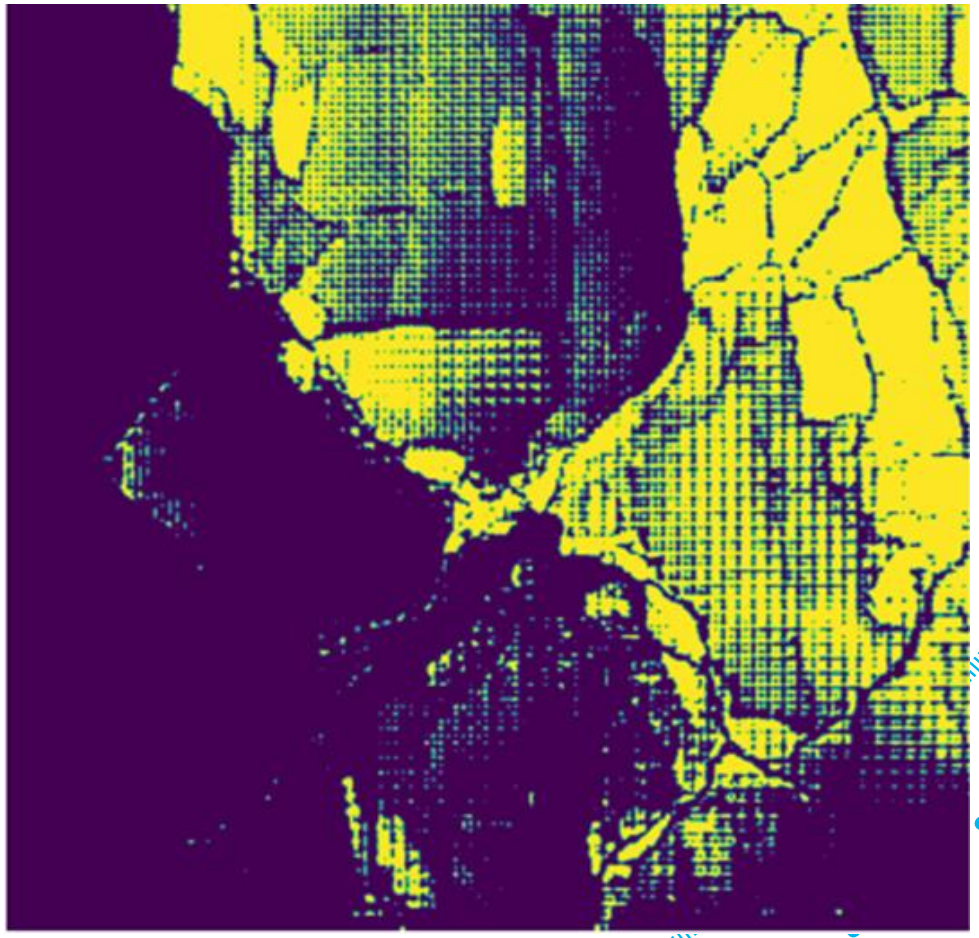
Planet 2023

3m Resolution per Pixel

Zero Shot Learning SAM

Input Image

Model Output Mask



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