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Master Thesis Update

October 2025

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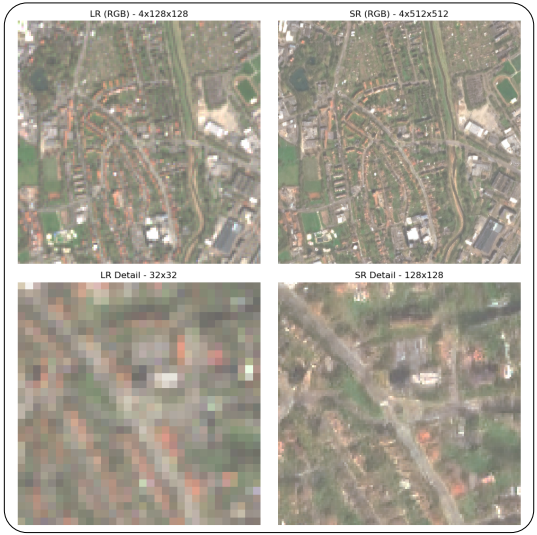
LDSR-S2

- Open Source
- Upscale: 10m -> 2.5m
- Pro: Tested Spectral fidelity
- Con: Low structural fidelity



S2DR3

- Upscale: 10m -> 1m
- Pro: Spectral fidelity is reliable but not perfect
- Con: not clear what is happening under the hood
- Con: Closed Source

Satlas-SR

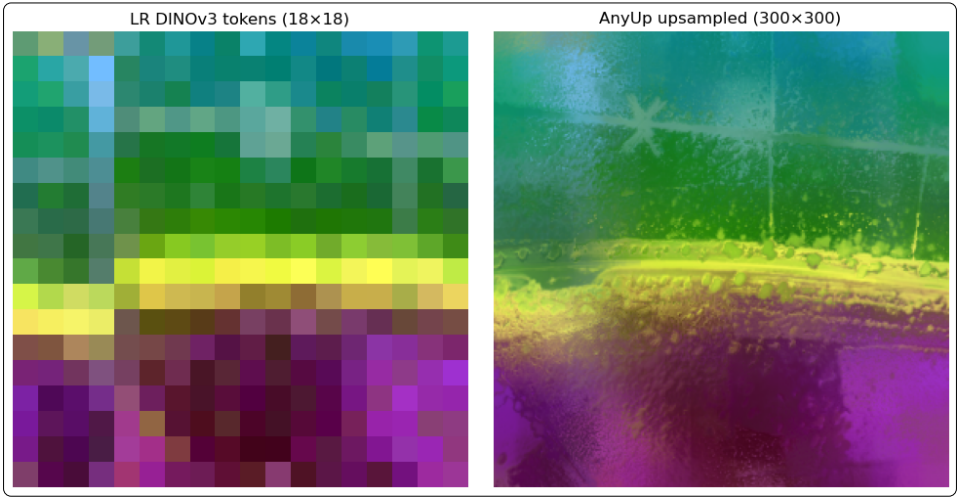
- 2.5m resolution
- Pro: high structural quality
- Pro: Well-documented paper
- Con: Outdated dependencies
- Con: needs plumbing to make it work
- Con: Computationally expensive

Dinov3-Models

- 10 models pretrained on web data (`LVD-1689M` dataset)
  - 1 ViT-7B trained from scratch
  - 5 ViT-{S, S+, B, L, H+} models distilled from the ViT-7B
  - 4 ConvNeXt-{T, S, B, L} models distilled from the ViT-7B
- 2 models pretrained on satellite data (`SAT-493M` dataset)
  - 1 ViT-7B trained from scratch
  - 1 ViT-L distilled from the ViT-7B

