



Zero-Shot Buildings' Segmentation using SAM

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GEOAI

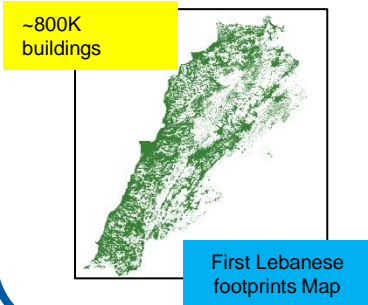
- Lead: Dr. Ali J. Ghandour
- Members: 16
- Webpage: www.geogroup.ai
- ranked 4th/730: **“NASA Field Boundary Challenge”**

International Collaboration



Ongoing Projects

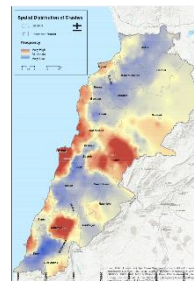
GeoUrban-AI Tool



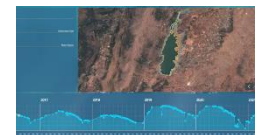
Solar rooftop potential map



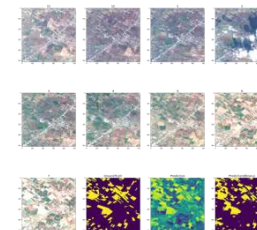
Road Crashes Observatory



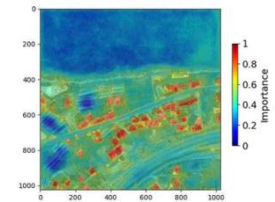
Water Body Monitoring



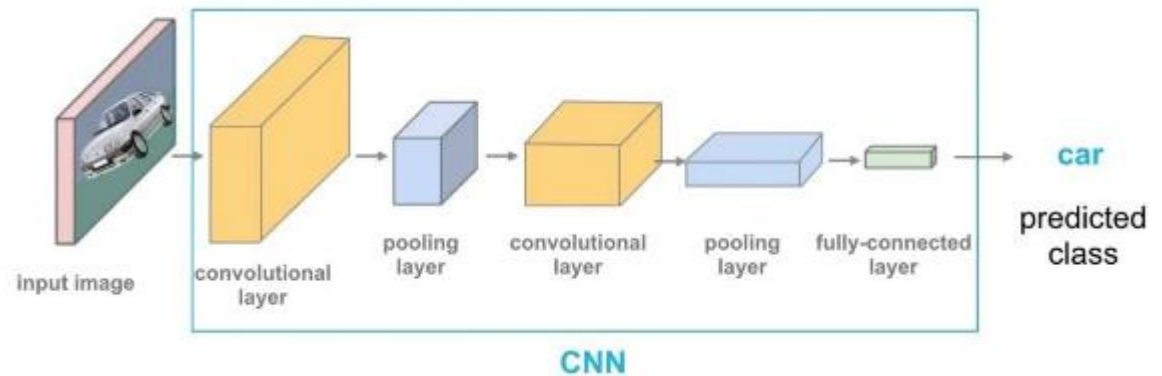
Winter Wheat Monitoring



eXplainable AI (XAI)

