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Final Presentation:

Change Detection for Remote Sensing

Change Detection Team

24-Mar-2023

Overview - Progress

Siamese Networks

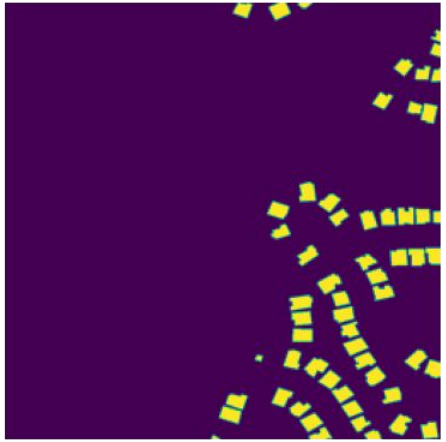
(image pair inputs – pre/post change)

➔ Customized CosimNet (adapted from paper)

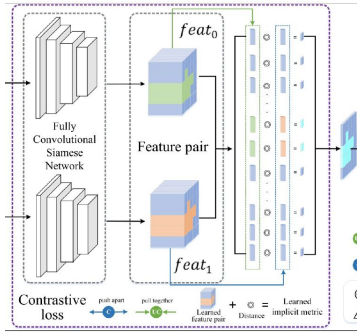
➔ SARAS-Net

Levir-CD Dataset

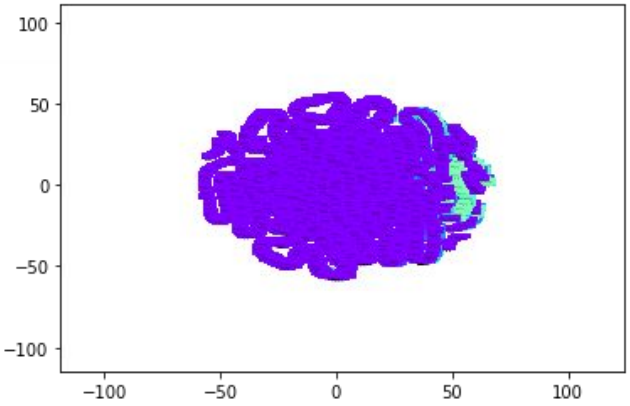
- ➔ Google Earth image patch pairs 1024 × 1024 - resized to 256x256 for project
- ➔ Image counts: Train: 445 Validation 64 Test 128
- ➔ Used to train network to identify Building Changes
- ➔ Urban, forested and mixed-land images



Custom CosimNet - adapted from paper




```
SiameseNet(
  (CNN): SiameseCNN(
    (conv1): Sequential(
      (0): Conv2d(3, 32, kernel_size=(3, 3), stride=(1, 1), padding=(1, 1))
      (1): ReLU(inplace=True)
      (2): Conv2d(32, 32, kernel_size=(3, 3), stride=(1, 1), padding=(1, 1))
      (3): ReLU(inplace=True)
    )
    (embedding_layer): Conv2d(32, 32, kernel_size=(3, 3), stride=(1, 1), padding=(2, 2), dilation=(2, 2))
    (fc): Softmax2d()
  )
)
```