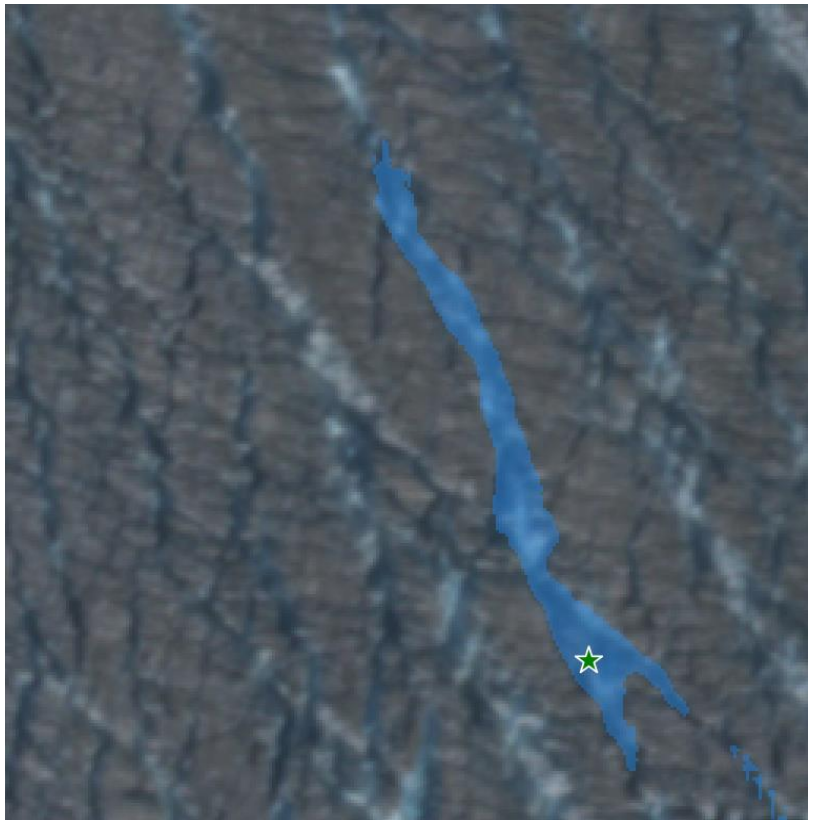
One Shot Learning PerSam 256 x 256

Input Image



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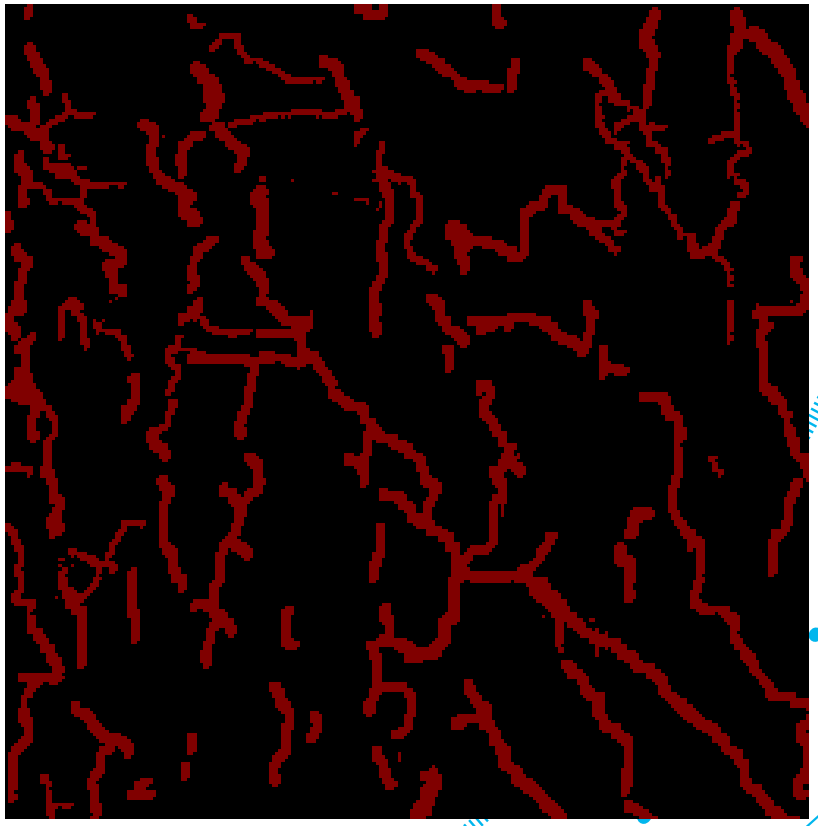
Model Output Mask