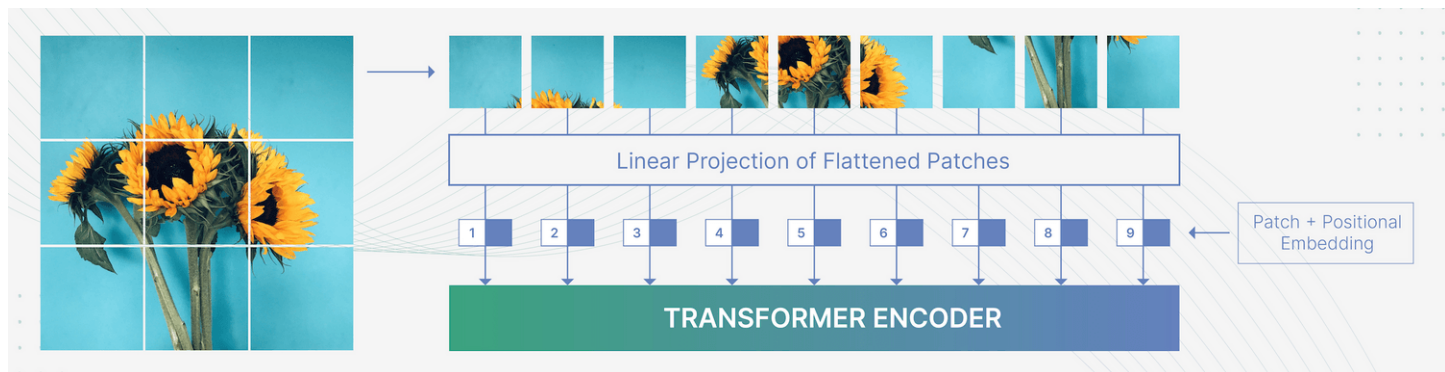


■ CNN:



Source: <https://viso.ai/deep-learning/vision-transformer-vit/>

■ Transformers:



Source: <https://www.picsellia.com/post/are-transformers-replacing-cnns-in-object-detection/>

- **Out-of-Distribution Generalization:**
 - testing distribution is unknown and different from the training



source: <https://www.gabriele-cavallaro.com/teaching/parallel-and-scalable-machine-learning-for-remote-sensing-big-data-ws-2020-2021>



Foundation Models

- coined in July 2022:
 - <https://arxiv.org/pdf/2108.07258.pdf>
 - Large (deep neural network) model
 - trained on broad data (generally using self-supervision at scale)
 - usually multimodal
 - can be adapted to a wide range of downstream tasks

- transformer model on a large scale.
- widely used in NLP: Large Language Models (LLMs)
- human brain:
 - ~86 billion neurons
 - 100 trillion synapses



Source: <https://huggingface.co/blog/large-language-models/>



SAM



- foundation model Meta AI (April 2023):
 - <https://arxiv.org/pdf/2304.02643.pdf>

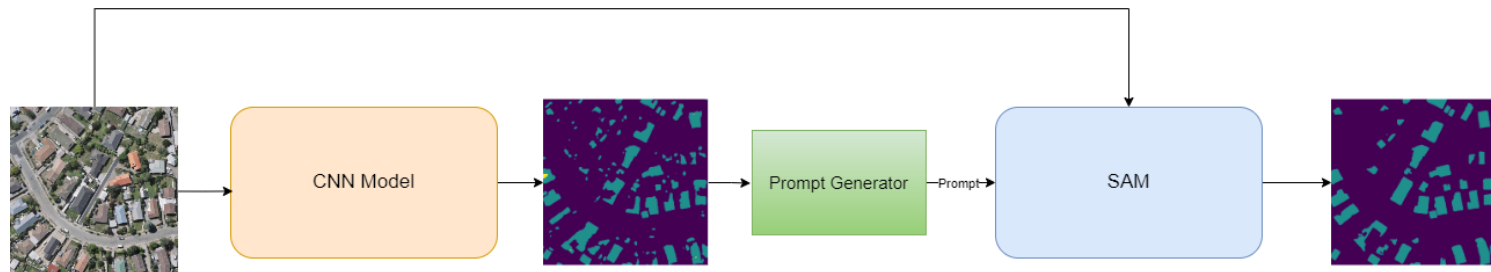
- SA-1B Dataset:
 - 11M diverse, high-res images (3300x4950 pixels)
 - 1.1B segmentation masks (99.1% auto-generated)
 - High-quality masks
 - Significantly larger than any segmentation datasets