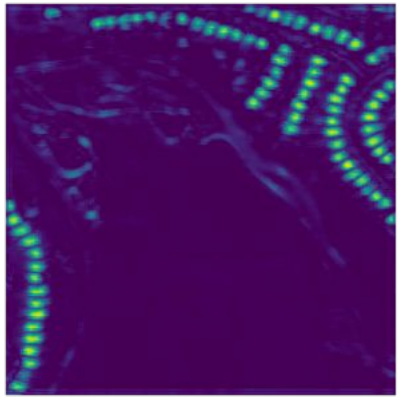


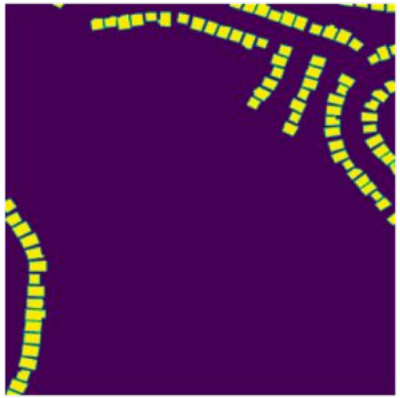
➔ Trained for 100 epochs F1 Score: 0.52

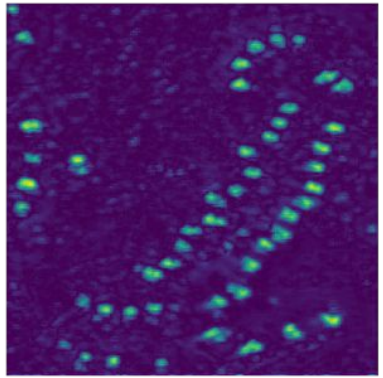
➔ **Contrastive Loss** minimizes loss **separately** for **each** layer (conv, embedding, fc) prior to generating a cumulative loss.

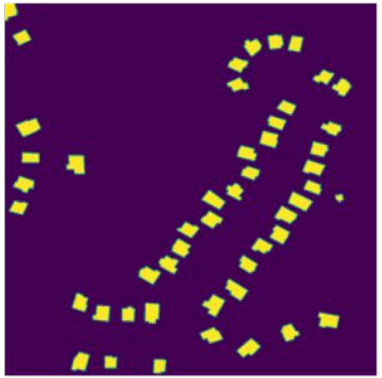
Learning to Measure Changes: Fully Convolutional Siamese Metric Networks for Scene Change Detection Enqiang Guo, Xinsha Fu, Jiawei Zhu, Min Deng, Yu Liu, Qing Zhu, and Haifeng Liy

Custom CosimNet - Results



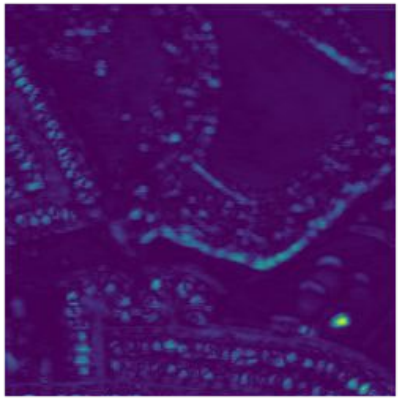


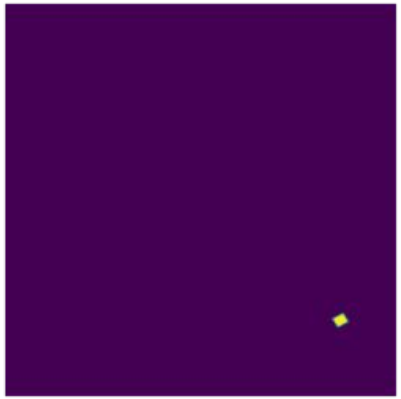




Change Map **Target** **Change Map** **Target**

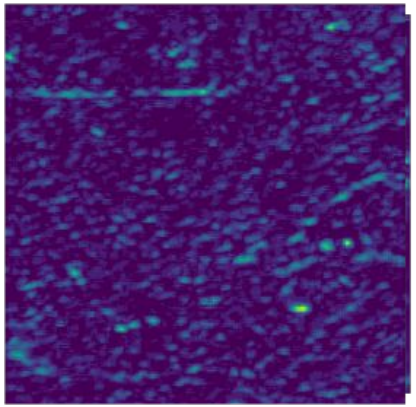
Custom CosimNet - Results

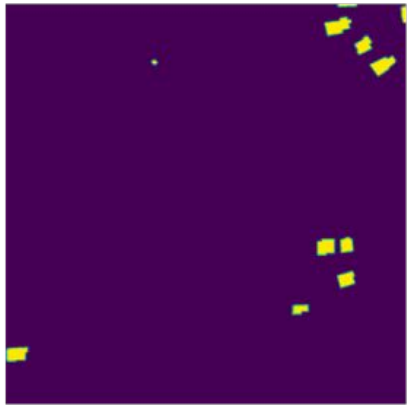




Change Map

Target





Change Map

Target

Takeaways - Customized CosimNet

➔ Custom Siamese Network with a single convolutional layer is able to locate building changes - demonstrating the discriminative capabilities of the approach

➔ Adding additional layers and attention weights will enhance the blurry building edges with improved building/vegetation separation and minimize noise