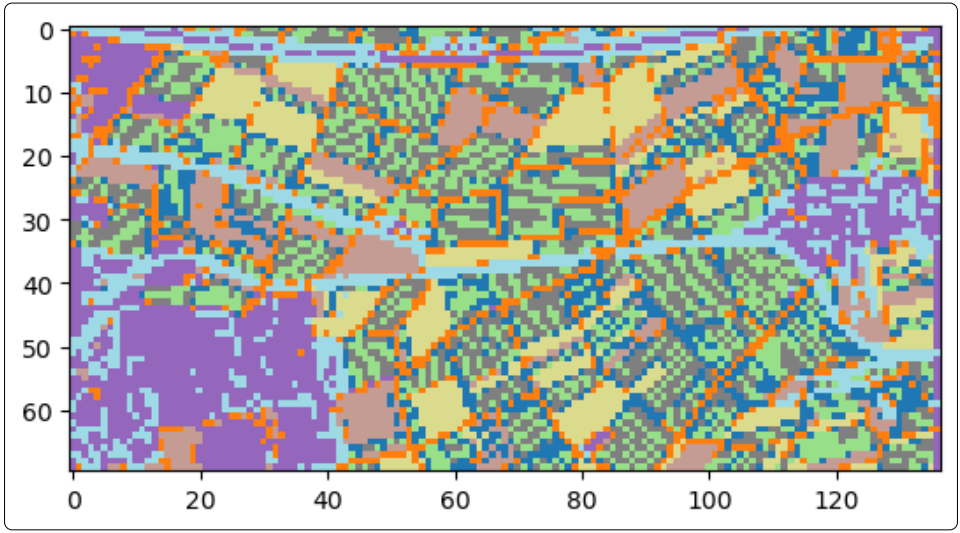
Image Example

Feature Extraction with PCA coloring

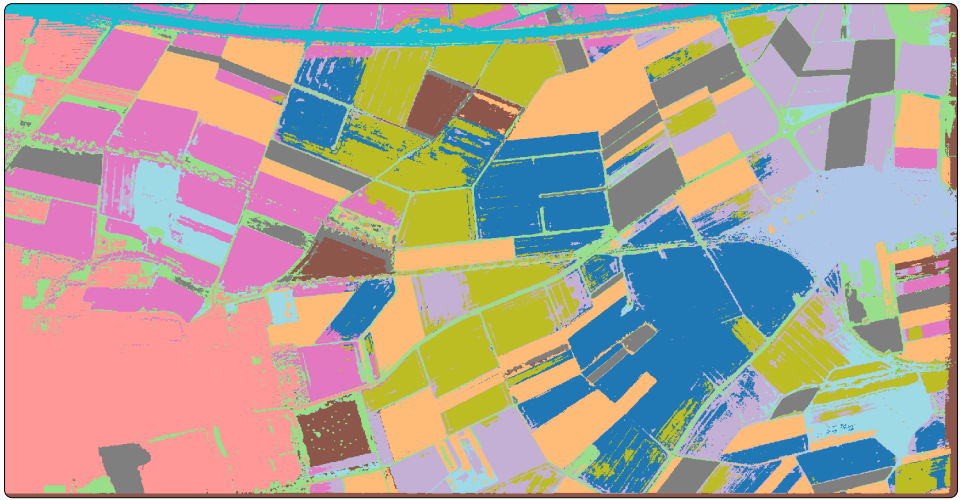


Example Image

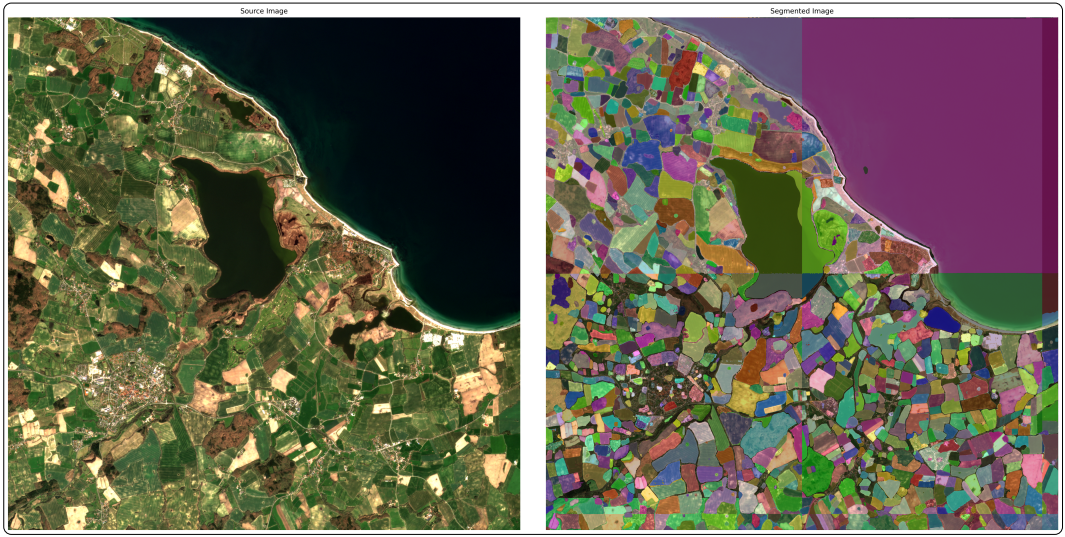
Feature Extraction with KNN



Feature Extraction with KNN Upscaled



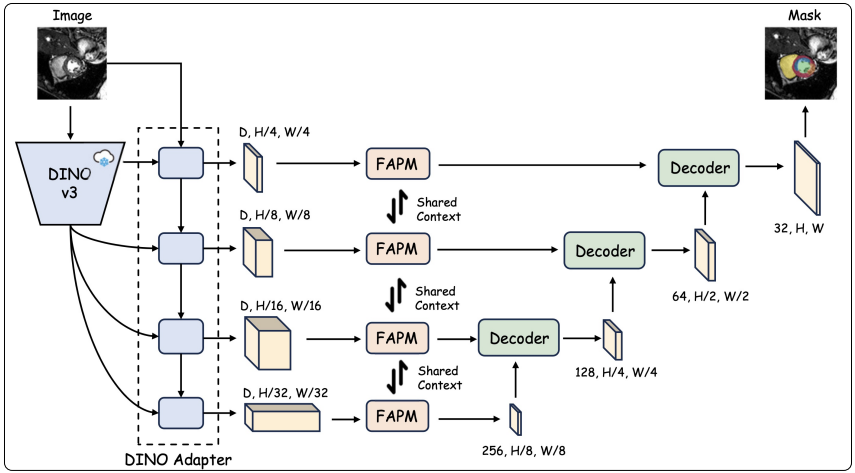
Sam2 Output



Sam2 Status

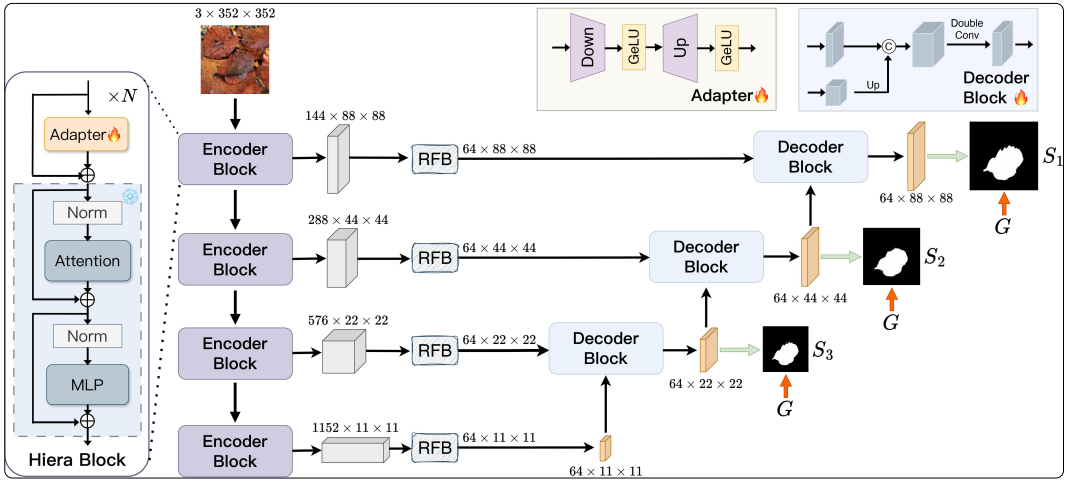
- Export SAM2-generated masks for all image tiles
- Build a classifier on top of SAM2 masks to distinguish linear woody features (LWF)
- Add an auxiliary mask covering areas not segmented by SAM2
- Validate classifier predictions against ground-truth LWF annotations

Dinov3 U-Net



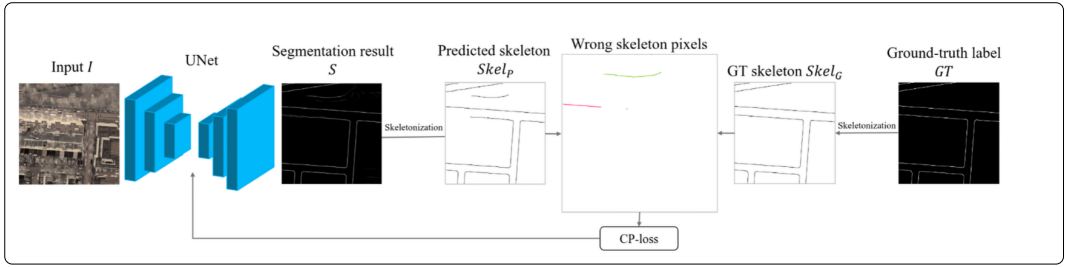
Gao et al., “Dino U-Net: Exploiting High-Fidelity Dense Features from Foundation Models for Medical Image Segmentation”

Sam2 U-Net



Xiong et al., "SAM2-UNet: Segment Anything 2 Makes Strong Encoder for Natural and Medical Image Segmentation"

CP-loss Architecture



Xu et al., “CP-Loss: Connectivity-Preserving Loss for Road Curb Detection in Autonomous Driving with Aerial Images”

CP-loss

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References

Gao, Yifan et al. “Dino U-Net: Exploiting High-Fidelity Dense Features from Foundation Models for Medical Image Segmentation”. In: *arXiv preprint arXiv:2508.20909*. 2025. DOI: 10.48550/arXiv.2508.20909. URL: https://arxiv.org/abs/2508.20909.

Xiong, Xinyu et al. “SAM2-UNet: Segment Anything 2 Makes Strong Encoder for Natural and Medical Image Segmentation”. In: *arXiv preprint arXiv:2408.08909* (2024). Technical Report. URL: https://arxiv.org/abs/2408.08909.

Xu, Zhenhua et al. “CP-Loss: Connectivity-Preserving Loss for Road Curb Detection in Autonomous Driving with Aerial Images”. In: *arXiv preprint arXiv:2107.11920* (2021). Accepted at IEEE/RSJ International Conference on Intelligent Robots and Systems (IROS) 2021. DOI: 10.48550/arXiv.2107.11920. URL: https://arxiv.org/abs/2107.11920.