Prompt Engineering SAM

- PE SAM for satellite imagery:
 - CNN model as prompt generator

- Prompt types:
 - Single point
 - Bounding Box
 - Skeleton



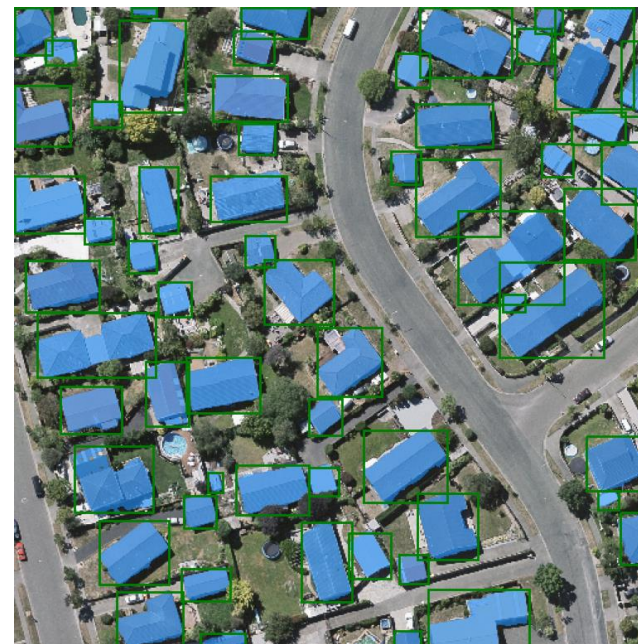
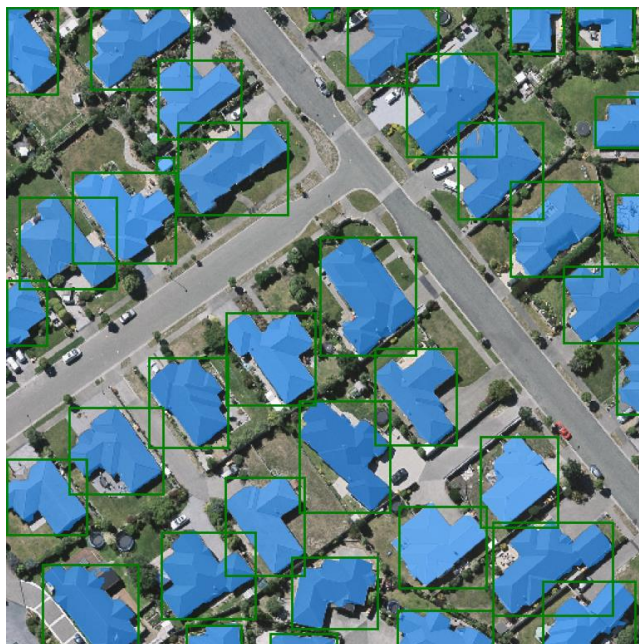