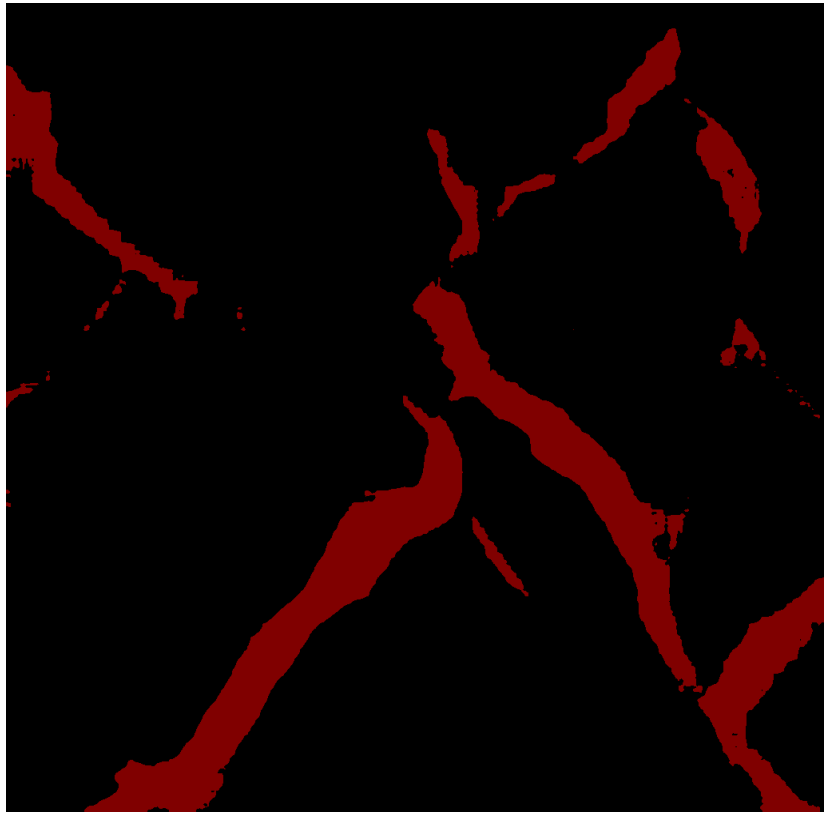
Ground Truth



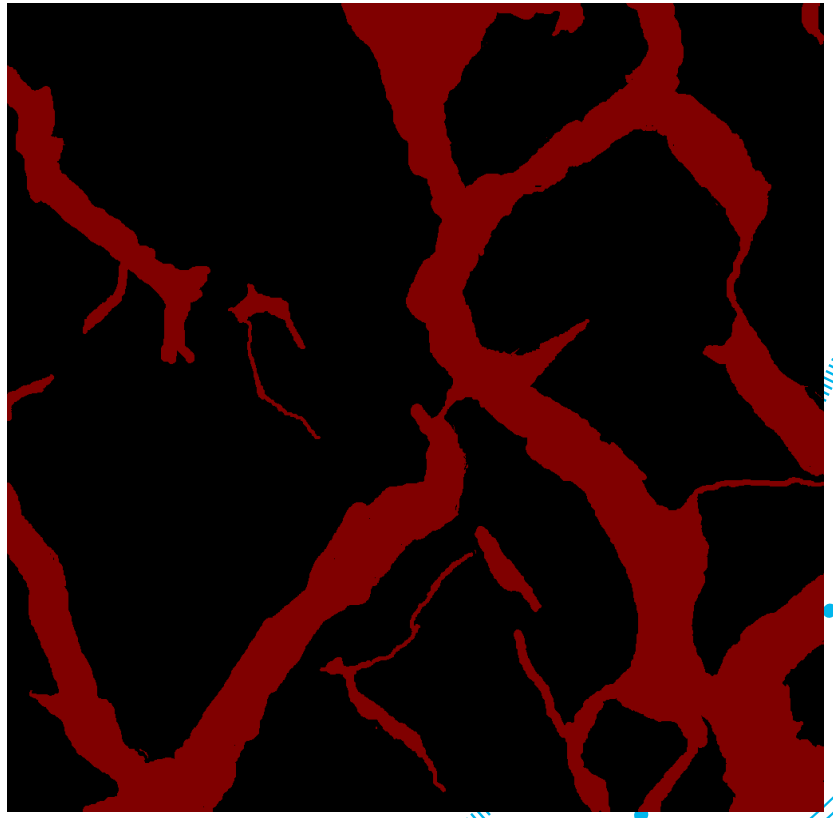
One Shot Learning PerSam ViT-H

Input Image

Model Output Mask



Ground Truth Mask

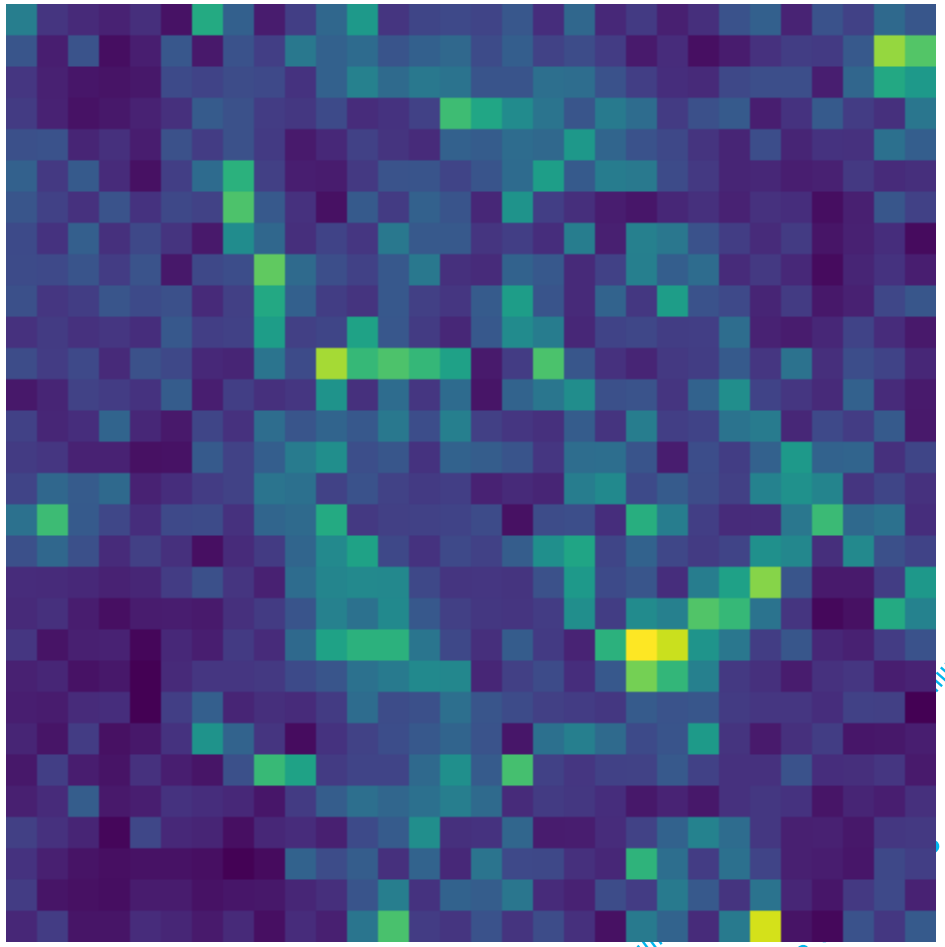


Hann et al. 2024

DINO Attention Mask – Drone Data

Input Image

Transformer Attention Mask



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Summary

1. Segment Anything Model (SAM) displays promising results during zero and one-shot learning on similar data to the training set
2. Foundation model exploration shows that careful fine-tuning techniques are required
3. Further exploration with new and existing foundation models is required

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