➔ Can be used to monitor unauthorized development

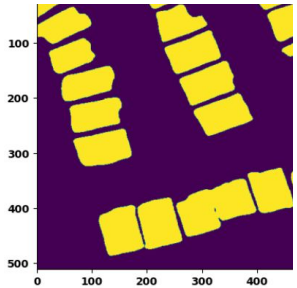
SarasNET - Results

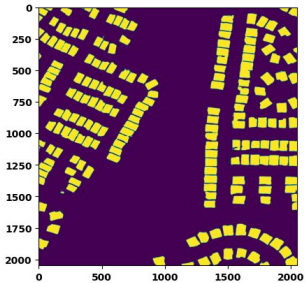
- Works accurately on imagery with high spatial resolution & face memory issues when fine tuning this model
- Applied to other datasets such as CDD dataset but the results were blank images due to different resolutions
- Can do a progressive image resizing approach for images fine-tuning

Pre Post Mask

Ground truth:

Generated mask:





IoU: 91.3%

Relevant datasets

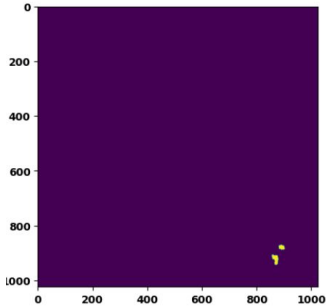
- **SECOND Dataset:** data of non-vegetated, low vegetation, and building images similar to HILT, evaluate change detection of Siamese Network
- **DynamicEarthDataset**: Planet labs, daily observations Jul 2018 - Jul 2019, 75 study areas worldwide, resolution of 1024x1024, 524GB
- Currently, the pre-trained SarasNET does not generate much results on datasets other than Levir-CD dataset so requires fine-tuning

Second dataset

Pre

Post

Ground mask



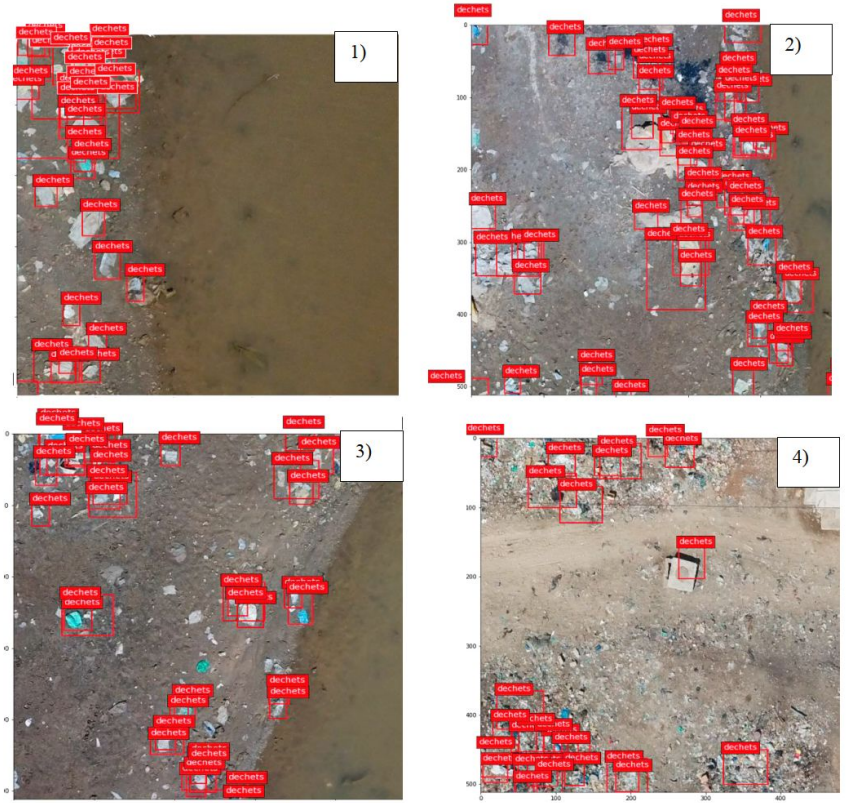
Prediction mask

Future work

- ➔ UAV imagery capturing: Youme et. al. (2021)
  - High resolution essential
  - Local environment data
  - Large number of data needed
  - → reinforcement learning (launch alert change detection)

HILT's WAIHE'E REFUGE

Google Earth Image



1,2,3: Study area
4: University campus