Single Prompt



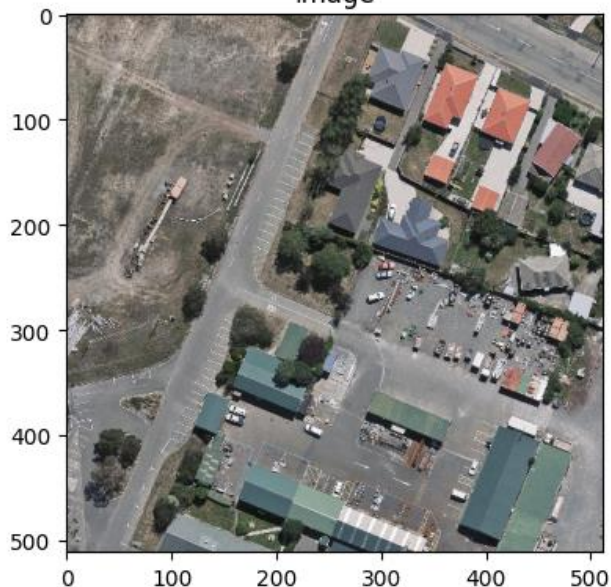


Bounding Box Prompt

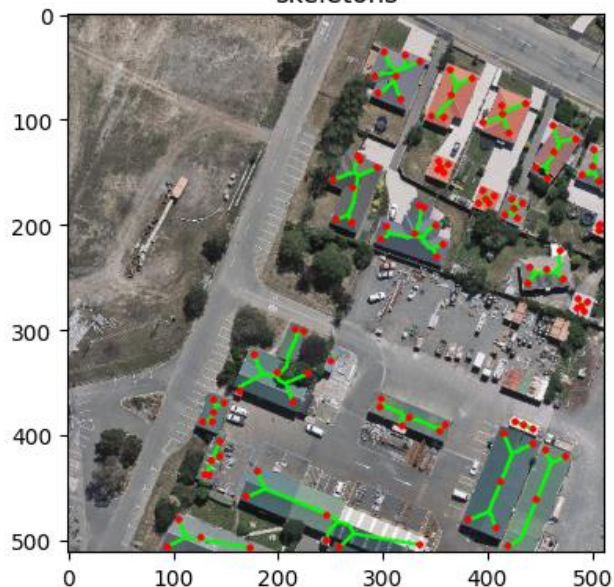


Skeleton Prompt

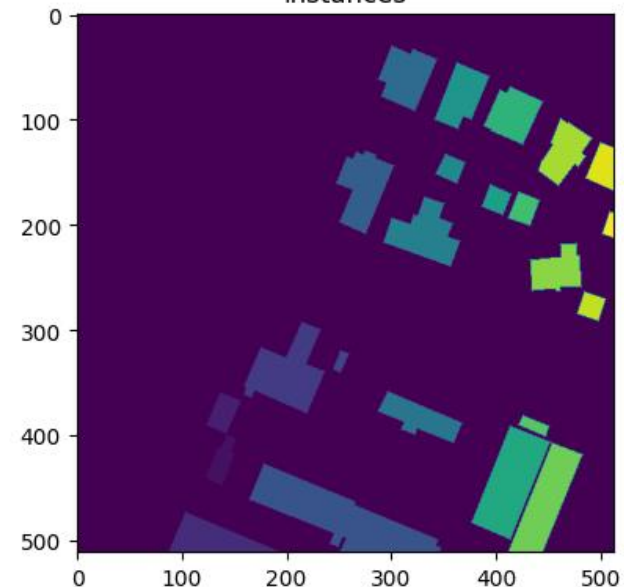
image



skeletons



instances



GroundTruth



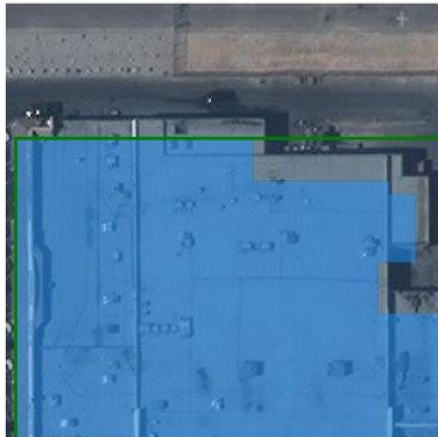
Prediction





Crowd AI dataset – *cont.*

GroundTruth



Prediction



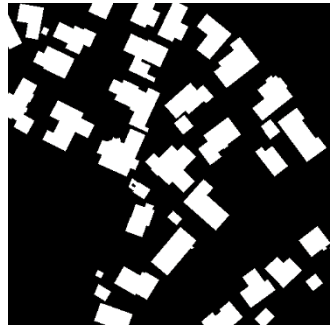


Ongoing Work



GT

predicted



TP-F1 score: 93%

- Ali: graduate student at GEOAI group
- Hasan: research engineer at GEOAI group

□ [Link](#)





Thank you!

<https://github.com/geoaigroup/buildingsSAM>

GEOAI group

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www.geogroup.ai